Harelip and cleft palate : with special reference to the operative treatment and its results / by James Berry and T. Percy Legg.


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HARELIP
AND
CLEFT PALATE

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WITH SPECIAL REFERENCE TO THE
OPERATIVE TREATMENT AND
ITS RESULTS

BY

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TWO HUNDRED AND FORTY-TWO FIGURES AND
APPENDIX OF CASES OF OPERATION
FOR CLEFT PALATE

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PREFACE

Our object in writing this book has been to describe in full detail the methods that we have found most useful in the treatment of harelip and cleft palate.

We have endeavoured to illustrate the subject fully. In the case of harelip this has been done chiefly by photographs, for the majority of which we are indebted to Miss Katherine Wortham. For most of the illustrations of cleft palate the method adopted has been as follows: First, a cast of the teeth and hard palate has been obtained, and from this a drawing has been carefully made to scale. Details of the soft palate, which could not be obtained from a cast, have then been added and the whole drawing compared with the original before being finished. A drawing of the condition of the palate having been thus obtained, the various steps of the operation have been sketched during the actual performance by our artist, Mr. S. A. Sewell, his sketches being checked and corrected immediately afterwards by ourselves.

We are greatly indebted to him for attending a large number of our operations, and thus familiarising himself with the details of a somewhat complicated proceeding. It is, we believe, only by

some such method as the above that it is possible to obtain really accurate representations of cleft palate.

The sources of the few illustrations that have been borrowed from other authors have been acknowledged in the text.

Of the turnover flap operation, of which so much has been heard in recent years, we have said but little, because we think that the results obtained by this method are usually bad, and we cannot recommend its performance.

In the Appendix of Cases we have endeavoured to describe as fully as possible the actual results of all our operations for cleft palate.

To Professor Arthur Keith of the Royal College of Surgeons we are greatly indebted for allowing us to quote freely from his writings and for reading the chapter on Development. We have also to thank Mr. H. Blakeway, F.R.C.S., for kindly reading the proof-sheets, and the Editor of the *British Medical Journal* for permission to reproduce some of the illustrations that have already appeared in its pages. Messrs. Allen and Hanburys have been good enough to lend us many blocks for the illustrations of instruments.

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DEVELOPMENT OF THE LIPS AND PALATE

Normal development of the lips and palate : Formation of stomatodœum : Mandibular arches : Maxillary processes : Fronto-nasal process : Globular processes : Division of stomatodœum into nasal cavity and mouth : Union of maxillary and intermaxillary processes : Table of dates : Formation of the various types of harelip and cleft palate : Situation of the cleft in the alveolus : Relative frequency of the different types of harelip and cleft palate : Causation of harelip and cleft palate

In order to understand the formation of the different varieties of harelip and cleft palate it is necessary to know something of the normal development of the lips and palate.

In very early fœtal life the primitive mouth or stomatodœum appears as a depression between the head and pericardium, and is separated from the fore-gut by the bucco-pharyngeal membrane, which in the human embryo disappears about the fifteenth day (Fig. 1). When the stomatodœum first appears on the fourteenth day, it has not any lateral boundaries: these appear later, and from the space so formed the upper part of the mouth and the nasal cavities are developed, the floor of the mouth and the tongue being developed from the pharyngeal portion of the fore-gut.

In the third week of intra-uterine life the man-

dibular arch is formed on either side (Fig. 1). As it develops, this arch forms the lateral and lower

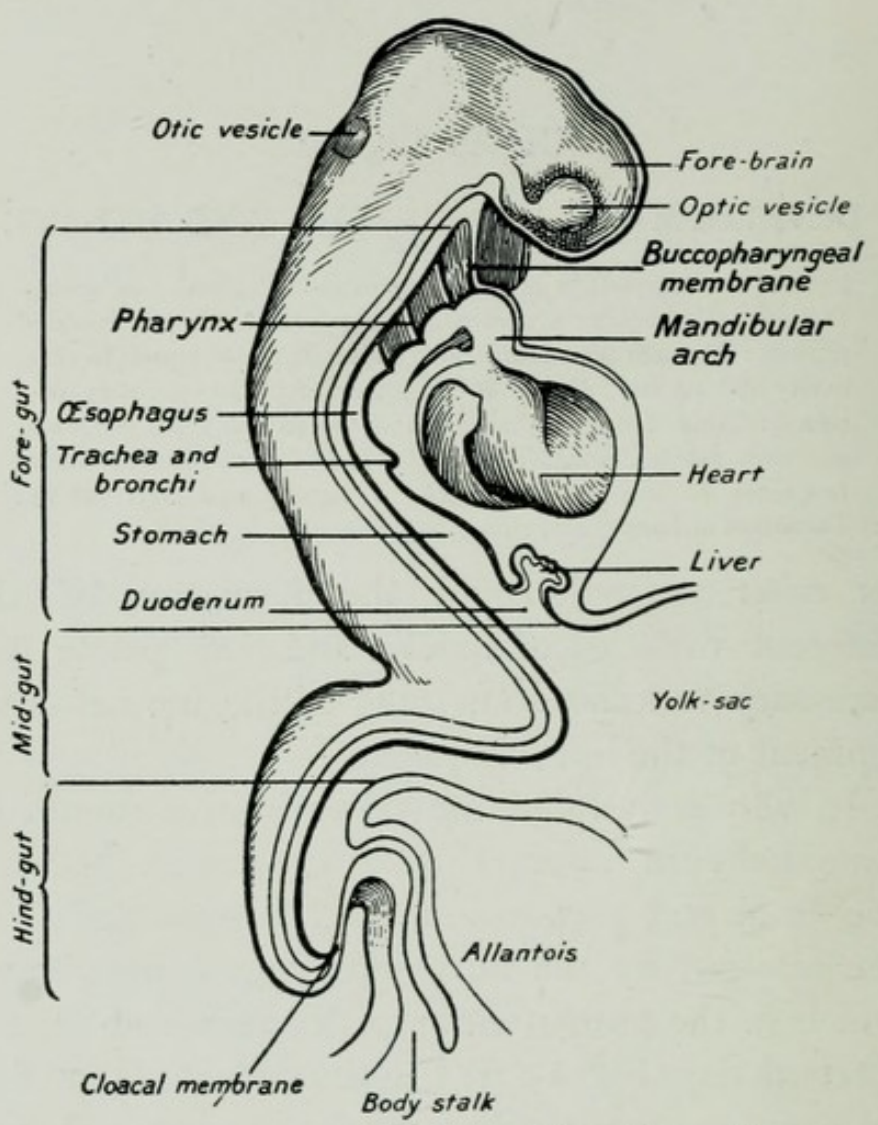


FIG. 1. Diagram representing the condition of the alimentary canal in a human embryo about 15 days old (modified from His). (From Cunningham's "Anatomy.")

boundaries of the stomatodœum (Fig. 2): each arch grows forwards, and eventually meets its fellow in the middle line (Fig. 3) in front of the tuberculum impar, from which the tongue is partly formed. From

these arches the greater part of the lower jaw and the tissues covering it are formed. From the upper margin of the mandibular arch on either side the maxillary processes bud out and grow forward (Fig. 3): these also appear in the third week. Above and in front of the stomatodœum is seen another process—the fronto-nasal—which

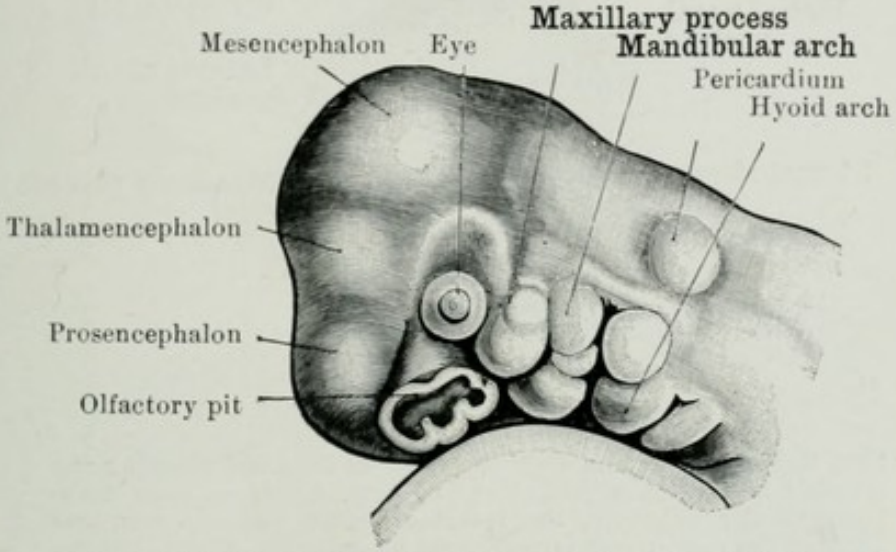


FIG. 2. Side view of the head of human embryo about 27 days old showing the olfactory pit and the visceral arches and clefts (from His). (From Cunningham's "Anatomy.")

grows downwards; on its lower and anterior surface two oval depressions appear; these are the olfactory pits, and they form the first rudiments of the nose. As these pits increase in size they grow backwards towards the stomatodœum, and divide the lower portion of the fronto-nasal process into three parts, thus forming the median and two lateral nasal processes. In the fifth week (Fig. 4) the nose begins to grow forwards, and the olfactory pits—the primitive nostrils—are widely separated from

each other. From each lateral angle of the median nasal process a spheroidal elevation—the globular process—arises, and from the lower part of the area between the globular processes is formed the columella which becomes the lower and anterior part

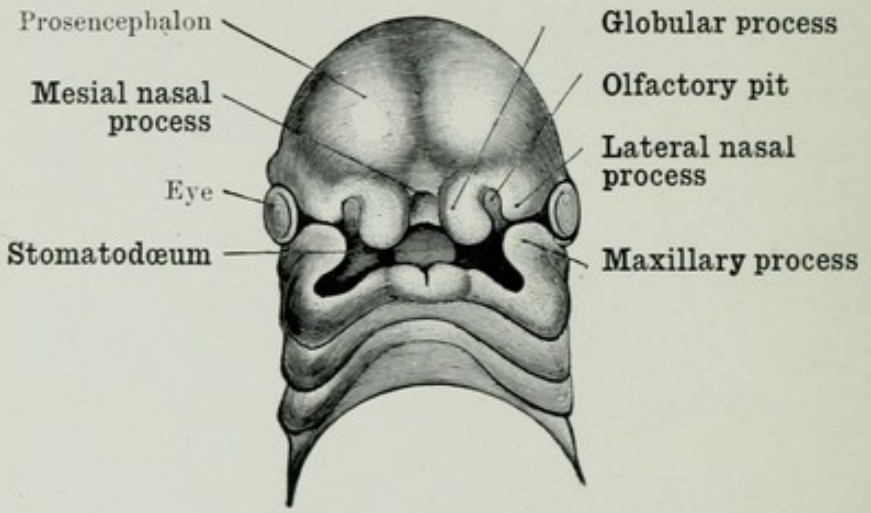


FIG. 3. Head of human embryo about 29 days old, showing the division of the lower part of the mesial frontal process into the two globular processes, the intervention of the olfactory pits between the mesial and lateral nasal processes, and the approximation of the maxillary and lateral nasal processes, which, however, are separated by the oculo-nasal sulcus (from His). (From Cunningham's "Anatomy.")

of the septum of the nose, while the upper part becomes the dorsum of the nose. The globular processes themselves become the middle part of the upper lip (the philtrum) (Fig. 5), and the lateral nasal processes form the alæ nasi.

During this time the maxillary processes from the mandibular arches are growing inwards below the eyes, and ultimately they unite with the globular and lateral nasal processes, thus completing the lower boundaries of the anterior nasal

orifices, and forming the lateral parts of the upper lip. The union of the lateral nasal with the maxillary processes takes place about the sixth week. The fusion of the globular processes with

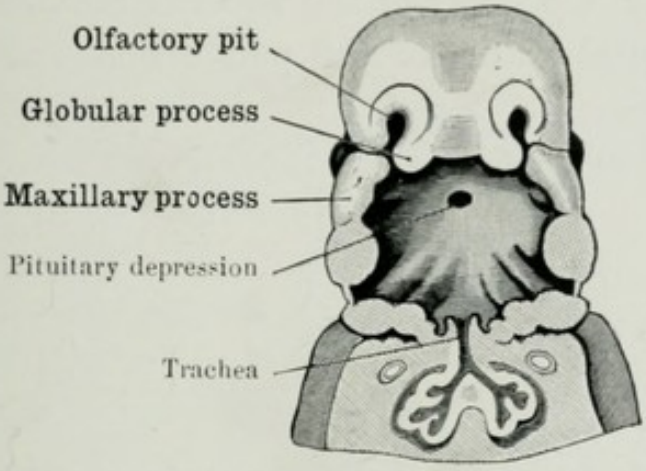


FIG. 4. Portion of the head and neck of a human embryo 32 days old. The floor of the mouth and pharynx and the ventral part of the anterior portion of the body have been removed. By the approximation of the globular and maxillary processes, the boundaries of the anterior nares are almost complete, but the olfactory pits still open in the whole of their lengths into the roof of the mouth (from His). (From Cunningham's "Anatomy.")

one another takes place in the eighth week, thus completing the formation of the upper lip.

The stomatodœum is next divided into two cavities—the upper forming the nasal cavity and the lower the mouth. This is accomplished by the formation of the palate, which is developed partly from the globular processes and partly from the maxillary processes (Fig. 6). From the former a process grows backwards on each side: these fuse together, and in the conjoined portion the intermaxillary (premaxillary) bones are formed. The remainder of the palate (*i.e.*, the greater portion) is

formed from the maxillary processes by a horizontal ingrowth on each side; these ultimately unite in the middle line. In front, they fuse with the intermaxillary process. In these horizontal processes the palatal segments of the superior maxillæ and the horizontal plates of the palate bones are

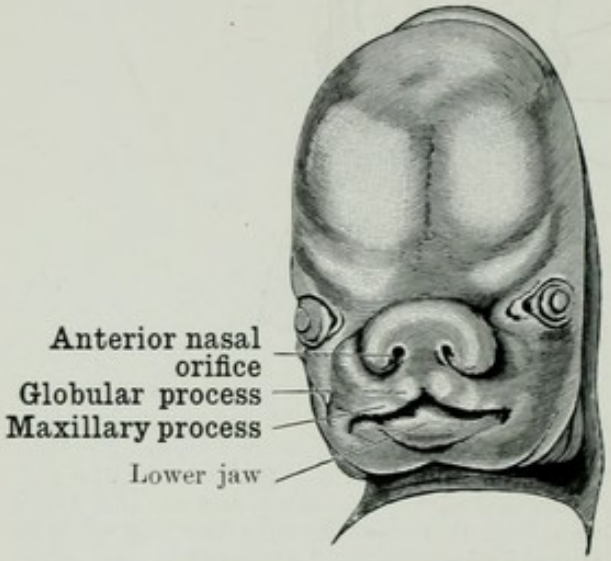


FIG. 5. Head of human embryo abont 2 months old, showing the union of the globular processes and their fusion with the maxillary processes. The anterior nasal apertures are now completely defined (from His). (From Cunningham's "Anatomy.")

formed. The union of the three portions of the palate commences anteriorly at the eighth week of intra-uterine life, and proceeding backwards, is completed by the fusion of the posterior parts, which should occur about the tenth week, the halves of the uvula being the last to unite.

At first the lower part of the nose is a single chamber: its division into two parts is brought about by the formation of the septum, which grows downwards and backwards from the inferior aspect

of the fronto-nasal process. The septum is formed before the separation of the nose from the mouth is complete. Fusion with the margins of the palatal processes eventually occurs, and the oral and nasal cavities are completely formed. Part of the primitive septum is converted into the vertical plate of the ethmoid, and part remains as

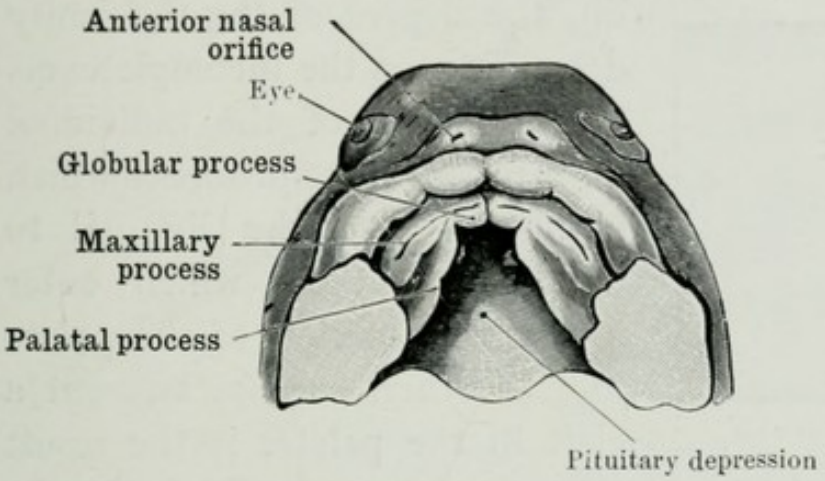


FIG. 6. Portion of the head of a human embryo about 2½ months old (His). The lips are separated from the gums, and the line of the common dental germ is visible in the latter. The palatal processes are growing inwards from the maxillary processes (from Cunningham's "Anatomy").

the septal cartilage: in the remainder the vomer is developed.

TABLE OF DATES

Fœtal life

Fourteenth day	Appearance of primitive mouth or stomatodœum.
Fifteenth day	Disappearance of bucco-pharyngeal membrane.
Third week	Mandibular arch of either side formed; maxillary processes bud out from mandibular arches.
Fifth week	Fronto-nasal process appears; olfactory pits widely separated by the primitive nose; globular processes appear.
Sixth week	Union of lateral nasal with maxillary processes; division of stomatodœum into an upper cavity, the nose, and a lower cavity, the mouth.

Eighth week . Union of the three portions of palate commences anteriorly ; completion of the upper lip by fusion of the globular processes.

Tenth week . Completion of union of the palate segments, the uvula being the last part to be completed.

The various forms of harelip and cleft palate arise from failure of union of the separate processes which enter into the formation of the mouth and lip, the degree of the deformity depending on the incompleteness of the fusion of the individual segments. If the processes which normally form the lip fail to unite, while those which enter into the formation of the palate join together, harelip, without a cleft in the palate, is the result (Fig. 7). On the other hand, the upper lip may be perfectly formed, but the palate cleft, usually at the posterior part (Fig. 8). Moreover, one half of the palate may be completely united to the lower margin of the septum of the nose, while the other half of the palate has failed to grow inwards and to fuse with the septum (unilateral or single cleft palate) (Fig. 9). It has already been pointed out that union of the individual processes begins in front and proceeds backwards. Consequently it is exceedingly uncommon to find an incomplete cleft of the palate involving the anterior part only: it is quite common to find a cleft limited to the soft palate and

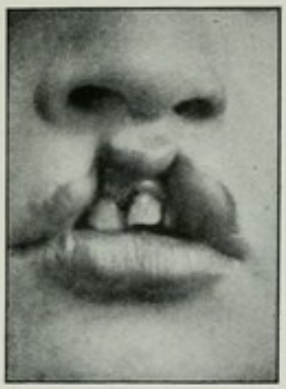


FIG. 7. Double incomplete harelip without cleft of the palate.
Ernest H., aged 4½ years.

posterior part of the hard palate (Figs. 10 and 11). A congenital cleft involving the intermediate parts of the palate is very rare, though not unknown: such an example came under our observation, and is illustrated in Fig. 12. Two-thirds of the opening are in the hard palate and one-third is in the soft. The uvula and posterior edge of the soft palate are also congenitally cleft. (*See also* p. 68.)

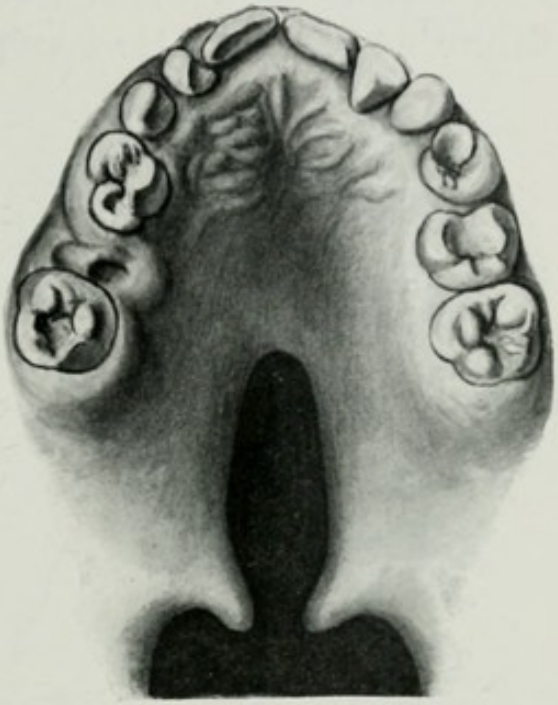


FIG. 8. Cleft of the soft palate and posterior edge of the hard. There was also a double incomplete harelip. (*See* Figs. 37 and 38, pp. 46, 47.)

Sylvia D., aged 6 years. Royal Free Hosp. 1911. Appendix, Case 145.

Three elements enter into the formation of the palate, viz., the intermaxillary segment anteriorly, and the palatal processes laterally, the former being placed between the latter, and in the early stages of development these segments are separated from each other by fissures. If these fail to close, a cleft will be formed, which anteriorly is placed on one or both sides of the median line and also involves the alveolus. Hence in single complete cleft palate the cleft is placed laterally at the anterior end, and in or near the middle line of the

hard and soft palates. If the alveolus be examined in cases of simple harelip a vertical groove will often be noticed on the outer aspect of the gum. This groove is generally situated between the central and lateral incisor teeth, and represents the fissure between the inter-maxillary and the maxillary

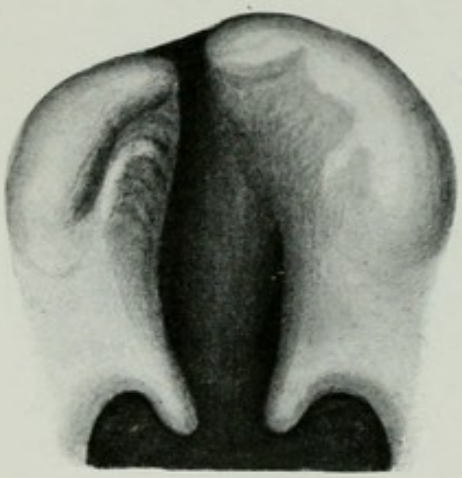


FIG. 9. Unilateral (right) complete cleft palate. The septum is seen to have united with the left palatal process.
Fred. M., aged 4 months.
Royal Free Hospital, 1911.

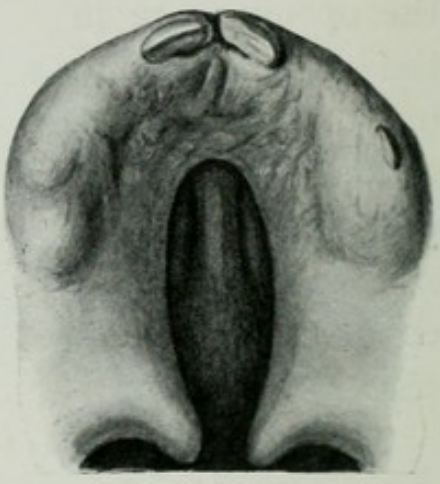


FIG. 10. Median cleft involving the soft and most of the hard palate. The lower edge of the septum is free, being united to neither palatal process except at its anterior end.
Gwendoline C., aged 1 year.
Royal Free Hospital. 1911.
Appendix, Case 142.

processes, and it may be said "to represent an attempt at the formation of a cleft palate." When a single harelip is accompanied by a cleft palate, there may be a complete separation of the intermaxillary bone on the affected side, the fissure between the intermaxillary and the palatal maxillary processes not having been closed. When failure of union occurs on both sides, it is usually accompanied by double harelip. This deformity is

due to the want of union of the globular with the maxillary processes. From the former the intermaxillary process and the central part of the upper lip are developed, and as the globular processes are derived from the median nasal process, from which

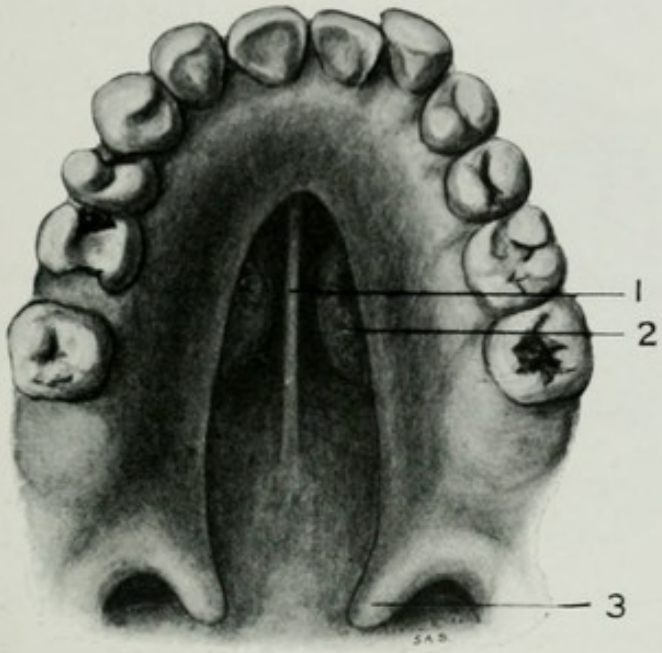


FIG. 11. A similar cleft in an older patient. Note the thinness of the septum. 1. Nasal septum; 2. Inferior turbinated bone; 3. Uvula.
Catherine S., aged 17 years. Royal Free Hospital, 1909. Appendix, 122.

the lower part of the septum is formed, the explanation of the attachment of the intermaxillary bone to the septum naris in examples of double harelip is evident (Fig. 13). The amount of projection of the premaxillary bone is due to an abnormal increase in length of that part of the septum which is formed by the premaxillary processes. In unilateral cleft palate, where union of the premaxilla with the maxilla has occurred on

one side only, the extra growth of the septum still takes place, with the result that the premaxilla is bent towards the side on which union takes place, with undue prominence of the bone on the ununited side. (Fig. 29, p. 40.)

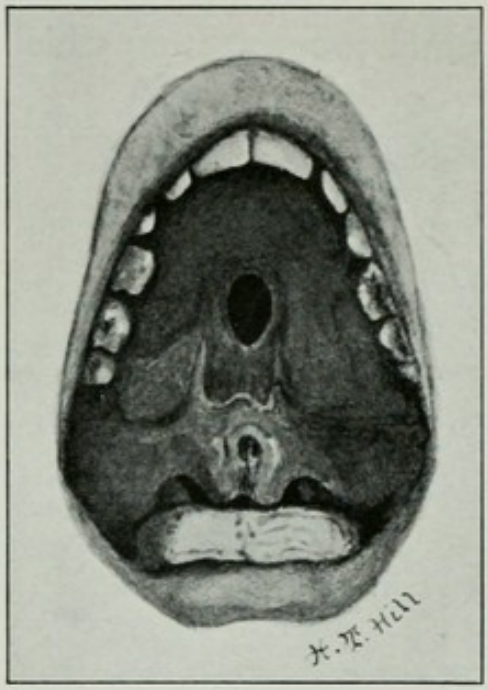


FIG. 12. Central congenital cleft of the palate with cleft uvula. The oval white areas on the palate indicate roughly where the tissues are unusually thin. The white patches near the divided uvula are partly high lights and partly mucus. None of the white patches represent scars. No operation of any kind had been performed. The reproduction is unfortunately from a *coloured* drawing.

Hannah W., aged 16. Appendix, Case 73. See *Trans. Clin. Soc.* 1906, vol. xxxix. p. 222.

Situation of the Cleft in the Alveolus

The cleft usually lies between the middle and lateral incisor teeth, or between the lateral incisor and canine teeth: occasionally a third incisor is developed. To explain the varying relationship of the incisor teeth to the fissure Albrecht supposed that the premaxillary bone was developed in two parts, that carrying the median incisor being developed in the mesial nasal process, and that carrying the lateral in the lateral nasal process. This explanation is not correct, for the lateral nasal process does not enter into the formation of the palate or of the lip.

The germ of the lateral incisor is laid down in the cleft between the maxillary and premaxillary processes. In cases of cleft palate the processes move apart during the middle and later months of fœtal life. The bud of the lateral incisor may then be

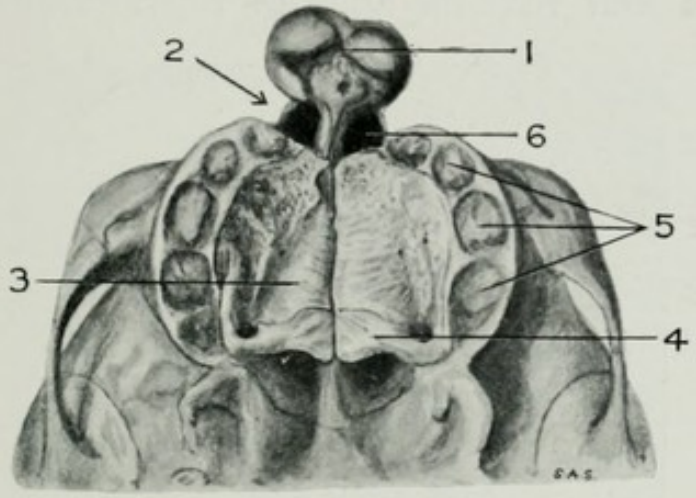


FIG. 13. A drawing of an infantile skull showing the very rare condition of double cleft of the alveolar portion of the palate with great prominence of the premaxillary process, but no cleft of the rest of the hard palate. The condition of the soft palate is not known to us: it is not unlikely that it was at least partially cleft, as in the child depicted in Figs. 40 and 49, pp. 48, 58.
The specimen was kindly lent to us by Dr. Johan Ulrich of Copenhagen.

1. Premaxillary process; 2. Arrow pointing to cleft in alveolus; 3. Palatal process of superior maxilla; 4. Palatal process of palate bone; 5. Temporary teeth not yet erupted; 6. Anterior part of nasal cavity.

destroyed, it may remain attached to the premaxillary process, or more frequently it moves outwards attached to the maxillary process (Keith). The bud of the lateral incisor belongs to and is developed from the mesial nasal process. The lateral incisor is often of small size (Fig. 14). It may be absent, or there may even be an accessory lateral incisor (Fig. 62, p. 71), and this has been

specially noticed in families in which cleft palate is apt to occur (Warnekros*). Albrecht has also called attention to the fact that there may be a double centre of ossification in each premaxilla, and the position of the suture between the premaxilla and maxilla and its relationship to the

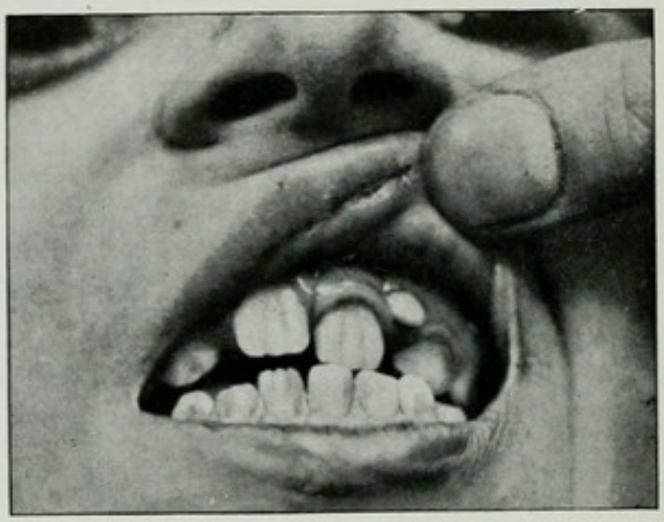


FIG. 14. To show a small and misplaced left lateral incisor tooth in a case of cleft of the soft palate only.
Edwin B. at the age of 7 years. Appendix, Case 57.

teeth are extremely variable. As a rule it ends between the lateral incisor and canine; in extreme cases it has been found between the lateral and middle incisor, or between the canine and first milk molar. The lateral part of the premaxilla is formed within the maxillary process: the process of ossification is not influenced by the position of the embryonic fissure.

In complete unilateral harelip and cleft palate

* See a paper entitled "Gaumenspalten," by Prof. Warnekros of Berlin, published by Hirschwald, 1909.

(the bipartite palate) the premaxilla has undergone normal union on one side, generally the right, so that the cleft is usually on the left side. In these cases union has taken place between the nasal septum and the edge of the palatine process; occasionally the posterior part of the septum remains free.

Clefts formed as a result of the non-fusion of the palatine processes of the maxillary and palate bones are most common. Clefts limited to the soft palate are not very infrequent, and they indicate an arrest of development of the palate when the fœtus is entering the third month of intra-uterine life. In many cases which seem to be of this type, a cleft in the posterior part of the hard palate will often be found if the latter is carefully examined. Sometimes the uvula alone is cleft. Premaxillary clefts—that is, clefts limited to the alveolar portion of the jaw—are occasionally seen, and may be unilateral or bilateral (Fig. 13); in such cases arrest has occurred during the period of formation of the primary palate, whereas the process of formation of the secondary palate has been completed. They are always associated with harelip, and often also with cleft of the soft palate.

A rare deformity is that in which a mesial cleft is present in the lip and anterior part of the palate; this is caused by the arrested development of the globular processes at an early stage. Still rarer is a median harelip without cleft palate. In this

deformity the two globular processes have incompletely united.

Instead of an actual cleft between the premaxillary and maxillary portions of the palate, the deformity may be limited to the bones, the soft parts alone being uncleft, the bony cleft being filled in by fibrous tissue. The amount of fibrous tissue may be so small that it forms a thin strand or band, or it may be much more abundant. Such a case was that of a girl *æt.* $3\frac{1}{2}$ sent to one of us in 1906 by Dr. W. H. B. Brook, of Lincoln. There was no harelip and no actual cleft of the palate, except a short one involving the uvula and posterior part of the soft palate. But the tissues at the front of the soft palate and posterior part of the hard palate were exceedingly thin. No operative treatment was recommended.

The premaxilla may also be joined to the palatine process of the maxilla and the ala nasi by a thin or thick strand of fibrous tissue.

The Causation of Harelip and Cleft Palate

Very little is known * as to the cause of these deformities, though it is agreed that heredity often plays a prominent part. The pedigrees in the Appendix show the hereditary nature of the deformity in two cases.

* On this subject, see an exhaustive and interesting report by Dr. H. Rischbieth, in "Treasury of Human Inheritance," Part IV., "Eugenics Lab. Mem." xi. 1910.

Clinically it is not common to find other associated deformities, such as spina bifida, or club-foot. Embryologists consider that morbid intra-uterine or placental conditions are the commonest cause of the want of union of the primary processes which go to form the palate.

In some cases a great difference in the age of the parents has been noticed, and it has also been observed that the children affected are often those born at the beginning or the end of a large family. In many cases there is an absence or irregularity of an incisor tooth, and this peculiarity has also been noticed to run in families.* In a sense, the slightest degree of cleft palate is the absence, ill-development or malposition, of an upper lateral incisor tooth.

* See an interesting paper "On an Ill-developed Upper Lateral Incisor as a Forerunner of Harelip or Cleft Palate," by Mr. R. Clement Lucas, in *British Journal of Children's Diseases* for November 1904.

CHAPTER II

ANATOMY AND PHYSIOLOGY OF THE LIPS AND PALATE

Anatomy of the lips : Anatomy and functions of the palate : Mucous membrane ; Muscles and their actions : Nerve-supply : Blood-vessels

Anatomy of the Lips

The lips are two fleshy folds covered externally by the integument, and internally by the mucous

Fig. 15. Lips of a normal male child aged 10 months.

membrane, which is continuous with that of the cheeks and gums.

In the middle line of the outer surface of the upper lip there is a wide, shallow, vertical groove or furrow—the philtrum—which is bounded on either side by a ridge descending from the columna naris. At the lower end of this groove a slight

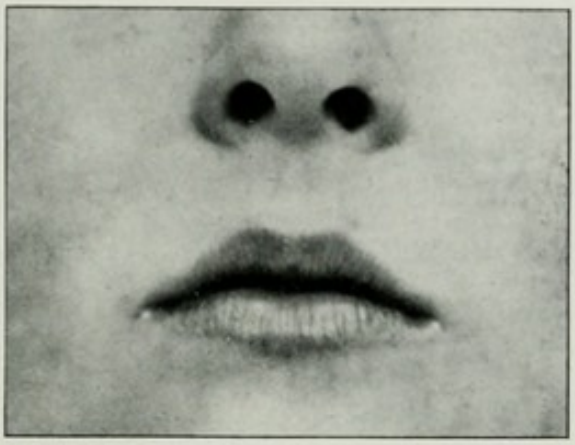


FIG. 16. Lips of a normal female child aged 2 years.

prominence—the labial tubercle—is present (Figs. 15 and 16).

The inner aspect of both the upper and lower lips in the middle line is connected to the gum of the corresponding jaw by a fold of mucous membrane. This fold—the frenum—is larger in the upper lip.

The mucous membrane covering the free or exposed aspect of the lips is drier and thicker than that on the oral aspect. The junction of the skin and mucous membrane is well defined, and forms a continuous slightly curved line (Figs. 15 and 16), a fact which should be carefully remembered in performing the operation for the cure of harelip.

Between the integument and the mucous

membrane the lips contain (1) the orbicularis oris muscle; (2) the submucous tissue, in which are a large number of glands of various kinds; (3) the coronary vessels; (4) the nerves, motor and sensory; (5) fatty and areolar tissue (Fig. 17).

The orbicularis forms a kind of sphincter for the mouth, some of its fibres being attached to the skin, others being continuous with the fibres of the other muscles passing to the lips. There are two muscles which are of great importance in connection with harelip and cleft palate, viz., the levator labii superioris alæque nasi, and the compressor naris. The former raises the upper lip, and thus helps to close the nostril. The latter compresses the nostril directly. Thus both limit the passage of air through the nose in the production of certain consonants, in the subjects of cleft palate. (*See also* chap. iv.)

Anatomy of the Palate

The palate consists of two portions—the immovable hard palate anteriorly, and the movable soft palate posteriorly. The hard palate separates the nasal from the oral cavity. The soft palate by means of its muscles is able to shut off the naso-pharynx from the oro-pharynx and from the mouth. When the muscles of the soft palate are relaxed this structure hangs as an oblique fold, leaving a free communication between the oro-

pharynx and the naso-pharynx, thus permitting the warm inspired air to pass on from the nose to the lower air-passages.

The **hard palate** is formed in the greater part of its extent by the palatine processes of the

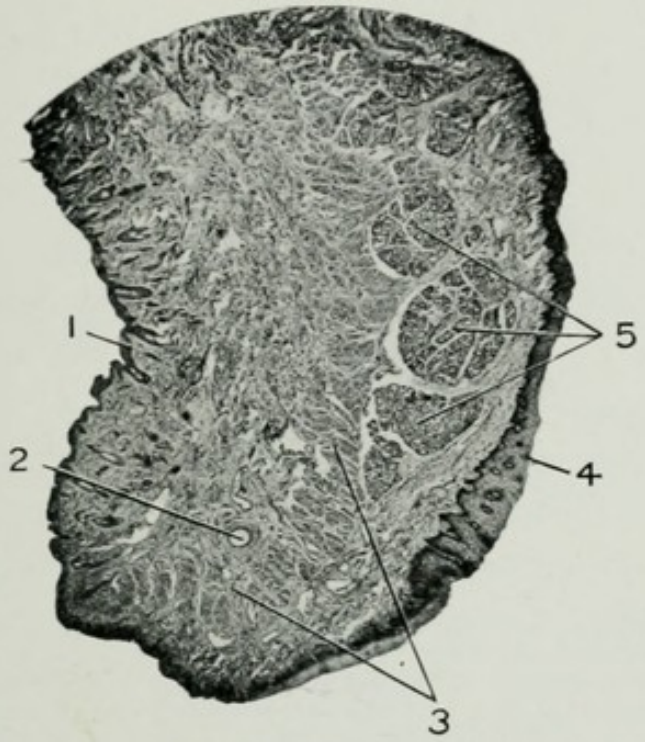


FIG. 17. Sagittal section through the upper lip of a male infant with single harelip and cleft palate.

1. Skin; 2. Coronary vessels; 3. Muscular fibres; 4. Mucous membrane; 5. Submucous glands.

superior maxillary and palate bones, which meet in the middle line. The lines of junction of these four processes are indicated even in an adult skull by a cruciform suture. At the anterior end of the sagittal portion of this suture the pre-maxillary bones are placed, thus completing the hard palate; in the skull of a fœtus and of a

young infant the sutures between these bones are clearly indicated, extending outwards to the alveolus (Fig. 18). Even in the adult skull it is sometimes possible to trace them. All traces of suture on the alveolus itself are usually lost soon

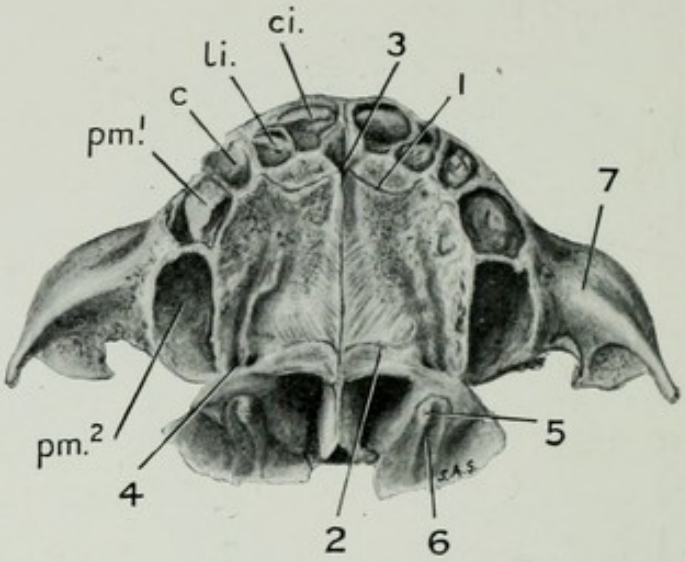


FIG. 18. Base of skull, showing the normal anatomy of the bony palate at birth.

1. Suture between premaxilla and maxilla; 2. Suture between maxilla and palate bone; 3. Ant. palat. foramen; 4. Post. palat. foramen; 5. Hamular process; 6. Scaphoid fossa (origin of tensor palati); 7. Malar bone; ci, li, c, pm^1 and pm^2, milk teeth and their sockets.

From a skull in the possession of the authors.

after birth. In many skulls even at birth there is no sign of their presence.

The posterior edge of the hard palate is thin, and has a concave margin, the concavity being interrupted at the middle point by the projection of the posterior nasal spine. Laterally, the alveolar processes bound the palate, the depth of the vault of the palate depending on the shape and position of those processes. Thus in the new-born infant

the palate and alveolus are almost in the same plane, the former being on a slightly higher level. When the teeth are fully erupted the palate is considerably higher than the lower border of the alveolus. After the teeth have been shed or removed, the levels of the palate and alveolus again approach one another as the alveolus becomes absorbed (*see* Fig. 55, p. 64). The degree of curvature of the palate varies in different individuals. In some the palate is "high," so that its shape resembles an Early English Gothic arch, while in others the curve forms a low, wide, open arch—the Norman type so called (*see* pp. 166–169). The hamular process of the internal pterygoid plate of the sphenoid bone is placed just within and behind the posterior extremity of the alveolus, and descends as low as the level of the alveolar margin. In this situation it can be readily felt by the finger (Figs. 51 and 52, pp. 60, 61). The process is curved outwards and backwards. The tendon of the tensor palati passes along a groove on its outer aspect.

Numerous foramina for the transmission of blood-vessels are present in the hard palate. Some of these foramina have received special names:

(1) The anterior palatine, which is situated in the middle line a short distance behind the incisor teeth (Fig. 18). In the depths of this foramen there are four smaller openings, two being placed laterally and two antero-posteriorly.

(2) The posterior palatine foramina, which are

placed one on each side, just internal to and behind the last molar tooth in the adult (Fig. 51), the last premolar tooth in the child (Fig. 18). Sometimes they are placed further forwards, as in Figs. 52 and 55. Extending forwards from the foramen there is

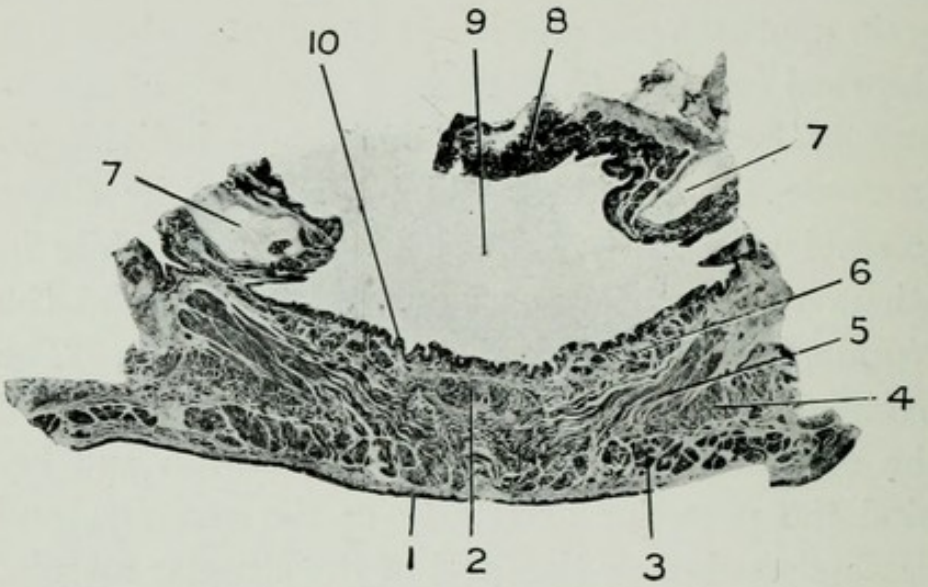


FIG. 19. Vertical coronal section through the middle of the soft palate of an infant (× 6 diam.).

1. Oral mucous membrane ; 2. Azygos uvulæ muscle ; 3. Oral submucous glands ; 4. Palato-pharyngeus ; 5. Levator palati ; 6. Naso-pharyngeal submucous glands ; 7. Cartilage of Eustachian tube ; 8. Mucous membrane and other soft structures in the roof of the naso-pharynx ; 9. Cavity of naso-pharynx ; 10. Naso-pharyngeal mucous membrane.

a groove on the surface of the palate, the inner margin of this groove not infrequently forming a thin sharp ridge. The descending palatine vessels and nerves lie in the foramen and pass forwards in the groove (Figs. 51, 52, 58).

(3) The accessory palatine foramina, which are placed close to the preceding and transmit the vessels and nerves of the same name.

The soft palate (Figs. 19 and 20) is a complicated structure containing muscles, an aponeurosis, vessels and nerves, and a large number of glands. The upper or nasal surface and the lower or oral surface are covered by mucous membrane, which is continuous round the posterior margin of the palate. Anteriorly

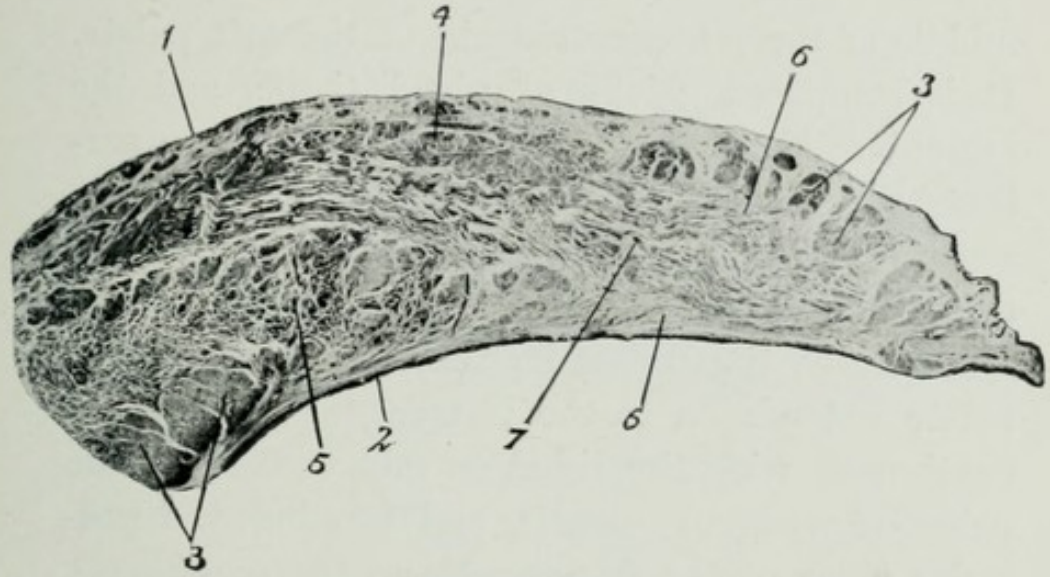


FIG. 20. Sagittal section through the soft palate near the middle line.

1. Nasal mucous membrane; 2. Oral mucous membrane; 3. Submucous glands; 4. Levator palati; 5. Tensor palati; 6. Palatopharyngeus; 7. Azygos uvulæ.

the soft palate is attached to the hard; laterally it blends with the walls of the pharynx, while its posterior margin is free.

The anterior portion of the soft palate for a distance of 8–10 mm. from the posterior margin of the hard palate contains the aponeurosis, covered by a thick layer of gland tissue on the oral surface. Here there are very few muscular fibres, and it is the least movable, as well as the thinnest portion

of the soft palate. The most movable and thickest part is the postero-lateral portion.

The aponeurosis is attached firmly to the posterior edge of the bony palate. It is present only in the anterior part and forms a common tendon for the insertion of the muscles.

The **uvula** is a conical projection from the middle of the posterior margin of the soft palate. It is composed chiefly of gland tissue, and the muscular fibres of the azygos uvulæ. It is important to remember that it is developed from two separate halves which remain distinct in congenital cleft palate.

Laterally, the concave posterior margin of the palate extends on to the pharyngeal wall, and is continuous with the ridge or fold containing the palato-pharyngeus muscle, and forming the posterior pillar of the fauces. From the oral aspect of the palate a smaller fold passes downwards and forwards on each side to the base of the tongue, forming the anterior pillar of the fauces, which contains the palato-glossus muscle.

The mucous membrane of the palate (Figs. 21 and 22).—On the hard palate the mucous membrane is firmly united to the periosteum, forming a dense layer, except posteriorly in the middle line, where it is often thinner. It is important to recognise that the thickness varies with the nutrition of the child; a thin child has a thin muco-periosteum, and in an emaciated child the thickness may be

little more than that of ordinary paper. In front and laterally the colour is pale red, posteriorly it is of a deeper red.

In the centre of the palate there is a longitudinal ridge or raphé, indicating the line of union of the original lateral segments from which the palate is

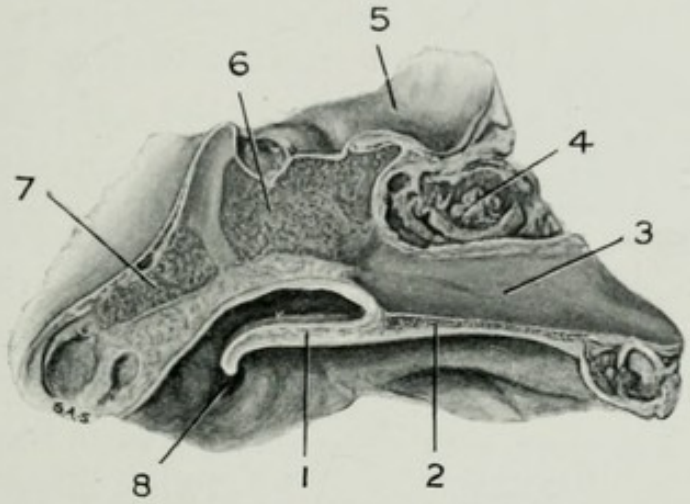


FIG. 21. Vertical sagittal section through the palate and adjacent parts of a new-born child (nat. size).

1. Soft palate ; 2. Hard palate ; 3. Nasal septum ; 4. Outer wall of the left nasal cavity exposed by removal of upper part of nasal septum ; 5. Cranial cavity ; 6. Basi-sphenoid bone ; 7. Basi-occipital ; 8. Orifice of left Eustachian tube.

formed. From the anterior end of this ridge a series of rugæ runs outwards on either side. These vary in the degree of their development, being generally well marked in the infant, and in adults they are often broken up into irregular masses (Fig. 167, p. 186).

On the soft palate the mucous membrane is thinner, and of a deeper red colour. The raphé may be traced to the base of the uvula. On the oral surface of both portions of the palate the

mucous membrane is covered with squamous epithelium; on the naso-pharyngeal surface of the soft palate the epithelium is of the columnar, ciliated type. Throughout the whole of its extent the mucous membrane contains racemose glands. These are specially numerous in the anterior part of the soft palate and in the uvula.

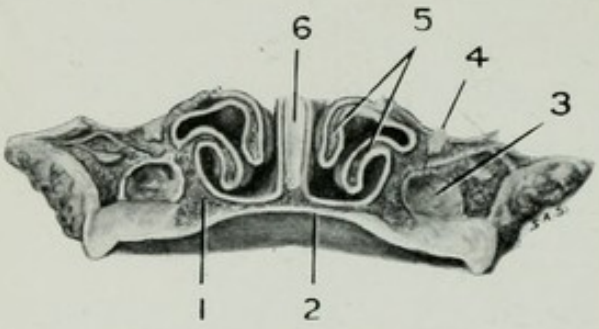


FIG. 22. Vertical coronal section through the nose, palate and upper jaws of a newborn child (nat. size).

1. Upper jaw; 2. Mucous membrane of hard palate; 3. Pre-molar tooth unerupted; 4. Floor of orbit; 5. Middle and inferior turbinated bones; 6. Nasal septum.

The muscles may be divided into groups—two superior, one intermediate, and two inferior on each side; there are thus five pairs of muscles controlling the movements of the palate.

The levator palati arises from the under aspect of the apex of the petrous bone, and from the lower margin of the cartilage of the Eustachian tube. It passes obliquely downwards and inwards across the upper border of the superior constrictor, and is inserted into the aponeurosis, some of its fibres becoming continuous with those of the opposite muscle. In the palate it lies between the two layers of the palato-pharyngeus.

The tensor palati arises from the scaphoid fossa of the internal pterygoid plate, the spine of the sphe-

noid bone, and the outer side of the cartilage of the Eustachian tube. It descends on the mesial aspect of the internal pterygoid muscle, ending in a tendon which hooks round the hamular process, and is inserted into the horizontal plate of the palate bone, and into the aponeurosis.

The palato-glossus is placed below all the other muscles, and immediately above the mucous membrane of the anterior surface of the soft palate. Its fibres are continuous with those of the opposite side, and descend in the anterior pillar of the fauces to the side of the tongue, becoming continuous with those of the stylo-glossus, and transverse fibres of the tongue.

The palato-pharyngeus consists of two layers. The superior is thin, and continuous across the middle line with the fibres of the opposite muscle: the inferior layer is thicker and is attached to the posterior margin of the hard palate. The two layers receive some fibres from the cartilage of the Eustachian tube (salpingo-pharyngeus) and unite at the posterior edge of the palate. The muscle descends in the posterior pillar of the fauces, and is inserted into the posterior border of the thyroid cartilage and the aponeurosis of the pharynx, being placed beneath the middle and inferior constrictors.

The azygos uvulæ consists of two small bundles of muscular fibres, arising from the posterior nasal spine and aponeurosis of the palate. They unite

as they pass backwards in the uvula. This muscle and the levator palati are enclosed between the layers of the palato-pharyngeus.

Another muscle, which, although not directly attached to the palate, nevertheless plays an important part in the mechanism of speech, is the **superior constrictor of the pharynx.** The upper fibres of this muscle, springing from the lower part of the internal pterygoid plate and neighbouring soft parts, pass backwards round the side of the pharynx to blend with those of the opposite muscle in the middle line. The levator palati passes obliquely from above downwards and from without inwards over the upper border of this muscle. The highest fibres of the superior constrictor act, therefore, as a kind of sphincter, which, when in action, presses the levatores palati towards the middle line and helps to shut off the oral from the nasal cavity. In a case of cleft palate this sphincter-like action tends to produce approximation of the edges of the cleft.*

Nerve-supply.—The tensor palati, belonging to the first visceral arch, is supplied, through the otic ganglion, by the third division of the fifth nerve. The other muscles—levator palati, palato-pharyngeus, palato-glossus, azygos uvulæ, and superior constrictor—are supplied from an entirely

* For a full description of these various muscular bands see an interesting publication by Warnekros, "Gaumenspalten," 2nd edit. (Hirschwald, Berlin, 1909).

different source, namely, the spinal accessory, through the pharyngeal plexus.*

Action of palate muscles.—These muscles are brought into action in two distinct processes, namely, that of swallowing and that of speech. The palato-glossi depress the soft palate and elevate the tongue; at the same time they bring together the anterior pillars of the fauces, and thus shut off the mouth from the pharynx.

The palato-pharyngei depress the palate and raise the pharynx, but their chief action is to bring together the posterior pillars of the fauces, and thus shut off the naso-pharynx from the oro-pharynx. The levatores palati raise, while the tensores palati tighten and fix, the palate. The azygos uvulæ muscles raise and shorten the uvula.

Action of the soft palate in respiration.—In ordinary quiet respiration with the mouth closed, the soft palate is relaxed and hangs loosely, thus allowing the air to pass freely from the naso-pharynx to the larynx and air-passages of the lungs. When the mouth is open, and breathing is carried on through this cavity and the nose at the same time, the palate is completely relaxed, and hangs as a loose fold. Snoring is the result of the vibration of the palate, when it is absolutely relaxed. When

* The exact origin of the nerves that supply these muscles has been the subject of some controversy. For confirmation of the statement in the text we are indebted to Mr. F. G. Parsons of St. Thomas's Hospital and Prof. D. Waterston of King's College, both of whom have kindly written to us on this subject.

respiration takes place through the mouth alone the palate is raised to its full extent.

Action of the palate in articulation.—One of the most important functions of the soft palate is to shut off the nasal from the oral cavity during speech. If the free and perfect action of the muscles of the palate is interfered with, either by traumatism, paralysis, or congenital deformity, so that these cavities cannot be separated completely during speech, some amount of nasal twang and indistinctness of articulation necessarily follows. This is more noticeable in the production of certain consonants than of others. In cleft palate, even though the result of the operation be an operative success, the correct pronunciation of consonants and words does not necessarily always follow, owing to shortness of the muscles or cicatricial contraction interfering with the delicate proper movements of the palate, so essential for correct articulation. To some extent imperfect speech after operation is due to a bad habit of pronouncing the consonants, and therefore in all cases it is necessary to educate the patient to speak properly. (For further details *see* chaps. iv. and viii.)

Deglutition.—During deglutition food is prevented from passing into the nose by the action of the soft palate, the muscles of which contract, tighten, and bring it into contact with the posterior pharyngeal wall. At the same time, mainly by the contraction of the upper portion of the superior

constrictor, the pillars of the fauces are approximated. The food is driven backwards by the action of the tongue muscles through the narrowed isthmus of the pharynx into the upper part of this cavity, whence it is carried along by the constrictors.

The vascular supply of the hard palate is derived from the posterior palatine artery, the accessory palatine, and the terminal branches of the naso-palatine. The soft palate receives its blood-supply from the first-named arteries, the ascending palatine branch of the facial artery, and the ascending pharyngeal artery. Thus an abundant vascular supply is provided, a condition which in the operation for the closure of cleft palate allows of free separation of the muco-periosteum of the hard palate, without any great fear of sloughing taking place, and which also permits of suitable lateral incisions being made for the relief of tension without undue risk to its vitality.

The exact position of the posterior (descending) palatine artery and of the terminal branches of the naso-palatine must be remembered. The former enters the hard palate through the posterior palatine foramen, the position of which has already been described (p. 23). The terminal branches of the naso-palatine artery enter the palate behind the incisor teeth, through the anterior palatine foramen, and anastomose with the terminal branches of the descending palatine artery.

In addition to the vascular supply derived from the muco-periosteum, the bony palate has an independent supply of blood, and hence necrosis does not occur when the muco-periosteum is detached.

CHAPTER III

VARIETIES OF HARELIP AND CLEFT PALATE

Situations of harelip : Associated deformities : Varieties : Unilateral : Bilateral : Median : Cleft palate : Diagnosis of congenital cleft palate : Varieties : Complete : Incomplete : Single : Double : Shape and width of the cleft : Nasal septum : Presence of adenoids : The premaxillary bones

Harelip

HARELIP is a congenital malformation due to the failure of union of the separate processes entering into the formation of the lip. The fissure may be situated :

(1) On one or other side of the middle line, constituting the variety known as single or unilateral harelip.

(2) On each side of the middle line, giving rise to double or bilateral harelip.

(3) In the middle line, forming a median harelip ; this variety is extremely rare.

Associated with the harelip or with a cleft palate a deformity of the lower lip is occasionally present (Figs. 23 and 24). These figures were taken from two sisters, each of whom had a cleft palate. There is a definite V-shaped notch in the middle of the lower lip, and on either side of it a

prominent tubercle or nipple-like process, covered by mucous membrane, is present. These processes vary somewhat in shape, being oval and elongated

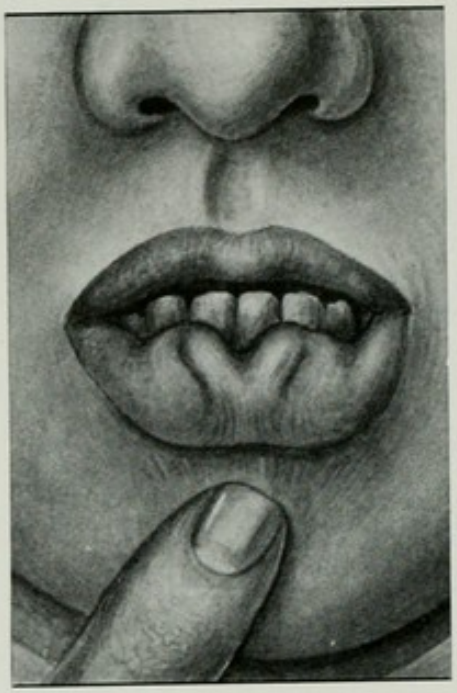


FIG. 23. Congenital deformity of the lower lip. Two prominent ridges of mucous and submucous tissues are seen on each side of the middle of the lip.

Mary P., aged 10 years (shown to us at the Foundling Hospital by Dr. Swift in 1909).

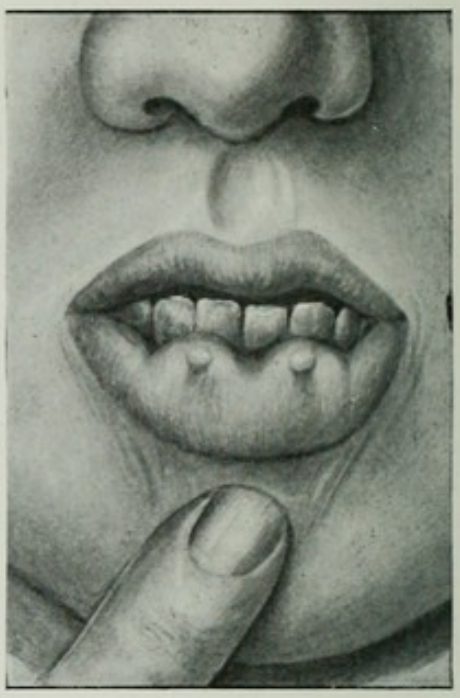


FIG. 24. Congenital deformity of the lower lip, somewhat similar to the preceding. A small prominent tubercle is seen on each side of the middle of the lip.

Florrie P., aged 10 years, twin sister of the preceding (shown to us at the Foundling Hospital by Dr. Swift). Both these children had also cleft palate.

(Fig. 23) or rounded and globular (Fig. 24). Their size varies: they may be small and nodular, or they may be much larger. Somewhat similar congenital folds of mucous membrane are occasionally seen in the upper lip apart from harelip (Figs. 25 and 26).

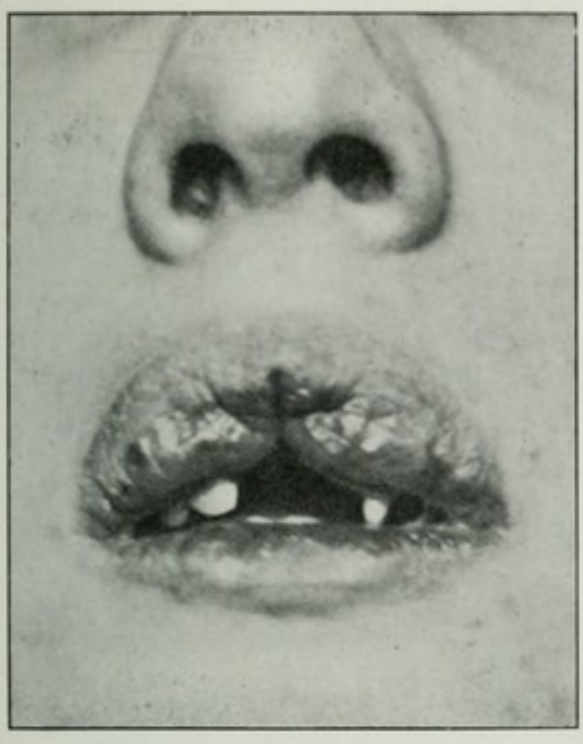


FIG. 25. Congenital abnormality of the upper lip. The lower part of the mucous membrane forms a prominent fold on each side.

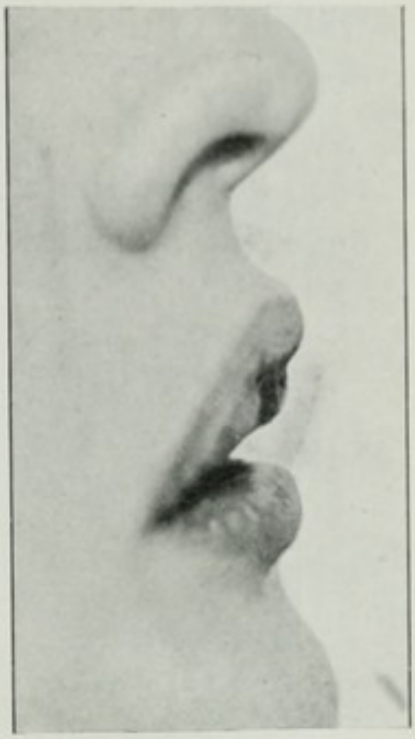


FIG. 26. Side view of the preceding.

Clara W., aged 25 years, Royal Free Hospital, 1911.

Single (Unilateral) Harelip

Single harelip may be incomplete or complete. In **incomplete harelip** the cleft does not extend into the nostril. There are two principal varieties:

(1) That in which the tissues of the lip above the actual cleft are normal. The upper part of the lip is of normal thickness and is covered with normal skin. In such cases the corresponding nostril is also normal in shape and not

widened as it is in the more severe varieties of the deformity.

(2) A more common variety is that in which the tissues above the actual cleft are abnormal. Without being actually cleft the tissues of the lip may

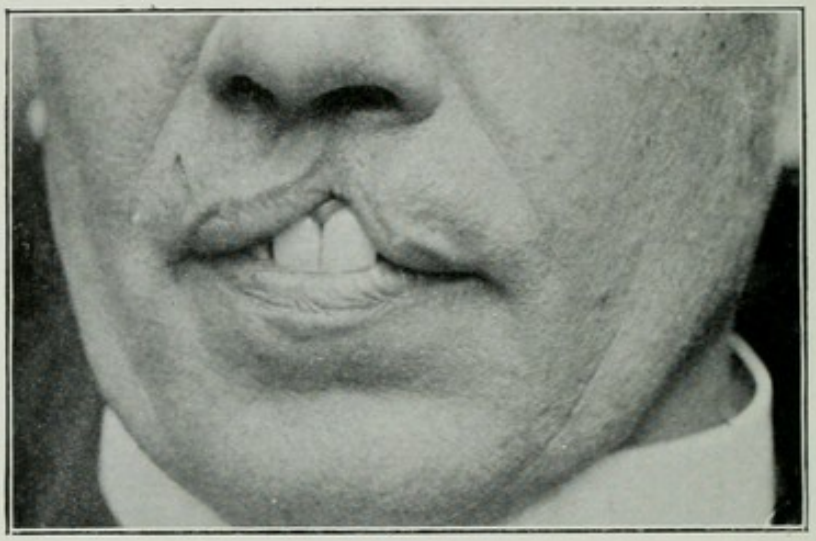


FIG. 27. Single incomplete harelip. Note the thinning of the tissues above the actual notch in the lip. The teeth are artificial. (For condition after operation *see* Figs. 94 and 95, p. 120.)
Mr. G., aged about 40.

be (*a*) thinner than they should be: the skin margins of the original division between the central and lateral parts of the lip have coalesced naturally, but the deeper muscular portions have failed to unite. In such cases the nostril is usually wider than it should be (Fig. 27). (*b*) There may be a narrow bridge of normal skin close to the nostril, the cleft extending almost as far as the nostril itself. In these cases also the nostril is usually wide (Fig. 28).

(*c*) In many cases of incomplete harelip not only is the part of the lip above the cleft thinner than normal, but its epithelial covering is not normal. It is smoother and thinner than true skin; it does not possess hair-follicles or sweat-glands; it is of a different colour, not white like

FIG. 28. Single incomplete harelip, showing widening of the left nostril and a bridge of normal skin beneath it.
Walter V., aged 9 weeks (a patient under the care of Dr. J. C. Baker, of Aylesbury).

skin, but reddish or purplish, more nearly resembling mucous membrane than skin. Sometimes this alteration in colour is but slightly marked, and the parts then present an appearance closely resembling that of a scar. A narrow or broad, slightly discoloured streak extends from the cleft upwards to the nostril (Fig. 27). If an operation in these cases is to give a really good result from the artistic point of view, all such thinned or discoloured tissue must be completely removed.

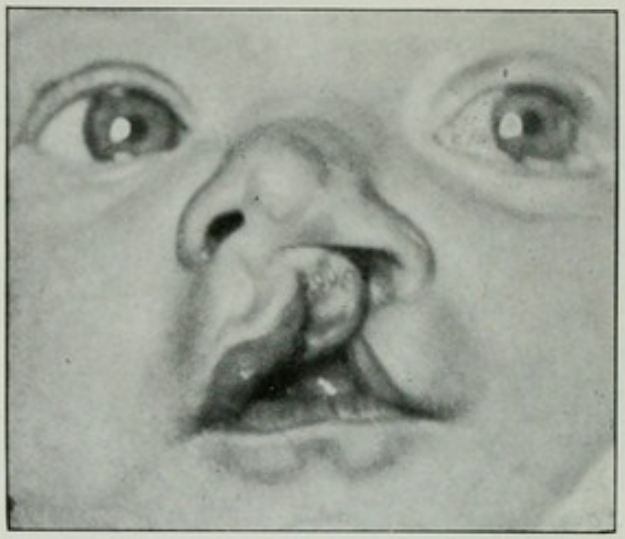


FIG. 29. Single complete harelip associated with single cleft palate. The premaxillary projects forwards, displacing the columna nasi to the right. The left nostril is much widened and flattened.
Phyllis W., aged 3 months, Royal Free Hospital, 1910.

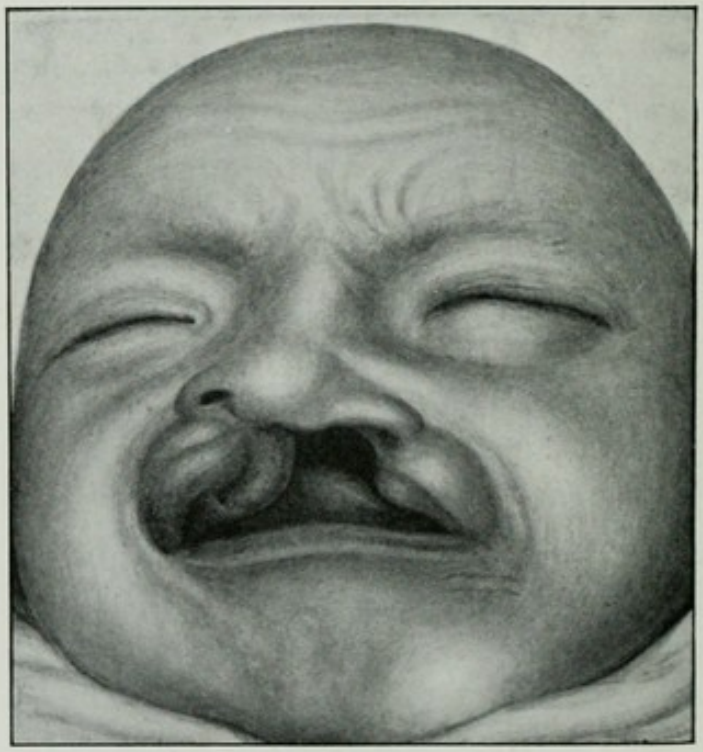


FIG. 30. Single complete harelip showing how the cleft widens when the infant cries. Drawn from a photograph.
George C., aged 8 days. Royal Free Hospital, 1910.

In complete harelip the fissure extends into the nostril. The fissure may be triangular, the margins of the cleft approximating one another at the upper extremity, or the margins may be more or less parallel, producing a quadrilateral defect (Fig. 29). The fissure may be very wide

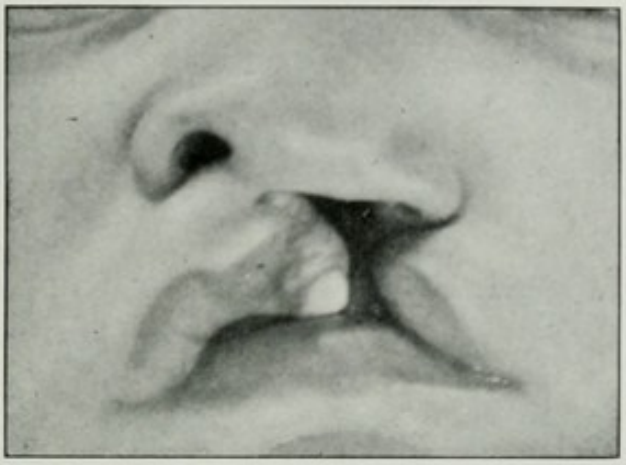


FIG. 31. Single left complete harelip with cleft palate. Showing the flattening of the nostril on the affected side, the prominence of the premaxillary process and the obliquity of the columna nasi. The visible tooth is the left central incisor. (For the associated cleft palate of this case *see* Fig. 54, p. 63.)

John M., aged 9 months, just before operation on the lip. Royal Free Hospital, 1910.

(Fig. 86), or it may be quite narrow. When the child cries or smiles the width is increased (Fig. 30). The sides are lined by mucous membrane, which is continuous with that of the under surface of the lip; towards the nostril the mucous lining generally becomes much narrower, and tails off to a point. In many cases the mucous membrane extends into the nostril, in others it does not do so, and there is a narrow strip of skin at the upper end of

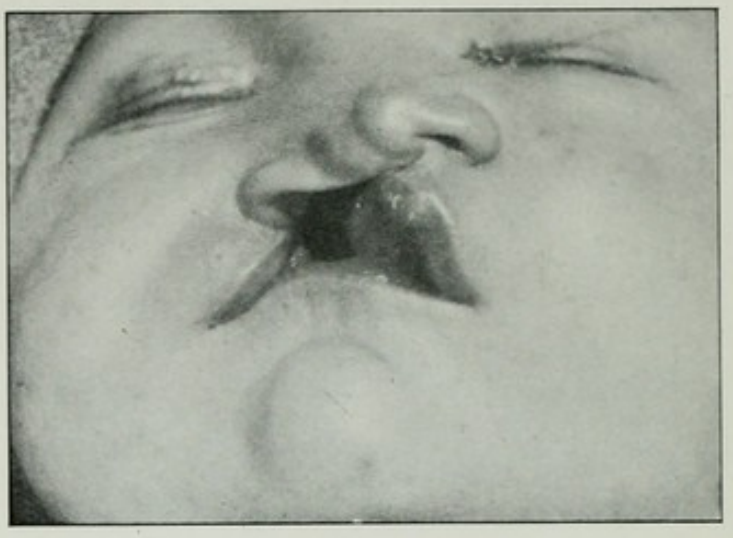


FIG. 32. Single right complete harelip with cleft palate. Similar to the preceding.

Elsie W., aged 3 weeks. Royal Free Hospital, 1910, just before the operation.

FIG. 33. Complete double harelip associated with complete double cleft palate.

Wm. T. M., aged 8 months. Royal Free Hospital, 1900. (For condition after operation *see* Fig. 96, p. 121.)

the cleft on each side. The nostril is widened and flattened to an extent corresponding to the size of the fissure in the lip; the free lower margin of the nostril is often stretched, and therefore thinner than the normal one (Figs. 31 and 32). The lip may be of unequal thickness on the two sides of the fissure, and may be closely or only loosely attached to the maxilla. The frenum is often large and forms a conspicuous fold. The degree of development of the lip is an important factor, both from the æsthetic and operative points of view.

Double (Bilateral) Harelip.

Double harelip may be complete or incomplete on both sides, or it may be complete on one side, and incomplete on the other.

In complete double harelip the fissure extends into the nostril of each side (Figs. 33 and 34). The mucous membrane covering the sides of the fissures is continuous with that of the nose, and is sometimes much thinner than normal. In the lower part of the gap it is often everted, so that more of it is exposed than at the upper part. The nostrils are widened and flattened, the alæ are thin, and the premaxilla usually forms a prominent projection attached to the lower end of the septum nasi. Normal lip tissue is present on each side of the gap, the size of the fissure depending on the degree of development of the structures of the lip.

In incomplete double harelip the fissures do

not extend into the nostrils. There are three degrees:

(1) A notch in the free margin of the lip on either side of the middle line. The remainder of

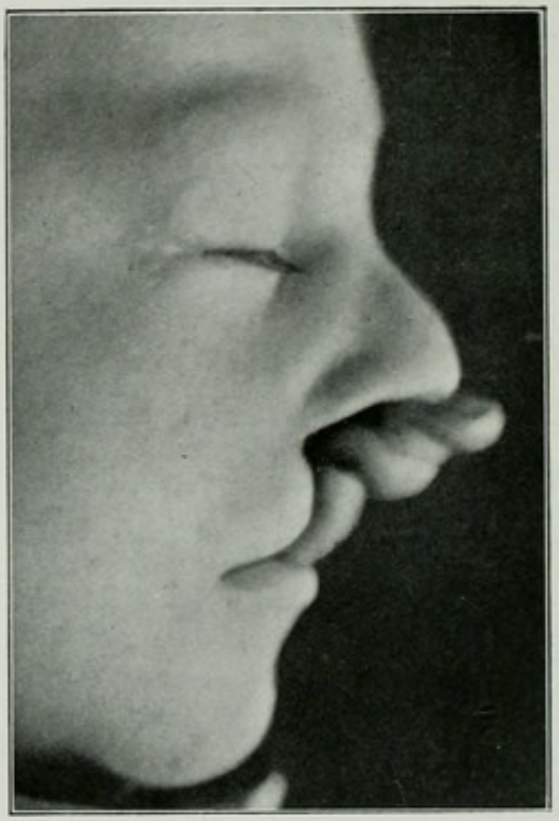


FIG. 34. Side view of the preceding showing the prominence of the premaxillary process and the projecting philtrum attached to the tip of the nose.

the lip is of normal size, and covered with normal skin. The nostrils are unaffected (Fig. 35).

(2) A notch on each side of the middle line, but deeper than in the preceding type. Extending to the nostril from its upper end, there may be a narrow band or groove along which the thickness of the lip is very much less than in the remainder of the

FIG. 35. A very slight degree of double harelip. There is a slight notch in the upper lip on each side of the middle line. The rest of the lip is quite normal. There is no cleft of the palate.

Mrs. M., aged about 60, seen with Dr. Willoughby Gardner of Shrewsbury. (Drawn from a photograph.)

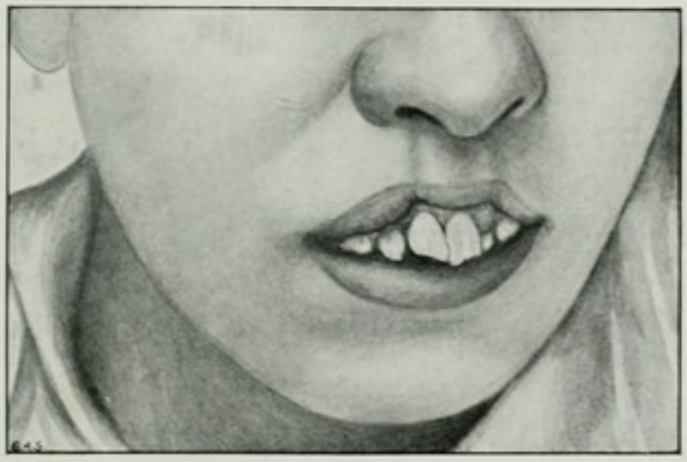


FIG. 36. Double incomplete harelip. The skin and mucous membrane are not cleft but the muscular portions of the lip have failed to coalesce. The condition resembled that of a scar on each side of the lip, although no operation had ever been performed. There are slight notches at the free margin of the lip.

Mary C., aged 23. Royal Free Hospital, 1903. (Drawn from a photograph.)

lip, which may also be thinner and smaller than a normal lip (Figs. 36, 37 and 38). The nostrils may be of natural size and shape, or they may be somewhat broadened.

(3) There is a ∧-shaped notch on each side, involving a large portion of the lip. Not infre-

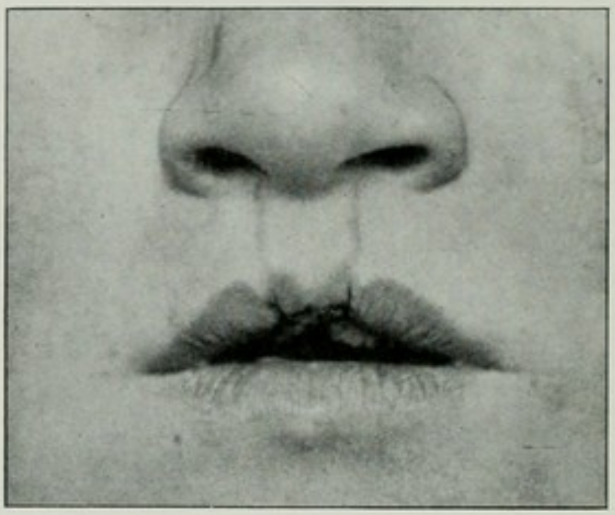


FIG. 37. Double incomplete harelip associated with cleft of the soft and posterior part of the hard palate. The condition is somewhat similar to that shown in Fig. 36. On each side a rather wide shallow groove extends upwards to the nostril from a slight notch in the free margin of the lip. *See also* Fig. 8, p. 9.

Sylvia D., aged 6 years. Royal Free Hospital, 1911.

quently the notches of the two sides are unequal in size. The central part of the lip may be smaller than normal. As in single harelip, if the notch is large, there will be only a narrow bridge of tissue between it and the nostril; when the notch is small, this part of the lip may be almost normal in thickness and structure, or there may be a groove or scar-like band extending from the apex of the notch to the nostril, and this part is often of

different colour and texture from that of the remainder of the lip. The nostrils may be normal, or one may be widened and flattened and the other

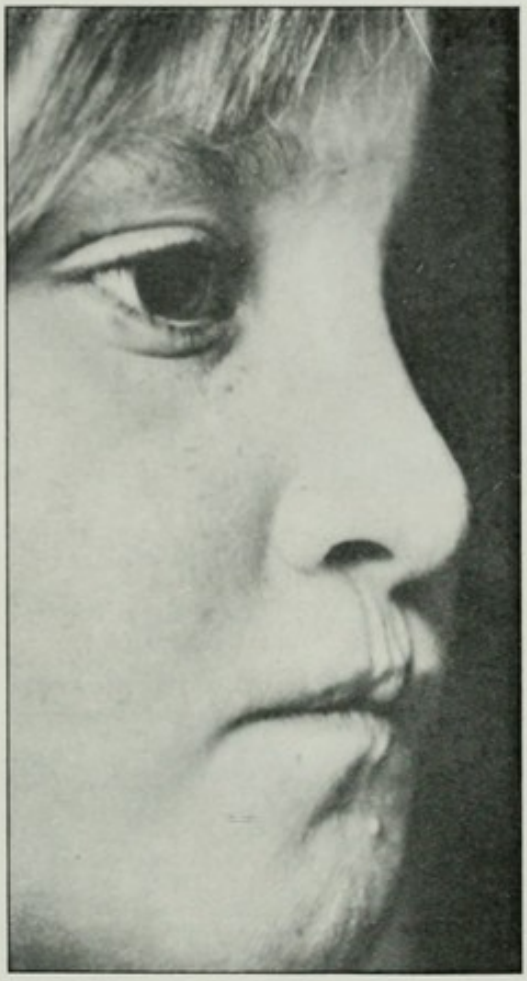


FIG. 38. Side view of the preceding. The grooves in the upper lip are more easily seen.

rounded; or both may be wider than normal (Fig. 39).

Complete on one side, incomplete on the other.—When the harelip is of this type the deformity will be a combination of those just

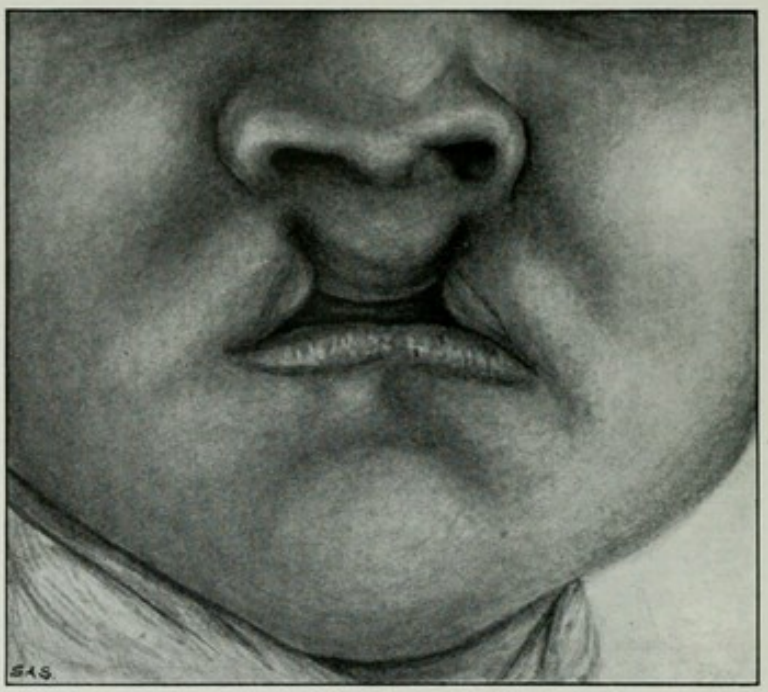


FIG. 39. Symmetrical double incomplete harelip without cleft of the palate.

Freda H., aged 9 weeks. Royal Free Hospital, 1904. (Drawn from a photograph.)

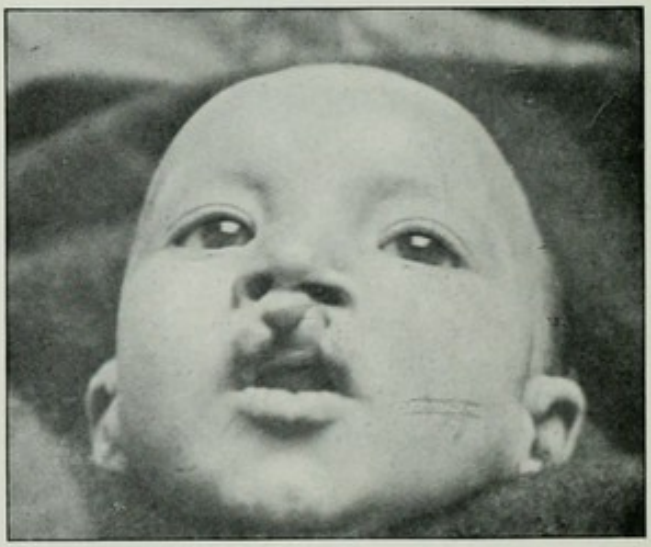


FIG. 40. Double harelip (left complete, right incomplete) associated with prominence of the premaxillary process and cleft of the left alveolar margin and of the soft palate, but not of the hard palate.

Cecil B., aged 4 months. Royal Free Hospital, 1907.

FIG. 41. Double harelip, right complete, left incomplete. There was also double complete cleft palate. Alfred B., aged 11 weeks. " Royal Free Hospital, 1908.

described. No further special description is therefore necessary (Figs. 40 and 41).

Median Harelip

This term is applied to a very rare deformity of the lip. Several distinct types may be described, but most of them are of no great practical importance:

(1) The simplest form may be regarded as a double incomplete harelip. The philtrum and premaxillary process are present in their normal positions. In the middle line of the upper lip there is a notch, or ∧-shaped depression, in the

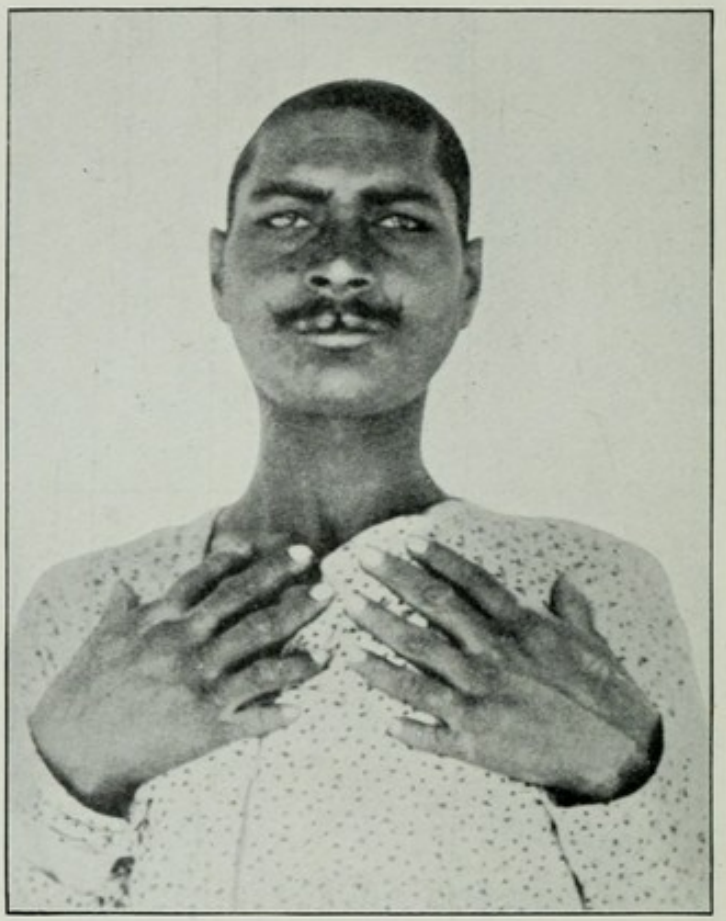


FIG. 42. Median harelip. There is a well-marked notch in the centre of the free border of the upper lip. The nostrils, the rest of the lip, and the palate were normal. There was also polydactyly in this case.

Captain E. O. Thurston's case, published in the *Lancet*, October 2, 1909. (By kind permission of Captain Thurston and the Editor of the *Lancet*.)

mucous membrane (Fig. 42). On either side of the philtrum a narrow scar-like line or depression may extend to the nostril.

FIG. 43. Case of so-called "median" harelip, really a double harelip and cleft palate without prominence of premaxillary.
(From a patient under the care of Mr. McAdam Eccles, at St. Bartho'omew's Hospital in 1906.)

(2) The premaxillary bone and philtrum may be absent or rudimentary. Therefore there is a gap

FIG. 44. The preceding, shortly after operation by Mr. McAdam Eccles.

in the lip and alveolus and in the anterior part of the palate (Figs. 43 and 44).

FIG. 45. Median harelip proper. The cleft extends along the septum of the nose as far as its extremity. There is thus a median cleft of the nose as well as of the lip. The nose itself is broad and flat. There was no cleft of the palate.

Mr. R. C. Dun's case. Reports of Society for Study of Diseases in Children, 1905, vol. v. p. 294.

(3) There is a cleft involving the whole depth of the lip, and extending into the septum nasi. This cleft is situated where union of the globular processes should normally occur. The nose is

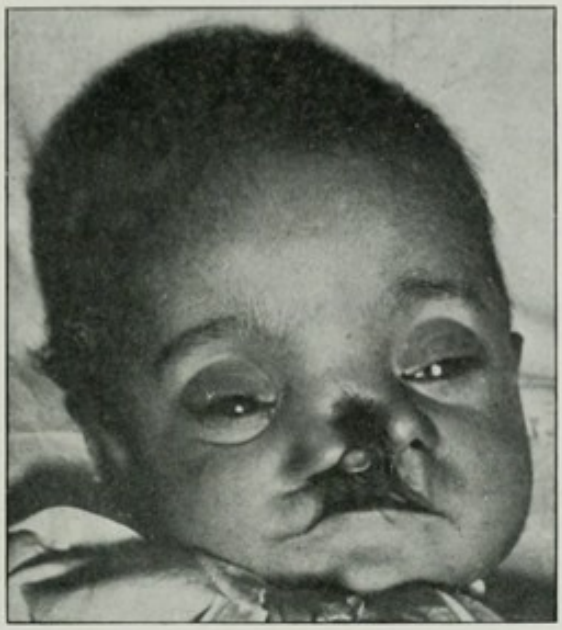


FIG. 46. Cleft of the palate, lip and nose.
(From a photograph kindly lent to us by Dr. T. A. Watson of Sunderland.)
For a slightly different view of the same patient and Dr. Watson's description of the case see *Brit. Med. Journ.*, May 3, 1902.

broad and flat and the width of the septum is greater than normal (Fig. 45).

(4) The cleft extends into the fronto-nasal process. There is a gap in the middle of the lip and a defect of the lower portion of the septum. In this type the globular processes have failed altogether to unite (Fig. 46).

(5) A more extreme cleft may be present in the fronto-nasal process (Fig. 47).

FIG. 47. Extensive cleft of the face involving palate, lip and nose. The cleft extends through the left side of the palate and lip. Note the meningocele and the supernumerary auricle.

For the photograph and drawing of this patient we are indebted to Mr. J. Keogh Murphy, under whose care the patient was.

Cleft Palate

The term cleft palate should be applied only to the congenital deformity, and not used for the acquired defects, which are caused by injury or are the result of syphilis or other diseases. It is important to distinguish between congenital cleft palate and defects due to these other causes. The history and the association with a harelip, or the presence of a groove in the alveolus at the site of

the suture between the premaxilla and maxilla, is strong evidence of the defect being a congenital one. A bifid uvula, the two parts being of the same size, is certainly a congenital deformity, and in all congenital malformations the soft palate is freely movable unless an unsuccessful operation has been performed.

When the defect is due to injury a history of the cause may generally be obtained. The aperture is frequently placed in the hard palate at its junction with the soft palate, and often scarring of the mucous membrane is visible round the defect. The aperture is not always in the middle line; it may be placed laterally. These acquired defects are sometimes the result of surgical procedures on the palate—*e.g.*, to gain room for the removal of a naso-pharyngeal growth. Under these circumstances there should be no great difficulty in making the diagnosis, because there will be a clear history of the operation. It is well to remember that in such cases the fissure is usually median (except as regards the uvula), and at first sight may simulate a congenital cleft. Some difficulty in diagnosis may be experienced in syphilitic cases, for there may be no past history of the disease, and not infrequently the condition of the palate is due to congenital syphilis. If the attention is directed to the following points, it is generally possible to determine the syphilitic nature of the defect: (1) The presence of scars on the soft

palate; these scars are usually circular or oval in shape, white in colour, and slightly depressed below the level of the mucous membrane. Scars at the angles of the mouth, or on the tongue, may also be present. (2) When the soft palate is affected, it is frequently adherent to the pharyngeal wall, and its movements therefore are restricted. The uvula is often completely destroyed. When the aperture is limited to the hard palate the mucous membrane is tightly adherent to the underlying bone, and often exhibits scars. (3) There may be evidence of disease in the nose, such as watery, purulent, offensive discharge, or there may be active ulceration, or scarring from the old ulceration in the pharynx. (4) In any doubtful case evidence of syphilis in other parts of the body should be carefully sought for.

It is especially in cases of cleft palate which have been unsuccessfully operated upon that difficulties in diagnosis are apt to arise. In the absence of the history of the operation, the presence of a linear scar on each side of the hard palate between the alveolus and the aperture would be strongly in favour of an operation having been done. The situation of the aperture is also a valuable help, for if, after the ordinary operation, a hole remains it will generally be found in the middle line of the hard palate, either at its anterior extremity or at its junction with the soft palate, and a scar between these places, or in front of or behind the hole, is

strong evidence of an unsuccessful operation. If a portion of one flap of muco-periosteum has sloughed, the hole may be placed to one side of the middle line. In such a case the situation of linear scars in the afore-mentioned situations would enable the surgeon to make the diagnosis of an unsuccessful operation.

When the soft palate has been unsuccessfully operated upon, and the uvula has sloughed, the resemblance to old syphilitic disease may be very close. But the presence of linear scars is sufficient to enable the diagnosis of a previous operation to be made. Stitch marks may also be present, and will aid in the diagnosis. Notches in the margins of the cleft often show where stitches have cut out.

Ulceration and sloughing due to diphtheria, measles, scarlet fever, and other exanthemata occasionally leave a condition of the palate which presents some resemblance to a congenital cleft.

Varieties of Cleft Palate

It will be remembered that the palate is normally completed by the union of its individual segments taking place from before backwards, the uvula being the last part to unite. The extent of the cleft, therefore, depends on the degree of failure of this union.

The principal varieties of cleft palate are

(1) **The uvula only is cleft**, and divided into

two equal segments, constituting the condition known as **bifid uvula** (Fig. 48). It is questionable if speech is ever affected by this condition.

FIG. 48. Bifid uvula. From a specimen, No. 1623 St. Bartholomew's Hospital Museum.

(2) **The uvula and soft palate are cleft.**— The soft palate is cleft in the middle line for a greater or less distance, and when the cleft extends

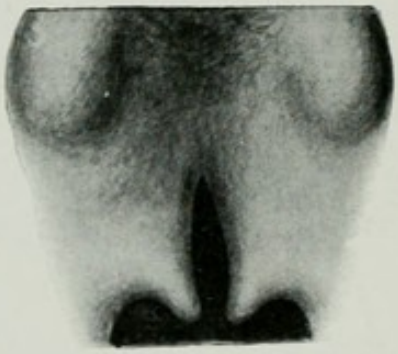


FIG. 49. A narrow cleft of the soft palate. In this case there was also a cleft of the alveolar margin and a double harelip. (*See* Fig. 40, from the same patient.)
Cecil B., aged 4 months. Royal Free Hospital, 1907. Appendix, 94.

as far as the posterior edge of the hard palate a ∧-shaped notch can often be felt in the middle line of this structure. The mucous membrane in this position is then often thin and bluish in colour. The cleft may be narrow, and its edges easily

brought together (Fig. 49): or the cleft may be wide and the edges difficult to approximate (Fig. 50).

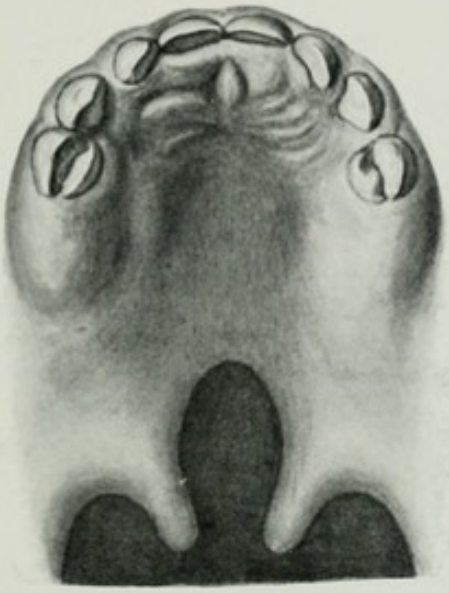


FIG. 50. A fairly wide cleft of the soft palate. There was no harelip. Dorothy L., aged 2 years. Royal Free Hospital, 1911. Appendix, 149.

(3) **Cleft of the soft palate and posterior part of the hard palate.**—This is a further degree of the preceding type: in it the cleft in the posterior end of the hard palate is visible (Fig. 51 and Fig. 168, p. 187,), whereas in the preceding variety it is bridged over by mucous membrane.

(4) **Cleft of the soft palate and posterior three-fourths of the hard palate.**—In these cases the cleft extends nearly to the anterior palatine foramen, and the inferior margin of the vomer forms a prominent ridge in the middle of the cleft. The cleft is strictly median (Figs. 52 and 53). Some cases of this kind were originally complete

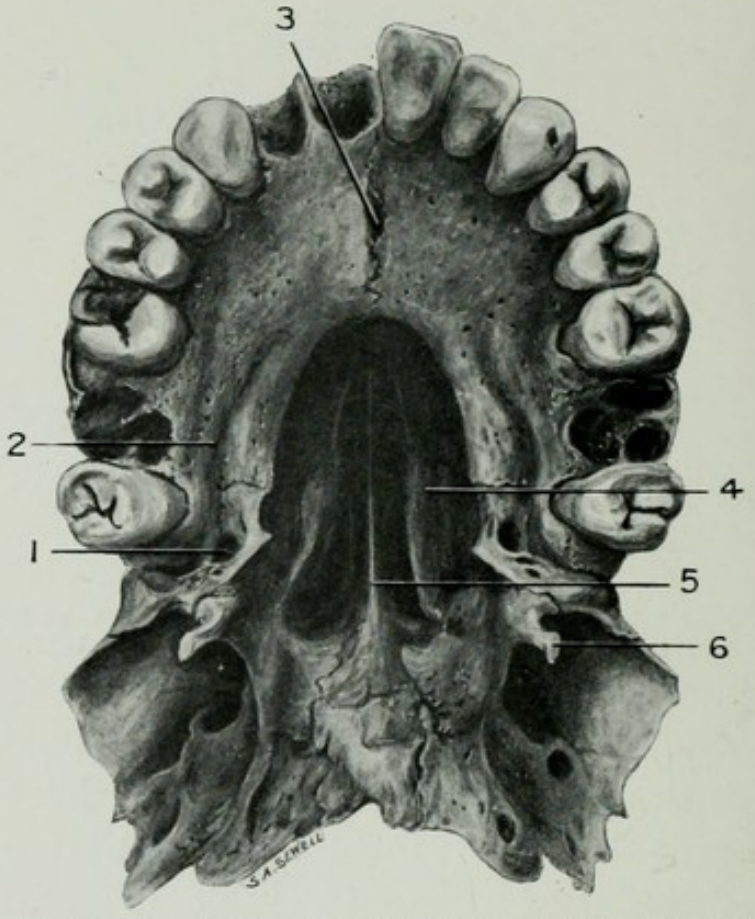


FIG. 51. Drawing of an adult skull showing a wide median cleft involving the posterior half of the hard palate.

(From a specimen, No. 1152, in the Museum of the Royal College of Surgeons.)

1. Posterior palatine foramen ; 2. Groove for posterior palatine artery ; 3. Anterior palatine foramen ; 4. Middle turbinated bone ; 5. Nasal septum ; 6. Hamular process.

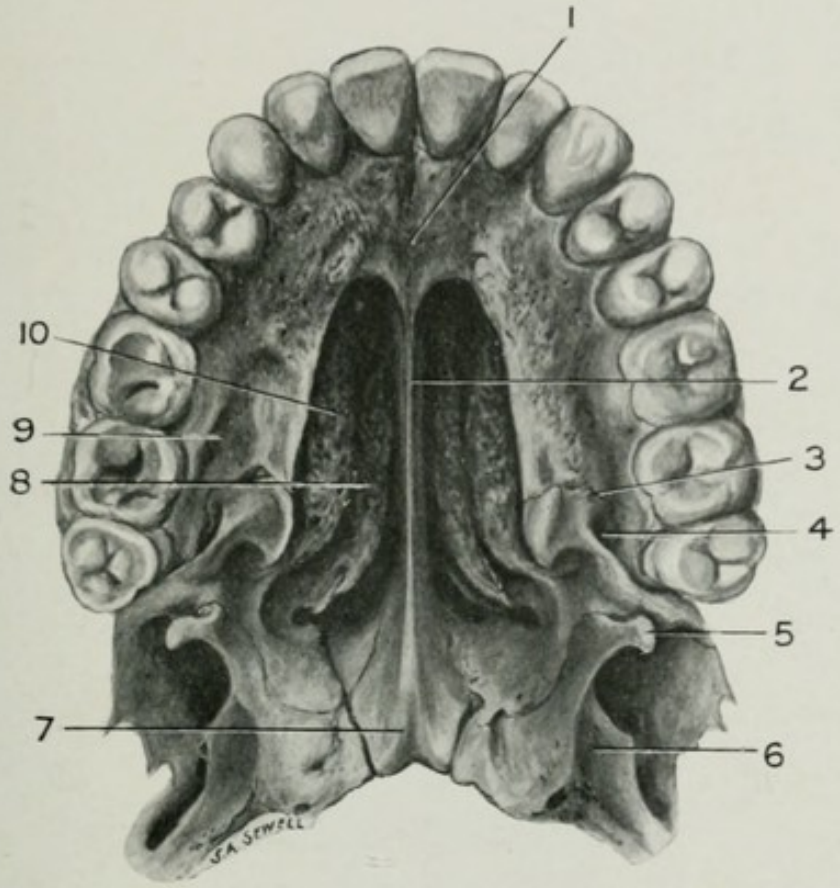


FIG. 52. Drawing of an adult skull showing a median cleft involving the posterior three-quarters of the hard palate (the left turbinated bones and some teeth have been restored).

(From a specimen, No. 210, in the Museum of the Royal College of Surgeons.)

1. Anterior palatine foramen; 2. Nasal septum; 3. Palato-maxillary suture; 4. Posterior palatine foramen; 5. Hamular process; 6. Origin of tensor palati muscle; 7. Vomer; 8. Middle turbinated bone; 9. Groove for posterior palatine artery; 10. Inferior turbinated bone.

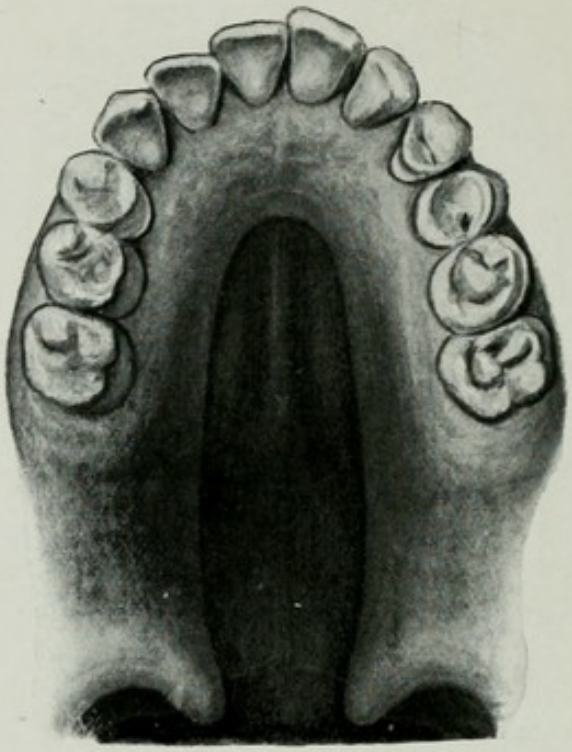


FIG. 53. A cleft of the soft palate and posterior three-quarters of the hard.

Janet W., aged 10. Royal Free Hospital, 1898.
Appendix, 7.

clefts of the whole palate, the alveolar margins having undergone spontaneous closure after birth.

(5) Clefts involving the Alveolus

In the great majority of patients with this type of cleft palate there will be also a harelip.

(1) **Single (unilateral) harelip and cleft palate.**—There is, as a rule, a complete cleft of the

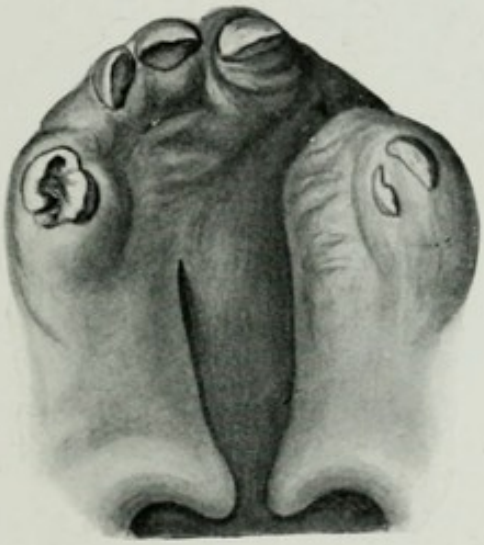


FIG. 54. Complete single cleft of the palate. The septum of the nose is seen to be attached to the right maxillary and to the premaxillary bones. There is no left lateral incisor. For the associated harelip of this case, see Fig. 31, p. 41. (*See also* Fig. 195, p. 219.)
John M., aged 13 months. Royal Free Hospital, 1911. Appendix, 139.

palate. Anteriorly the cleft is placed between the premaxilla and the maxilla; behind the situation of the anterior palatine foramen, the cleft is in or near the middle line of the palate (Figs. 54, 55, 56 and 57).

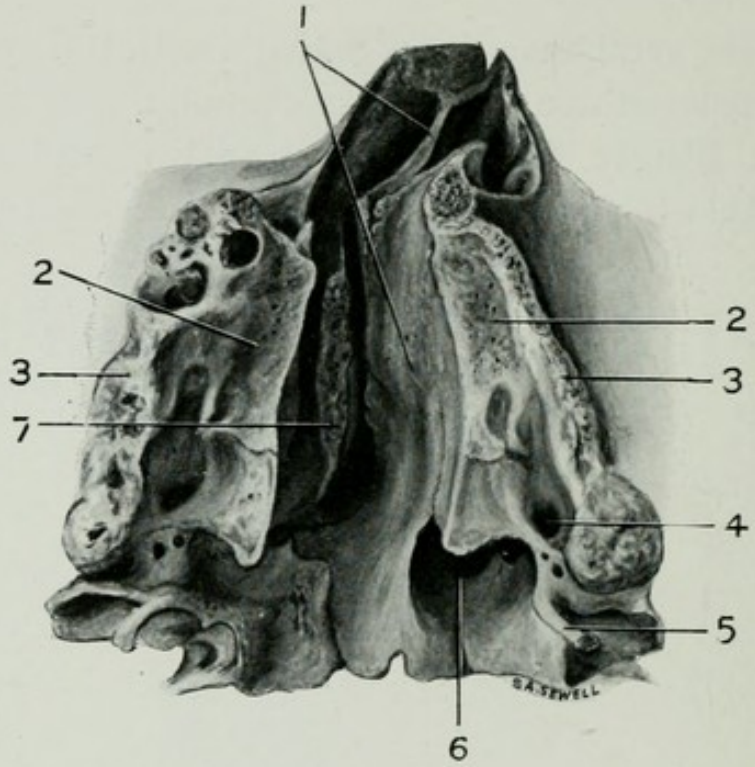


FIG. 55. Drawing of an adult skull showing a single right complete cleft of the palate. (From a specimen (No. 196) in the Museum of the Royal College of Surgeons.)

1. Nasal septum ; 2. Hard palate ; 3. Alveolus (edentulous on left side) ; 4. Posterior palatine foramen ; 5. Hamular process ; 6. Left posterior naris ; 7. Right middle turbinated bone.

(Note the deformity of the septum.)

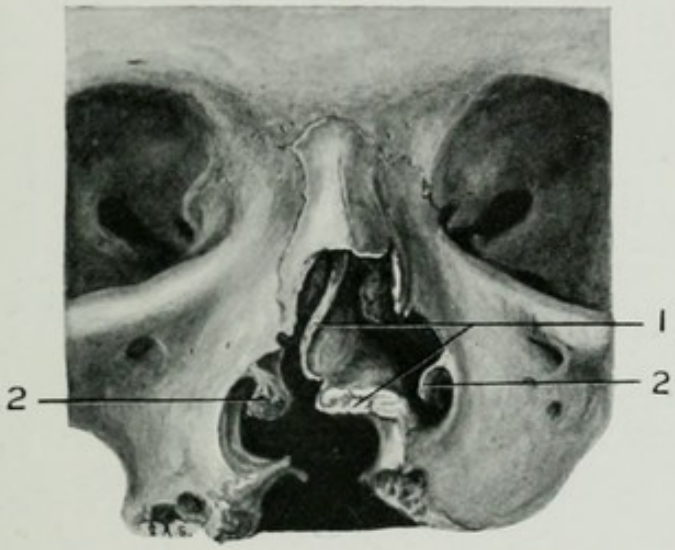


FIG. 56. The preceding, seen from the front.
1. Nasal septum ; 2. Inferior turbinated bone.

(2) **Double (bilateral) harelip and cleft palate.**—In the majority of cases the harelip is complete on each side, the premaxilla forming a

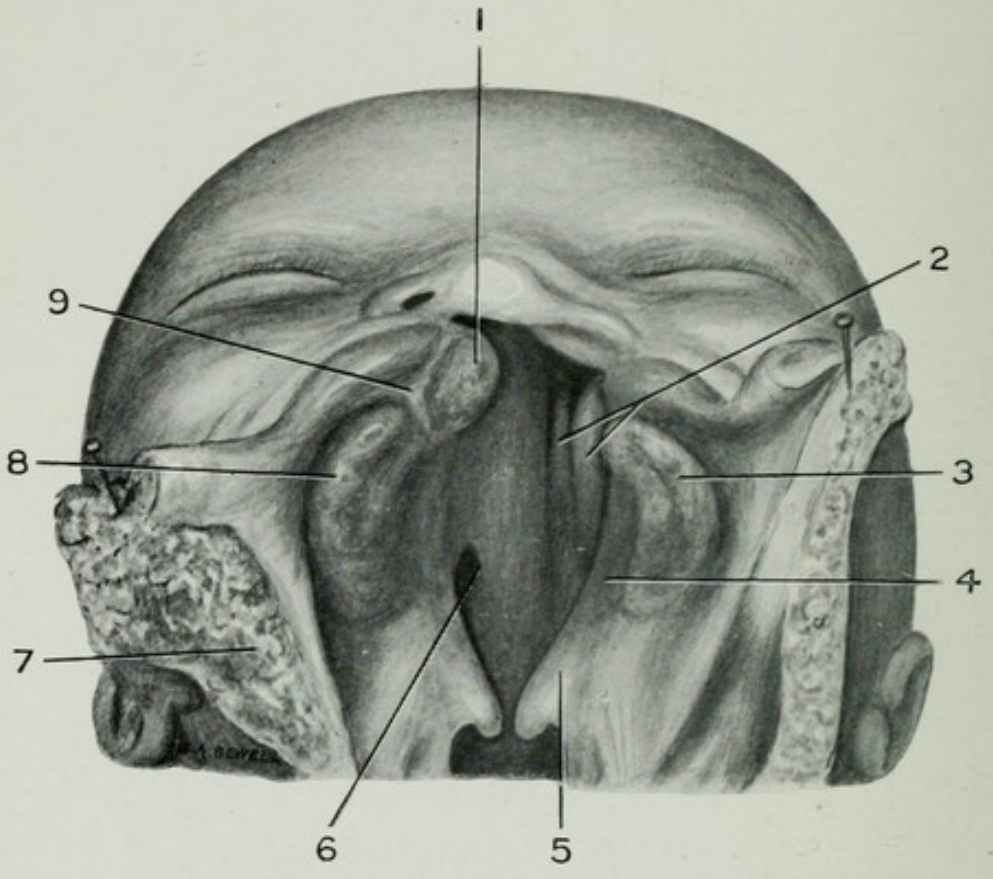


FIG. 57. Single left complete cleft palate with harelip.
(From a specimen in the Museum of the Royal Free Hospital.)
1. Premaxilla: 2. Middle and inferior turbinated bones; 3. Alveolus of the left side; 4. Hard palate; 5. Soft palate; 6. Posterior end of septum of nose; 7. Cheek turned back; 8. Alveolus of right side; 9. Frenum.

prominent projection from the lower end of the septum nasi. In other cases the harelip is complete on one side, and incomplete on the other, or there may be incomplete harelip on both sides. When the harelip is complete on both sides the cleft in the palate will be median throughout its whole

extent, except at the anterior extremity, where it divides to enclose the premaxillary process (Figs. 58, 59 and 60).

Besides these, which are the common types of cleft palate, congenital defects involving an inter-

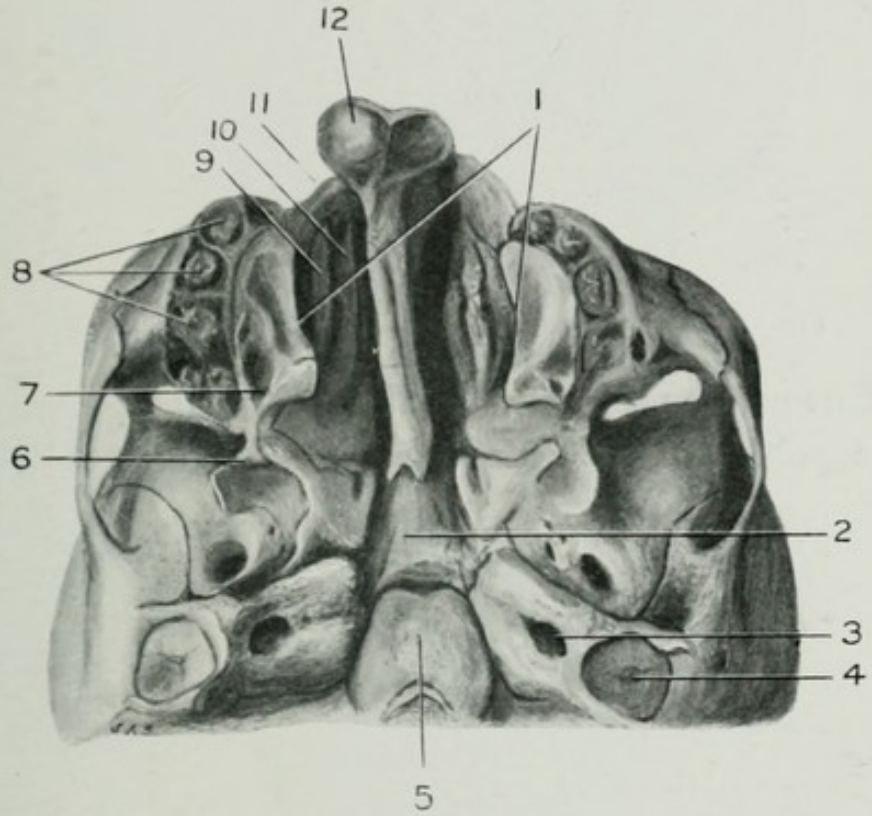


FIG. 58. Base of skull of a new-born infant with double complete cleft palate. (Natural size.)

1. Edges of bony palate; 2. Basi-sphenoid; 3. Jugular foramen; 4. Membrana tympani; 5. Basi-occipital; 6. Hamular process; 7. Posterior palatine foramen; 8. Germs of milk teeth; 9. Inferior turbinated bone; 10. Middle turbinated bone; 11. Edge of bony nostril; 12. Premaxillary process with germs of central incisor teeth. Note the absence of the lateral incisors.

(From a specimen kindly lent to us by Dr. Johan Ulrich of Copenhagen.)

mediate portion only of the palate are occasionally met with. It cannot be too strongly emphasised, however, that central holes are almost invariably

the result of syphilis or tubercle, or have followed operation or some other trauma. An example of

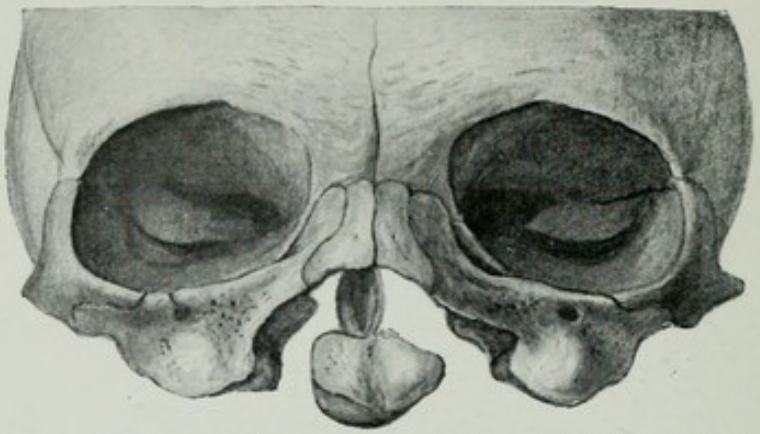


FIG. 59. The preceding seen from the front. (Natural size)

a true congenital defect of the intermediate part of the palate is illustrated in Fig. 12 (p. 12). The

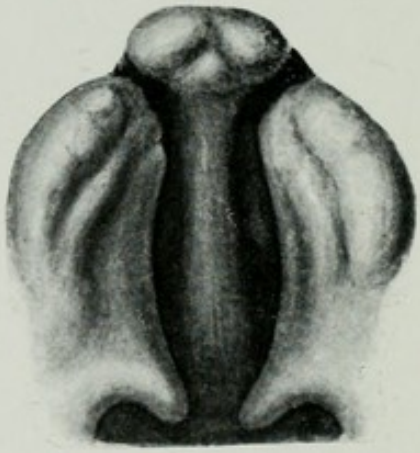


FIG. 60. Complete double cleft palate. Note the thickness of the septum.
Cyril R., aged 6 weeks. Royal Free Hospital, 1911.

patient was a girl aged sixteen years. At the junction of the hard and soft palates a congenital aperture measuring 7 mm. long and 5 mm. wide was present. Two-thirds of the opening were in

the hard palate, and one-third in the soft palate. The edges were thin, and on either side of and behind the opening the tissues were thinner than is natural. The uvula and posterior edge of the soft palate were also congenitally cleft. The mother stated that the opening in the hard palate was noticed soon after birth and that it was then nearly covered with a thin membrane. Similar cases have been recorded by other observers. In another type there is a congenital aperture in the bones of the hard palate, but the hole is covered by mucous membrane, and hence there is no visible cleft. Congenital apertures in the soft palate may be present without any defect in the hard palate, but this is very exceptional.

Several other important features of a cleft palate require to be described.

(1) The shape and width of the cleft.—(*a*) *Complete cleft palate.* The widest part of the cleft both in the single and double variety of this form is usually opposite to, or a little behind, the posterior end of the bony palate. Posteriorly the edges generally slope gently inwards towards the middle line. The tips of the divided uvula are often not very far apart even when most of the cleft is a wide one. When the constrictor muscles are put into action, as in retching, the tips of the uvula may often be seen to approximate closely to one another, or even to touch. Anteriorly the cleft narrows as it approaches the alveolus. In

single cleft palate the gap between the maxilla and premaxilla is nearly always much less than elsewhere.

In double cleft palate the maxillary bones are least widely separated at their anterior ends. Further forwards where the cleft passes between the maxillæ and the premaxillæ, the width of the cleft depends largely upon the degree of prominence of the premaxillary process. As the latter is seldom exactly in the middle line, the width of the cleft is usually unequal on the two sides.

In a young infant with a double harelip that has not yet been operated upon, the cleft in the palate usually remains widely open (Fig. 58). As growth takes place the whole cleft diminishes in width. Especially is this the case at the anterior end, and more so when the harelip has been closed. Indeed, it is rare to find any great amount of separation between the anterior ends of the maxillæ one or two years after the operation on the lip has been performed. This spontaneous closure of the anterior end of the cleft is further facilitated by the gradual repression of the premaxillary process which sets in and progresses steadily after the harelip has been closed.

A common type of complete single cleft palate at the age of one or two years is that depicted in Fig. 61. It will be seen that the maxilla and its corresponding premaxilla have approximated so closely that the cleft in this situation, although originally wide, is now represented by a mere

FIG. 61. Single complete right cleft palate. Note the fusion of the septum with the left maxilla. (For condition of lip *see* Fig. 86, p. 111.)

Winifred B., aged 2¼ years. Royal Free Hospital, 1910. Appendix, 130.

FIG. 62. Single complete left cleft palate. The anterior part of the cleft has undergone spontaneous closure and is now represented by a mere chink. Note the rudimentary extra lateral incisor of the left side. The harelip had been closed in infancy.

Clara W., aged 10 years. Royal Free Hospital, 1911. Appendix, 144.

chink. Indeed, it not infrequently happens that actual coalescence and complete obliteration of the cleft take place at this point (Fig. 62). A superficial groove on the outer aspect of the alveolus, and irregularity of the teeth may eventually be the only remaining sign of the cleft.

(*b*) *Incomplete cleft palate.* In those clefts which do not involve the alveolus the shape of the anterior end is of considerable importance. It may be narrow and pointed, as in Fig. 185, p. 208; these are relatively easy to close. In other cases the anterior end is broad and rounded. The shape has been compared to that of the curved end of a hair-pin.

A common type, shown in Fig. 63, is that in which a broad cleft extends nearly to the alveolus and has a wide rounded end. This is usually the most difficult of all clefts to close satisfactorily by operation (*see* p. 164). Such clefts are always strictly mesial, the septum not being attached to either margin.

Of more importance than the actual width of the cleft is the amount of soft tissues between it and the alveolar border on either side—that is, the amount of tissue available for the repair by operation.

It is the *relative* rather than the actual width that is important. The amount of tissue available on either side depends not only upon the width of the whole palate minus the cleft, but also upon the

height of the palatine arch. A wide cleft with only a small amount of muco-periosteum on either

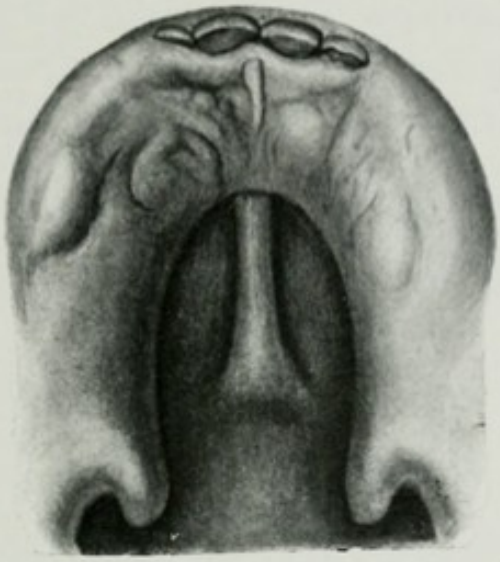


FIG. 63. An incomplete cleft of the palate, showing the wide rounded anterior end, often seen in this type of cleft. There was no harelip. The drawing was made from a cast taken ten months before the operation.

Kathleen T., aged 1 year. Royal Free Hospital, 1907 and 1908. Appendix, 103.

FIG. 64. The preceding some little time after a complete closure of the cleft by the median operation at the age of one year and ten months.

side is more difficult to close than one of the same width with plenty of such tissue.

(2) **The shape of the palate.**—This may be curved, forming a low, nearly horizontal arch; or it may be high, with sides approaching more or less to the vertical (*see* pp. 166–169).

(3) **The soft parts.**—In an ill-nourished child the muco-periosteal tissues of the hard palate are thin and pale; in a well-developed child they are thick and of a good red colour. Hence in the latter the flaps are better nourished than in the former, and therefore more likely to heal quickly after operation. The soft palate is always very much thicker than the soft tissues of the hard (Fig. 21, p. 27, and Fig. 180, p. 203).

(4) **The nasal septum** may be attached to one side of the cleft in the palate, and when this is the case it is attached to the side opposite to that on which the harelip (if this is present) is situated (Fig. 61, p. 71). When the septum is attached in this way the cleft in the hard palate becomes **lateral**, and may be termed **single** or **unilateral** cleft palate. The septum may be united nowhere to the edges of the cleft, the lower edge lying quite free between the sides of the cleft and on a level with the plane of the palate, or it may be at a higher level. In an infant the lower edge of the septum may be so wide that it nearly fills the space between the sides of the cleft (Fig. 60, p. 68), while in older children it is usually much thinner and does not fill

up the cleft (Fig. 167, p. 186). At the lower part of the septum a thin shell of bone may be present, forming a sort of casing to the cartilage.

The septum is not always straight; it is usually deviated considerably to one side (Fig. 68, p. 78),

FIG. 65. Oblique view of cleft palate, showing orifice of Eustachian tube, turbinated bones and septum nasi.
Edith P., aged 13 years. Royal Free Hospital, 1910.
Appendix, 129.

as well as being curved in a vertical plane (Figs. 55 and 56, pp. 64, 65).

(5) Adenoid tissue in the naso-pharynx is often abundant, and forms a large pad, which helps to shut off the nasal from the pharyngeal cavity. It should not be removed without some very definite and cogent reason. There is often a good deal of sticky mucus, which may form a black or brown

layer on the surface of the adenoid tissue. We have known this mucus mistaken by the inexperienced for a slough.

(6) On looking into the cleft, especially when it is wide, the orifices of the Eustachian tubes (Fig. 65), the turbinate bones, the septum nasi, and the base of the skull are all readily visible.

The Premaxillary Bones

The position of these bones in association with harelip and cleft palate is most important. In any of the forms of harelip the premaxilla may be in its normal position. If the alveolus is carefully examined in these cases, a groove or furrow, extending vertically across the line of the gum, is often seen, indicating the line of the suture between the premaxilla and the maxilla. In some cases, instead of the furrow, there is a vertical cleft in the alveolus, and this may be present without any cleft of the palate itself. In all these cases except the last, and often in this too, the alignment of the alveolar arch is normal. When, however, there is a cleft in the palate the premaxillary bones are always more or less displaced.

In single harelip with complete cleft palate the premaxilla may form either a slight (Figs. 61, p. 71, and 66, p. 77) or a very obvious projection (Fig. 83, p. 110). Moreover, in addition to this alteration in relation to the rest of the alveolus, the bone,

when it is markedly prominent, is also deflected, so that its anterior aspect is directed obliquely

FIG. 66. Incomplete right harelip showing slight prominence of the premaxillary bone.
Christian C., aged 8 weeks. Royal Free Hospital, 1910.

FIG. 67. Complete double harelip and cleft palate, showing prominence of premaxillary bones.
(For a later photograph of this patient, *see* Fig. 72, p. 83.)
Ivy W., aged 4 weeks.

forwards, and its inferior margin is not in the line of that of the alveolus on either side. When the

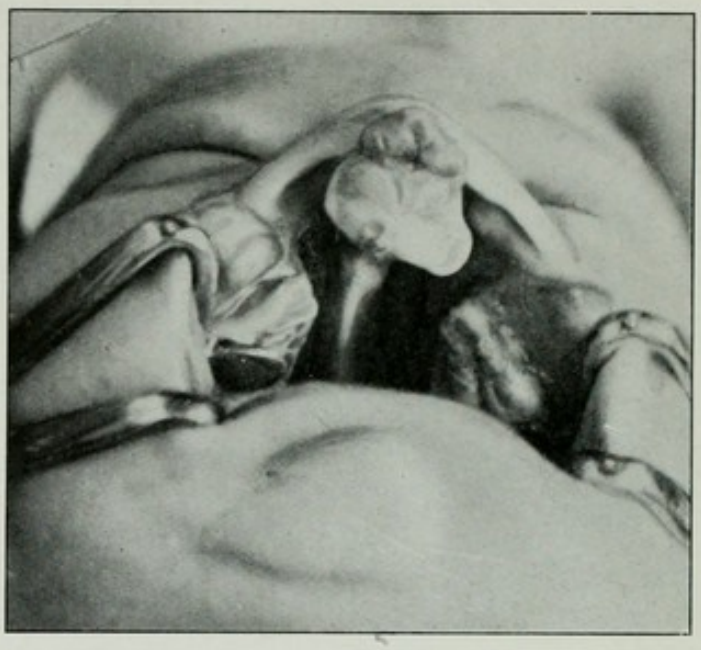


FIG. 68. Complete double harelip and cleft palate, showing the usual displacement and curvature of the nasal septum, and the forward projection of the premaxillary process.

Edward G., aged 11 weeks. Royal Free Hospital, 1909 and 1911. Appendix, 141.

FIG. 69. Front view of the same patient.

displacement is slight the closure of the harelip is often sufficient to cause the bone to recede to its proper position, and no special means to replace

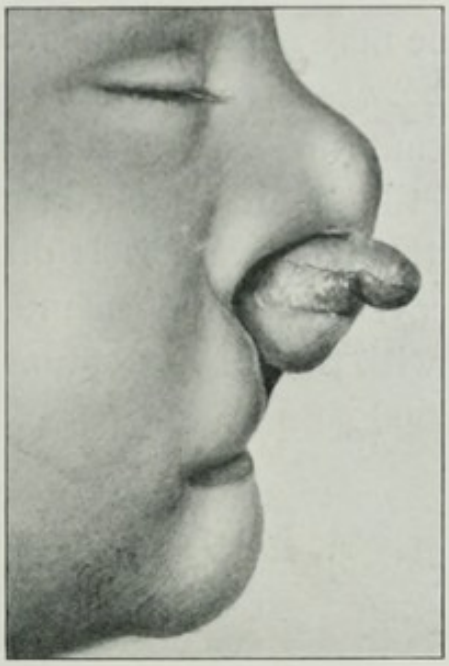


FIG. 70. Side view of the same patient, showing the prominence of the premaxillary process and the manner in which the philtrum is attached to the tip of the nose. (*See also* Fig. 102, p. 125.)

and keep it in position need be undertaken (*see* chap. v.).

In complete bilateral harelip, associated with complete cleft palate, the premaxillary process forms the most striking feature of the deformity. It is more or less oval in shape, and is attached to the lower and anterior end of the septum nasi by a kind of pedicle, which may be broad and strong or thin and slender, thus allowing a certain amount of lateral movement. Occasionally there is very little or even no forward displacement of the process;

in the majority of cases it projects in front of the lip, forming an unsightly deformity (Fig. 67, p. 77). It is not infrequently attached obliquely to the septum, so that the inferior margin is not horizontal. The size of the bone may appear to be greater than that of the space between the ununited portions of the lip. To the anterior surface the median portion (philtrum) of the lip is attached; this is always smaller than the bone, and it is often very thin. The bone is covered by mucous membrane, which is continuous with that of the septum nasi (Figs. 68, 69 and 70).

CHAPTER IV

THE FUNCTIONAL RESULTS OF CLEFT PALATE

Swallowing : Speech : Mechanism of normal speech : Pronunciation of consonants : Physiological alphabet : Mechanism of cleft-palate speech : Action of muscles of soft palate

A CLEFT of the palate interferes to a greater or less extent with two of the principal functions of the mouth and pharynx, namely: (I.) swallowing, (II.) speech. We shall consider each of these separately.

I. Swallowing

Normally when food or drink passes from the mouth into the pharynx on its way to the œsophagus these cavities are completely shut off from the cavity of the nose. The soft palate is raised and applied closely to the back and sides of the pharynx. The upper constrictor muscles of the latter, pressing gently upon the soft palate, help to form a diaphragm which prevents the contents of the mouth from passing upwards into the nose.

When the palate is cleft, food and drink tend to pass upwards into the nose. Fluids especially regurgitate thence through the anterior nares. The extent to which this occurs depends mainly upon the

degree of cleft; a complete cleft is naturally much more serious than the minor degrees, in which the soft palate alone, or a portion of it, is affected. In a great measure, however, this regurgitation of fluids can be prevented by the patient, who by practice generally learns to eat and drink with-

FIG. 71. An emaciated infant with complete double harelip and cleft palate at the age of 4 weeks.
Ivy W., seen at Aylesbury with Dr. J. C. Baker, 1910.

out discomfort or difficulty. Except in the case of quite young children, it is rare for patients with cleft palate to suffer from any serious inconvenience as regards swallowing. Occasional regurgitation of fluid through the nose is usually all that is noticeable. The difficulty in swallowing is most serious in the first few weeks of life, since the infant is unable in the majority of cases to take its mother's milk in the natural way. Even here, however, the difficulty is one of suction rather than of swallowing. The pharyngeal muscles are unaffected, and

if milk be allowed to trickle gently into the mouth the child will swallow without difficulty. A child with a cleft palate is in no danger of starvation

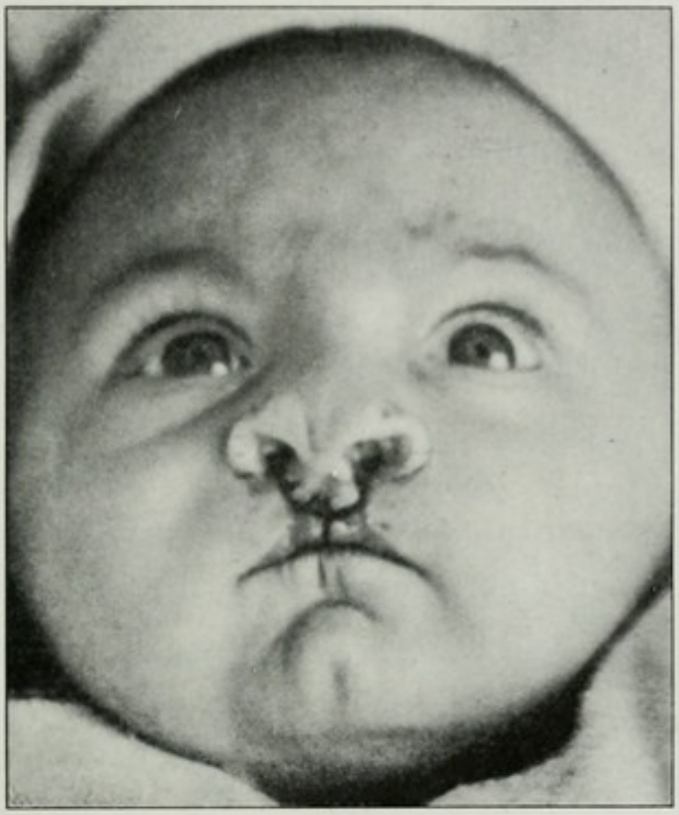


FIG. 72. The same child after two months' careful feeding and about a week after the operation on the harelip. No operation has been performed upon the palate. Note the great improvement in general nutrition.

These two photographs are introduced to illustrate the important point that the right way to treat these emaciated infants is to feed them properly and not to perform an immediate and extensive operation upon the palate.

provided the mother or nurse knows how to feed it, and will take sufficient care in doing so.

There are two methods by which an infant with cleft palate may be fed. One is by means of an ordinary flat boat-shaped feeding-bottle, to which a short, wide india-rubber teat has been fitted. A

rather large hole is cut with scissors on the under surface of the teat. The teat is placed in the mouth of the child, who may be either lying partly upon its side or in a sitting posture. By *gently* tilting the bottle the milk can be made to flow *slowly and intermittently* into the child's mouth.

A simpler and in some respects a better method is to feed the child by means of a spoon. The milk is allowed to trickle gently into the hollow of the cheek from the spoon inserted at the corner of the mouth.* It is a great advantage to the child if it can be fed by its own mother's milk, drawn off by means of a breast pump, under suitable precautions as regards asepsis and warmth.

Infants with cleft palate sometimes waste rapidly within the first few days after birth from sheer inanition. This is usually due to ignorance, on the part of the mother or nurse, of the proper way to give the milk.

It is sometimes urged that this malnutrition is due to inability to swallow, and this argument is used frequently as an excuse for an immediate operation upon the palate. It is far better to feed the child rationally by one or other of the above-

* The following instructive case was communicated to one of us a few years ago by Dr. Ogle, of Reigate. The patient was an infant aged 2½ weeks with a wide cleft of the soft and most of the hard palate. The method of feeding adopted by an ignorant nurse was to lay the child upon its back and pour milk into its mouth. She then reported to the doctor that the child got black in the face whenever it was fed. The doctor hurried off at once to see what was going on, but found on his arrival that the child was moribund, and could not be resuscitated, having been choked at its last meal.

mentioned methods before attempting to operate upon either palate or lip. A feeble, ill-nourished infant will stand an operation much better when the general health has been brought into good condition (Figs. 71 and 72).

II. Effects of Cleft Palate upon Speech

We now come to a far more important subject, the effects of cleft palate upon speech. It is the defective articulation produced by cleft palate which makes this deformity so serious to the subject of it, handicapping him more or less gravely in whatever station of life he may be called upon to play his part. It is mainly for the prevention or correction of this defective articulation that operative or other measures are adopted by the surgeon.

The very slightest degrees of deformity, such as cleft uvula, or even a very narrow cleft of a part only of the soft palate, may, it is true, have no injurious effect upon speech. In articulation the edges of such a very small cleft may come together and prevent any abnormal escape of air through the tiny cleft. But in all the more extensive forms of cleft, either of soft or hard palate, there is necessarily more or less interference with articulation. The most severe forms, if left untreated, may cause the patient's speech to be wholly unintelligible. In most cases, however, as years

advance the articulation of the subject of an untreated cleft palate of the less severe types undergoes a certain amount of amelioration. The patient who is unable to articulate consonants in the normal manner contrives to do so more or less imperfectly by other means. Occasionally, by the exercise of great care and long practice a very considerable degree of perfection in articulation can be obtained by a cleft-palate subject.* The speech of any patient with an extensive untreated cleft of the palate is usually very bad indeed.

Mechanism of Normal Speech

Let us first consider briefly the mechanism of normal speech as regards consonants. We shall then be in a better position to understand the defective articulation of cleft palate.

In the articulation of all consonants (with the exception of the voiced nasal resonants M, N, NG) the soft palate is raised, so as to shut off the oral cavity from the nose. The stream of air, during phonation, is thus driven through the mouth. By

* We are acquainted with a very intelligent young lady of fifteen whose parents have always refused to allow any operation to be performed upon her extensive and very wide cleft palate. She has succeeded after years of constant practice in attaining fairly good speech even without the help of an obturator. It is probable that with the addition of such help her speech would improve still more. In this case, however, the harelip had been closed in infancy and the cleft in the alveolar margins of the palate had closed spontaneously. So much improvement in speech without the help of either operation or obturator is but rarely seen.

the narrowing or complete closing of the oral channel at certain points, various consonants are produced (Figs. 73–75). Thus, complete closure of the lips followed by their sudden opening produces the explosive labial P. A similar closure of the channel

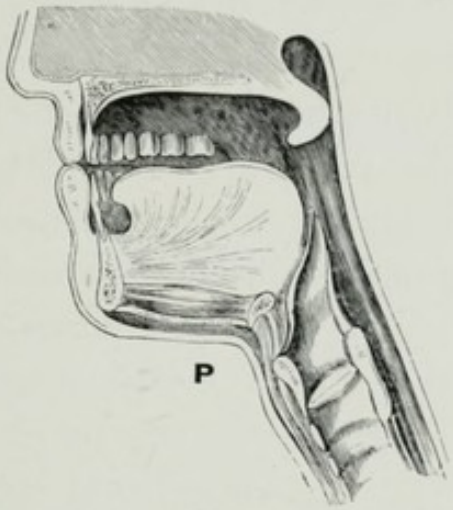


FIG. 73.

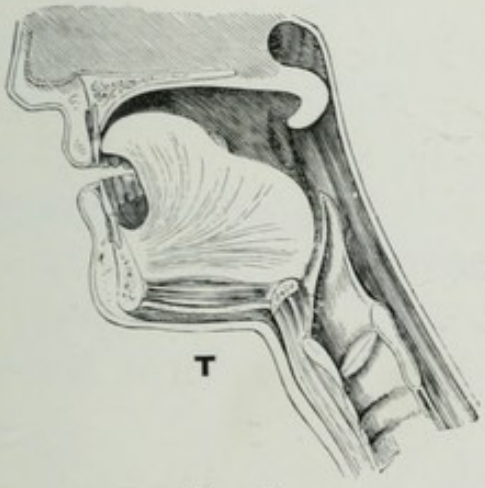


FIG. 74.

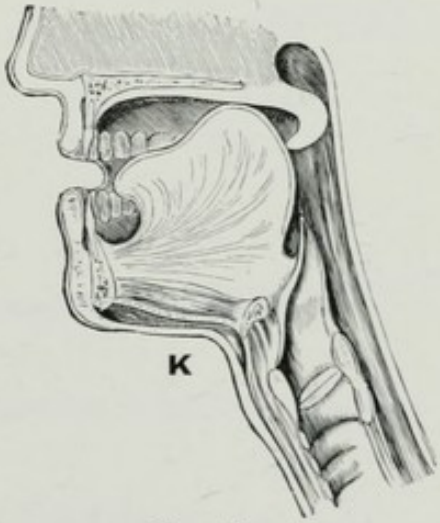


FIG. 75.

FIGS. 73–75. Diagrams illustrating the position of the tongue and soft palate in the pronunciation of the consonants P, T, and K. The lips and tongue block the current of air through the mouth at the three stop positions respectively, and the soft palate is raised, thus preventing the passage of air through the nose.

(From Max Müller's "Lectures on Science of Language.")

a little further back, by the application of the tongue to the anterior part of the palate, produces the explosive anterior linguo-palatal T. Closure still further back leads to the production of K. These three consonants are called *voiceless*, because in their pronunciation the stream of air passing through the larynx does not cause vibration of the vocal cords; they are therefore toneless or voiceless. If, however, the cords are allowed to vibrate, and voice be thus added, we get instead of P, T, K, the corresponding *voiced* oral consonants B, D, G, formed respectively at the three above-named situations. If the oral cavity be not completely shut off from the nasal cavity by elevation of the soft palate, the three voiced oral consonants B, D, G become converted respectively into the corresponding voiced nasal consonants or resonants, M, N, NG (Figs. 76–78). The three positions in which the consonants P and B, T and D, K and G are respectively formed—namely, at the lips, at the hard palate, and at the soft palate—are known as the *three stop positions*. At these three positions the current of air through the mouth is completely stopped at the moment of the formation of these consonants.

The accompanying diagrams from Max Müller (Figs. 73–78) show the positions assumed by the tongue and soft palate in the pronunciation of the consonants P, T, K, M, N and NG.

Other consonants (excepting always the nasals

M, N, Ng) are formed when the oral channel is narrowed, but not completely stopped. Thus w is formed at the lips, which are placed nearly, but not quite, in contact. The ordinary English w is

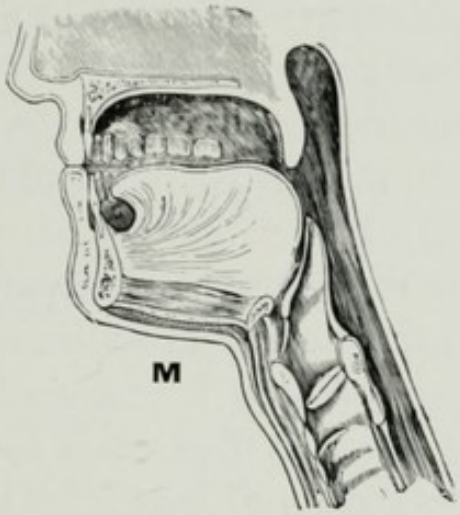


FIG. 76.

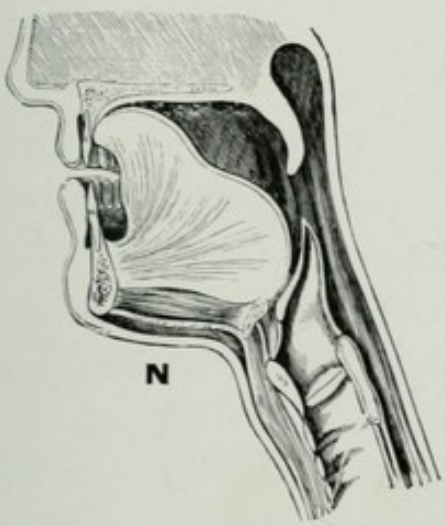


FIG. 77.

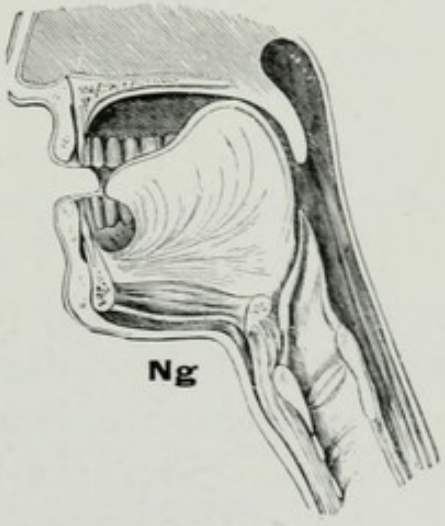


FIG. 78.

FIGS. 76–78. Diagrams illustrating the position of the tongue and soft palate in the pronunciation of the consonants (nasal resonants) M, N, and Ng.

As in the preceding, the lips and tongue block the current of air through the mouth at the three stop positions, but the soft palate is dropped, thus allowing air to pass through the nose, as in cleft palate speech.

(From Max Müller's "Lectures on Science of Language.")

a voiced consonant, but the Scotch or Irish W, which is pronounced almost as HW, is a voiceless one.

Similarly F and V are the corresponding voiceless and voiced consonants formed by approximating the lower lip and upper teeth. Contact between the tongue and upper teeth produces the voiceless consonants TH (as in "thatch"), and the voiced TH (as in "then"). In the production of S, however, which is the most precise and economical sound in the language, the tongue must be convex in the mouth with a complete lateral contact with the teeth. The tip is just free from the upper gum and directs the stream of breath on to the tops of the front upper teeth. The corresponding voiced sound is Z.

At the second stop position, when the tongue is placed against the hard palate, the voiceless SH and Welsh L (as in "Llanelly") and the voiced ZH, L, and R are formed. The difference between these sounds is produced by the partial escape of the air-current in different situations. Thus in L the sides of the tongue are depressed to allow of passage of the air-current; R is formed by vibration of the tip of the tongue: in SH and ZH the sides of the tongue are raised. It may be noted that in our language the sound of ZH does not occur at the beginning of a word; it is represented in the middle of a word by the s of "plea**s**ure," or the z of "a**z**ure." In French it is represented by initial

J as in "**j**our," "Jean," or by the initial soft G as in "Gironde."

At the third stop position, where K and G are formed by complete contact between tongue and soft palate, the voiceless guttural CH, the voiced Y, and the burring R of Northumberland speech are formed during incomplete contact of these parts. The whole subject of the formation of consonants may be summed up in the following Table with illustrative examples, taken from Dr. Wyllie's excellent book on "Disorders of Speech." *

PHYSIOLOGICAL ALPHABET. CONSONANTS

——	Voiceless oral consonants	Voiced oral consonants	Voiced nasal resonants	Illustrative sentences
Labials . . . *First stop position*	P (W)	B W	M	Peter Brown made white wax
Labio-dentals . .	F	V		Fine villages
Linguo-dentals .	TH[1] S	TH[2] Z		Thinkest thou so, zealot
Anterior linguo-palatals . . . *Second stop position*	SH T (L)	ZH D L R	N	She leisurely took down nine large roses
Posterior linguo-palatals . . . *Third stop position*	K H or CH	G Y (R)	NG	Can Gilbert bring Loch Hourn youths

The letters in brackets are the Scotch W (more properly HW), the Welsh LL, and the Northumbrian burring R.

* Edinburgh, 1894. To this book, and also to Prof. Tucker's "Natural History of Language" (London, 1908) and to Max Müller's "Lectures on the Science of Language," we are indebted for much valuable information on the subject of normal speech.

Mechanism of Cleft Palate Speech

The main cause of the defective articulation of a cleft palate patient is that some of the air which in the articulation of nearly all consonants ought to be expelled through the mouth escapes through the cleft into the nose. Here it vibrates in the nasal cavity and escapes through the anterior nares, imparting the well-known and disagreeable nasal character to the speech. The cleft palate patient is unable to hinder this escape of air through the nose in the normal manner by raising the soft palate. He endeavours to prevent its escape by contracting the anterior nares. This is effected chiefly by those facial muscles which act upon the upper lip and nostrils. The levatores labii superioris alæque nasi, by drawing up the upper lip, and the other smaller muscles round the anterior nares can effect a considerable closure of the anterior apertures of the nose. It is this effort to close the anterior nares that causes the exaggerated facial contractions that are so obvious when such a patient speaks.

In cases of cleft limited to the soft palate it is probable that a certain degree of closure of the posterior opening of the nose can be effected by the action of the superior constrictors of the pharynx together with other muscles that act directly upon the soft palate. Of these the levatores palati are

perhaps the most important. Marked hypertrophy of these muscles may be noticed in any old case of untreated cleft palate. But this hypertrophy is seldom, if ever, sufficient to effect such closure as is necessary for perfect speech.

Secondary causes of defective speech in patients with cleft palate are the irregular shape of the upper surface of the oral channel at its three principal situations, the soft palate, the hard palate, and the upper front teeth.

Of these three, the soft palate is by far the most important, and chiefly because its defects are much less easily remedied by the surgeon than are the other two. Irregularities and holes in the hard palate can be fully corrected either by the surgeon or the dentist. Irregularities or deficiencies in the arrangement of the teeth can also be made good by the dentist. For the soft palate the dentist can do but little beyond partially blocking up the opening between nose and pharynx. It behoves the surgeon, therefore, in his operation to take the greatest possible care to restore the soft palate as nearly as he can to the normal, both as regards shape and movements.

Let us consider now the comparatively simple case of a wide cleft of the soft palate alone, such as is shown in Fig. 50, p. 59. In this case during articulation air escapes through the cleft into the nose, thus weakening all the oral consonants and converting some of them into the corresponding

voiced nasal resonants. As already mentioned, this escape of air is partially counteracted by closure of the anterior nares by means of the facial muscles.

From what has been already said concerning the escape of air into the nose through the cleft in the palate it will readily be understood that the pronunciation of all consonants (except the nasals M, N, NG) tends to be affected by this deformity. The escape of a portion of the air-current which should be driven through the mouth weakens all these consonants. The cleft palate patient cannot pronounce his consonants as clearly, loudly, or forcibly as can a normal person.

The more completely he can close the anterior nares, by the method before alluded to, the more clearly, loudly, and forcibly will he be able to enunciate his oral consonants. The less completely he does so, the weaker will they be. Their pronunciation is often accompanied by a whiffing, or even a whistling sound as the air escapes by the nose. The explosives P, B, T, D, K, G, formed by a complete stopping of the oral channel, are especially apt to be weakened. Of these the voiced explosives B, D, G are particularly difficult to pronounce, since they tend to be converted into the corresponding voiced nasals M, N, NG.

In this respect the articulation of a cleft palate patient is the converse of that of the patient with a cold in the head. The latter trying to say "moon" or "morning" pronounces these words as "**b**oo**d**"

and "**b**or**d**ig." A cleft palate patient who tried to pronounce these latter syllables would convert them back into "**m**oo**n**" and "**m**or**n**ing." Similarly, in his speech "**b**a**d**" becomes "**m**a**n**," and so on.

The more extensive the cleft in the palate the greater the escape of air into the nose and the more difficulty there is with the oral consonants. Now the consonants K, G, CH, H, and Y, that are formed by approximation of the back of the tongue and the soft palate, cannot be formed in the normal manner. In an imperfect manner some of them can be produced a little further forward by applying the tongue to the posterior edge of the uncleft hard palate. But K and G are especially difficult to pronounce.

The difficulty is accentuated when the patient has to produce a series of consonants one after another without the interposition of a vowel. Such combinations of consonants are a marked feature of our English language. Combinations such as DGL, RKGR, KLKL, MPBL, STS (*e.g.*, as in "ki**dgl**oves," "da**rk gr**ove," "Un**cle Cl**arke," "la**mpbl**ack," "la**sts**") generally prove serious obstacles to the patient with a cleft palate, or one that has been but imperfectly cured by operation. English, consequently, offers a greater difficulty than does a more simple language, such as Italian, in which combinations of more than two consonants are rare.*

* In 1000 consecutive words taken from a modern Italian magazine article we find only forty-four combinations of as many as three

If the cleft involves not only the soft but also the hard palate, the speech is likely to be still worse. The consonants that are formed by approximation of tongue and hard palate (SH, ZH, T, D, L, and R) cannot be formed in the usual way, and are usually mispronounced. The L, however, which is produced by depression of the lateral borders of the tongue, can sometimes be sounded in these cases when the other consonants cannot.

When the cleft involves not only hard and soft palates, but the alveolar arch as well, the defective articulation is still more marked, owing to the irregularity of the dental arch. The teeth, and especially the upper front teeth, play a most important part in articulation. Even when the cleft in the alveolus has closed either spontaneously, as it often does, or by means of an operation, some irregularity of the dental arch nearly always remains. This irregularity is one of the principal causes of the defective speech that sometimes persists even after the whole of the cleft in the palate has been successfully closed. S, Z, and TH, which are formed between the tongue and upper teeth, are the consonants which are especially likely to be mispronounced. Deformity of the lips, unless so marked as actually to prevent approxi-

consonants, and of these no less than forty-one contained an R. In 1000 words taken from a similar article in the *Strand Magazine* we find ninety-four combinations of three or more consonants, even when double letters such as WH, CH, CK, NG, TH, and SH are counted as single consonants. Only twenty-six contained an R.

mation of these parts, does not in itself interfere very much with the pronunciation of the labials. In most cases the harelip has been operated on before the patient has learnt to speak.

Regulation of the teeth by dental measures, and the insertion of artificial teeth in the place of those that are missing, are important adjuncts to the operative treatment of cleft palate. Such dental measures, and especially the regulation of the teeth in childhood, are but too often neglected. When the surgeon has performed his part by closing the cleft palate, it is his duty to impress upon the patient, or the parents, the urgent necessity of having the irregularity of the teeth corrected by a competent dentist at the earliest opportunity.

CHAPTER V

TREATMENT OF HARELIP

Treatment before operation : Time for operation : Operation for single complete harelip : Control of hæmorrhage : Undercutting the lip : Rounding up the nostril : Paring the edges of the cleft : Insertion of sutures : One suture in nostril : Dressing : Operation for incomplete harelip : For double harelip : Treatment of projecting premaxillary bones

Treatment before Operation

The practitioner who is present at the birth of a child with harelip should take care that the distressing news is broken gently to the mother. She should not be allowed to see the infant until the deformity has been temporarily covered up with a piece of strapping. She should also be informed that the deformity is one that can easily be remedied by a simple operation.

His next care should be to see that the child obtains sufficient nourishment. Since most infants with harelip are unable to take the breast, arrangements must be made at once for artificial feeding by means of a spoon or bottle (*see* p. 83).

Best Time for the Operation

The next question to be settled is the best time for the operation upon the lip. If there is also a cleft palate, some surgeons recommend that the palate should be dealt with before the lip. The reason commonly alleged for this is that the gap in the lip allows the surgeon better access to the palate, giving him better light and more room for the necessary manipulations.

Without denying the truth of these assertions it must be remembered that other points have also to be considered. The authors, and, they believe, the great majority of practical surgeons, hold that it is better to close the cleft in the lip first, and to undertake the operation upon the palate at a somewhat later period.*

The chief reason for this course is that after the harelip has been closed, spontaneous closure of the cleft in the palate, and especially of its anterior part, takes place to a considerable extent as the development of the jaws proceeds. The cleft in the palate is consequently more easily closed by a suitable operation at this later period. If the harelip is accompanied by a cleft palate which does not involve the alveolar arch, suture of the lip has no appreciable influence on the spontaneous narrowing of the palate.

* An exception to this must be made if Brophy's operation is to be performed (*see* chap. x.).

The real difficulty of most cleft palate operations consists in obtaining sufficient tissue with which to bridge over the cleft. The size of the mouth is a matter of but little moment to any surgeon who is reasonably skilful with his fingers. The greater accessibility of the palate through an unclosed harelip is of less importance to the operator than the width of the cleft, the height of the palatine arch, and the amount of tissue available for its closure. At any rate, after a large experience of cleft palate operations we have rarely, if ever, found any serious difficulty to arise from the previous closure of the harelip.

If an extensive cleft of the palate be operated upon in early infancy the operation of choice would be in most cases either that of Brophy or that of cutting a large flap from the palate and gum, and turning it over like the leaf of a book. To the latter operation, which seems so tempting to the beginner, there are serious objections, which will be dealt with later when the subject of cleft palate is under discussion.

The usual time for the closure of a harelip is about a month or six weeks after birth. But provided that the infant is otherwise healthy and in good condition the sooner the operation on the lip is performed the better. It should certainly be performed within the first few weeks of life, and there is no objection to its performance within the first few days.

A case illustrating the value of postponing the operation sometimes for a few weeks until the general health has improved is shown in Figs. 71 and 72 (pp. 82, 83).

Ivy W., when first seen by one of us, was aged four weeks. She had a double harelip and complete cleft palate. She was a miserably thin child. During the next seven or eight weeks she was carefully fed by a skilled nurse. Fig. 72, taken about a week after the operation, on the lip, shows what a marked improvement had taken place in the general nutrition.

The time between the birth of the child and the performance of the operation may be employed with advantage by drawing the edges of the cleft together with strapping. By this means a wide cleft may be made considerably narrower even in the course of a few weeks. The operation is thus facilitated. Great care must be taken, however, in the employment of strapping, that the delicate skin of the infant's cheeks and lips be not excoriated. The strapping should be changed frequently. It should not be applied very tightly. Excoriation should be avoided by the application of a little lanoline or some similar application to the skin of the lip.

Operative Treatment

We shall first describe fully the operation for single complete harelip, next the operations for incomplete harelip, and then those for double harelip. Finally the treatment of the premaxillary bones will be discussed.

I. Single Complete Harelip

Position of the patient.—The child should lie upon its back with the head slightly raised and resting on a firm pillow or cushion. The head should be held firmly by an assistant.

Anæsthetic.—Chloroform is the most convenient anæsthetic for the operation, though if the patient is not a young infant ether may be used for induction. Chloroform should be given on a mask until the operation is commenced. Subsequently it should be administered through the tube of a Junker's apparatus, so as not to interfere unduly with the surgeon.

After the parts have been thoroughly cleansed, a small sponge is inserted into the nostril to prevent blood running through the nostril into the pharynx and larynx. A piece of silk is attached to this sponge to facilitate its subsequent withdrawal, and to prevent it from slipping too far back into the nose. A narrow strip of gauze may be employed instead of a sponge.

Control of hæmorrhage.—Bleeding from the coronary arteries and their branches may be controlled to a large extent by means of clamps. They should be applied to the lips, near the corners of the mouth, so as to compress the facial arteries. The most convenient form of clamp is shown in Fig. 79.

The form of double clamp figured in some books, by which both halves of the cleft lip are held by the same instrument, is bad, and should never be employed.* It prevents the surgeon from everting the lip sufficiently during the process of under-cutting.

FIG. 79. Smith's hare-lip clamp for the right side.

In the absence of suitable clamps, hæmorrhage may be checked to a certain extent by digital pressure upon the facial arteries, exerted against the lower jaw by the fingers or thumbs of the assistant who is holding the patient's head. The bleeding which in any case takes place from the cut surfaces should be checked by direct pressure of sponges upon the bleeding surfaces.

Ligatures are not required. They tend to prevent that rapid healing of the wound which is essential.

It should be remembered that unless the nostril has been completely blocked by the sponge or gauze, blood tends to make its way unnoticed through the nose into the pharynx, whence it may pass into the larynx and cause trouble. It is

* The inventor of this clamp, the late Sir Thomas Smith, told one of us that he soon entirely abandoned the use of it.

advisable from time to time to sponge out the pharynx through the mouth.

Undercutting of the lip. Rounding up of the nostril.—The most obvious part of a harelip operation is paring the edges of the cleft and sewing together the raw surfaces thus obtained. But an equally important step consists in freeing the lip sufficiently from its attachment to the maxilla to enable the cut surfaces to be placed in apposition without undue tension.

It is precisely this part of the operation which the inexperienced or timid operator is apt to perform incompletely. The result is only too often seen in the persistence of the widened nostril, or the presence of a triangular scar running downwards from it (Fig. 121, p. 142). This scar betokens gaping of the wound, due in most cases to tension caused by insufficient under-cutting.

The surgeon seizes the upper part of the outer margin of the cleft lip with a pair of forceps, or with his finger and thumb, and everts it so as to expose the reflection of mucous membrane from the lip on to the gum. With a short-bladed scalpel this reflection is cut through (Fig. 80). The incision is then prolonged laterally outwards towards the cheek. Care must be taken to keep close to the bone, to avoid undue hæmorrhage from branches of the facial vessels. Any hæmorrhage that occurs is easily stopped by firm pressure with a sponge for a few minutes.

The extent to which this under-cutting must be carried outwards depends upon the width of the cleft and of the nostril. It should be continued until the flap of lip and nostril is sufficiently free to

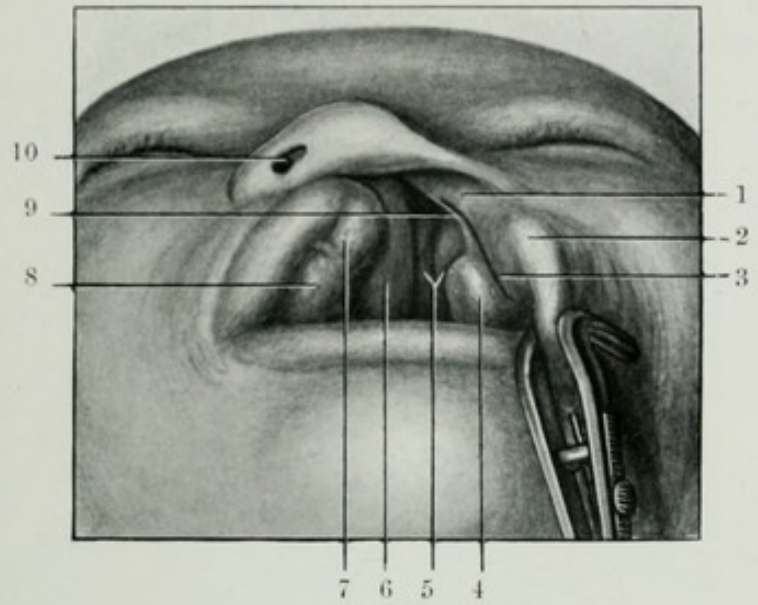


FIG. 80. Operation for single left complete harelip, showing the position of the incision for undercutting the lip and nostril. The clamp for controlling hæmorrhage is shown on the left side only.

1. Left nostril; 2. Left half of lip everted; 3. Incision for undercutting; 4. Left maxilla; 5. Turbinated bones; 6. Nasal septum; 7. Left premaxilla. 8. Right premaxilla; 9. Bony edge of left nostril; 10. Orifice of right nostril.

enable the parts to be laid in their new position without tension upon the sutures. It is especially important to convert the widened and splayed nasal orifice into the round or oval form of the normal nostril on the other side. To do this effectively it is necessary to carry the incision upwards and outwards along the lower and outer margin of the bony nasal orifice. It is only by freely detaching the nostril from its bony attachment in this

region that it can be displaced inwards sufficiently to correct the deformity. It is extremely common to see cases of old harelip which have been operated upon without sufficient attention to this

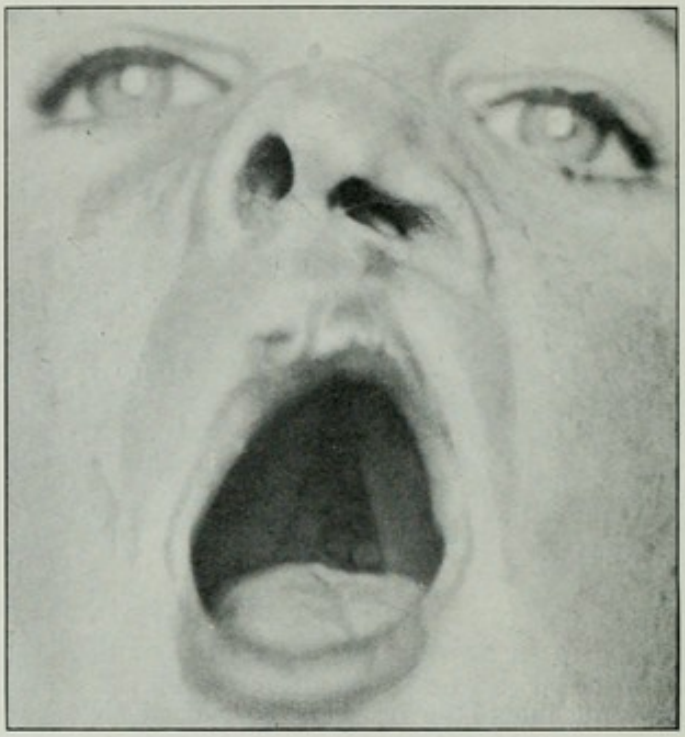


FIG. 81. Photograph of a patient admitted for a cleft palate operation. The harelip had been operated upon elsewhere in infancy. The yielding of the upper part of the harelip wound has left much widening and flattening of the nostril. (*See also* Fig. 121, p. 142).

Clara W., aged 10 years. Royal Free Hospital, 1911. Appendix, 144.

point. The nostril in such cases remains wide and unsightly, as in Fig. 81.

It is, in our opinion, never necessary, even in the worst cases, to carry any incision through the skin of the cheek round the outer edge of the nostril, in the manner recommended and figured by some authors.

On the inner or septal side of the cleft little or no under-cutting is desirable. The edge of the cleft is usually quite close to the septum. It is impossible to do much under-cutting without encroaching upon the septum itself. Troublesome hæmorrhage from the artery of the septum is also likely to follow if the incision be carried too far in this direction.

Paring the edges of the cleft.—Care should be taken to cut away sufficient tissue, so that the whole thickness of the lip presents a raw surface for subsequent union to that of the opposite side. The incision should always be made in the white skin close to the mucous membrane, and not in the mucous membrane itself. If even small areas of mucous membrane be left on the lip, they will present themselves, after the parts have healed, as red streaks or patches, whose colour forms a permanent disfigurement to the lip (Figs. 122 and 126, pp. 144, 146).

Much care is required in the treatment of the lower part of the cleft—that is, the part that is subsequently to form the free margin of the lip—and in the fashioning of a suitable flap or flaps, if a really good artistic result is to be obtained.

Mere paring of the edges and subsequent suturing will result in most cases in leaving a triangular area of red mucous membrane extending upwards into the area of white skin. Even if the actual free margin of the lip be correctly restored without any

notch, the result will not be good if the above-mentioned triangular red area is left.

It is actually more important that the line of the lower edge of the white skin area should be an unbroken one, than that the line of the free red margin of the lip should have no notch in it. A small notch in the free mucous edge of the lip is not, as a rule, very unsightly, since the contrast between the dark red of the mucous membrane and the darkness of the neighbouring oral cavity is not striking. The contrast, on the other hand, between the whiteness of the skin and the redness of the mucous membrane is great. A triangular area of red mucous membrane breaking the line of the skin margin is an obvious deformity. At a little distance such a red area looks like an actual notch in the lip. The artistic effect is bad.

The further the incisions are carried downwards and outwards, that is—the larger the raw surfaces that are to be brought into apposition—the less marked will be the notch in the lip or in the skin margin. But mere prolongation of the incision will not suffice to wholly obviate this defect. One or more flaps must be made to fill up the gap that would otherwise be left. There are several methods by which this may be done.

If the cleft is not wide and its margins are nearly parallel, it may suffice to carry the incisions through the lip in a curved direction, the con-

vexity of the curve being directed outwards, thus:

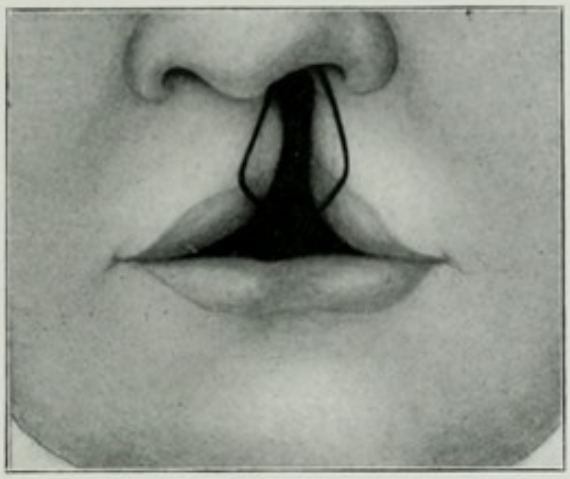


FIG. 82. Diagram to show method of closing harelip by simple curved incisions.

A projecting angle is thus left at the point where the incision cuts the free margin of the lip. When the curved edges are straightened out and approximated these angles are brought down and fill up the notch that would otherwise be left.

In most cases, however, the margins of the cleft are not parallel, but diverge considerably. The outer edge of the cleft is nearly vertical, while that on the inner or mesial side slopes away obliquely. To fill up the notch that would otherwise be left, an incision is carried outwards into the skin of the outer portion of the lip. A triangular flap of skin is thus formed. On the inner side the incision is carried downwards and outwards for a considerable distance in the skin close to the mucous membrane,

and then prolonged in an oblique direction through the red portion of the lip till it emerges at the free

FIG. 83. Single complete left harelip with prominence of the premaxillary bones. The anterior part only of the hard palate was cleft. At the operation no attempt was made to replace the premaxillary bones, the lip being united over them.

Leonard W., aged 3 months. Royal Free Hospital, 1901.

FIG. 84. Showing the incisions made in the preceding case.

border (Figs. 83, 84, 85). The triangular flap is then fitted to the lower part of the pared surface

of the other side, and the resulting line of union forms an obtuse angle.

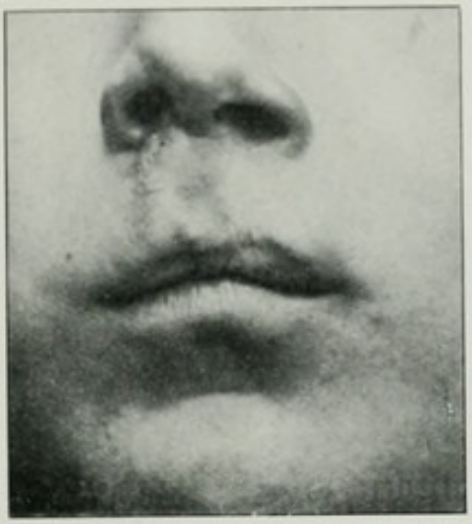


FIG. 85. The same patient ten years later. Showing well formed upper lip, not unduly depressed. (The irregularities near the right nostril are due to recent herpes.)

In making this lateral cut for the flap, the knife should be carried downwards and outwards from

FIG. 86. Single complete right harelip and cleft palate. The premaxillary bone is not prominent. For condition of palate *see* Fig. 61, p. 71.

Winifred B., aged 2½ months. Royal Free Hospital, 1908. Appendix, 130.

the pared edge of the lip. Beginning a little below the middle of the margin of the cleft, the incision

should end at some little distance above the muco-cutaneous line. If it be carried too near the

FIG. 87. To show the lines of the incisions that were made in the operation on the case shown in the preceding figure.

mucous membrane an awkward notch is produced at the base of the flap when it is turned downwards to be fitted to the other side of the cleft.

FIG. 88. To show a fairly good result after the operation for single harelip.

Elsie S, Royal Free Hospital, 1911.

In shaping and in fitting together the pared edges, the greatest care should be taken that the two lines of muco-cutaneous junction should correspond accurately, so as to form one unbroken line.

Insertion of the sutures.—The two sides of the cleft lip having been suitably pared and fashioned to the required shape, must now be united by means of sutures.

The use of the old-fashioned harelip pins has rightly been abandoned. They are unnecessary, and if employed are apt to cause an unsightly scar.* In the rare case of an adult male with harelip their use is sometimes permissible; the flaps are large and heavy, and the scars left by the pins are of little importance if a moustache is grown. But even in such a case sutures are preferable to pins. If harelip pins are employed they should be well coated with carbolic oil or some similar application to facilitate their subsequent withdrawal. They should be removed at the end of forty-eight hours.

The best suture material is moderately fine fishing-gut. Horsehair may be used for some of the finer stitches. Its blackness renders it more easily visible, and the subsequent removal of the stitches is thereby facilitated.

The stitches are passed by means of fine fully

* Fig. 137 (p. 154) shows a scar evidently caused by a pin. In this case the pin was probably left *in situ* much too long.

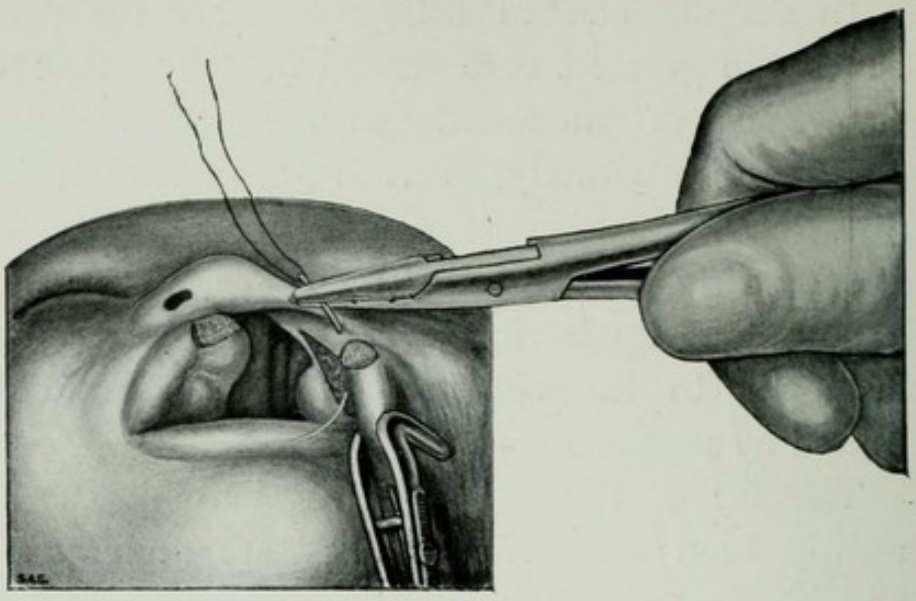


FIG. 89. Needle-holder with needle and suture; showing method of passing the first stitch.

curved needles held in some suitable form of needle-holder (Fig. 89).

One suture within the nostril.—The highest stitch should be placed just within the nostril, where its scar will not show (Fig. 90). This stitch is important, as by its means the correct rounded or oval shape of the nostril can be well maintained. As its scar is within the nostril, where it will not be visible, this stitch may, if necessary, be left in position a day or two longer than those which pass through the white skin. This stitch should be passed deeply from within the ala of the nostril, and made to emerge at the upper part of the raw surface of the lip close to the nostril. It is then carried across the cleft and inserted in a corresponding place on the raw surface of the inner

or mesial side of the cleft. Here it should also be inserted as deeply as possible close to the cartilage of the septum, and again made to emerge inside the nostril. The stitch on this latter side necessarily cannot be inserted so deeply as on the outer side. When tied, the knot lies inside the nostril. The

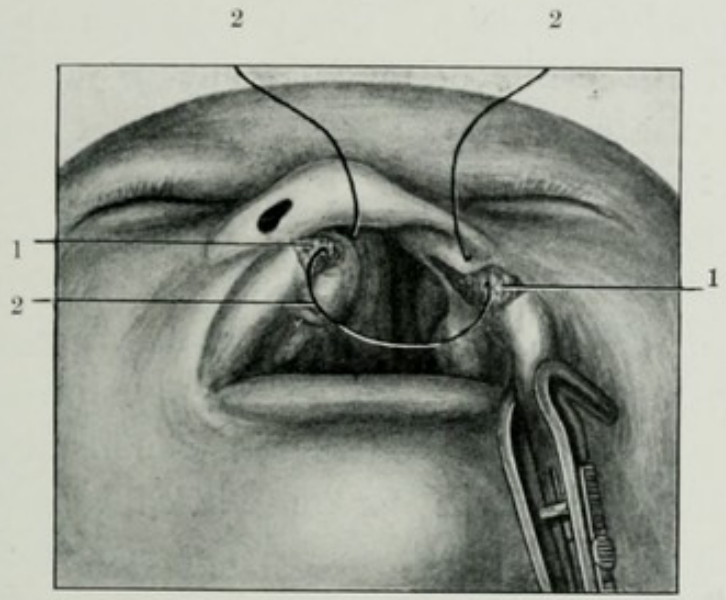


FIG. 90. Operation for single complete harelip. The edges have been pared and the important first suture inside the nostril has been inserted.

1, 1. pared surfaces of lips. 2, 2, 2. suture within the nostril.

ends should be cut rather long, usually about half an inch, so as to facilitate subsequent removal.

Sutures in the skin of the lip.—These sutures should be made to enter the lip close to the pared edge. The needle should be passed deeply into the substance of the lip in an outward direction, so as to include sufficient of the muscular substance. Its point should then be directed inwards, and made to emerge on the raw surface of the lip

close to the cut edge of the mucous membrane. The suture should then be carried through the opposite side of the cleft in the reverse direction—that is, entering just in front of the cut mucous membrane and emerging from the skin close to its cut margin. Two or three of these deep stitches are usually sufficient. The lowest one should be placed in the line of muco-cutaneous junction, so as to ensure accurate apposition at this important situation.

In tying up the sutures care must be taken to see that the edges of the skin are not inverted. The cut edges must be in exact apposition along the whole line of the skin incision, or the scar will not be a satisfactory one. It is usually desirable, after the deep stitches have been tied, to insert one or two fine superficial ones. These pass through little more than the skin, and serve to maintain accurate apposition of the edges of the wound.

Sutures in the mucous membrane.—Two or more sutures should be placed in the mucous area of the lip. One of these should be at the free margin and another on the posterior surface. Indeed it is often possible to pass several other sutures deeply through the substance of the lip from its posterior surface, and so obviate the necessity for as many deep sutures through the skin. Deep sutures passed through the lip from behind are more difficult to insert correctly, but they have the great advantage over skin sutures

that they do not leave any visible scars. An objection to the use of silkworm-gut sutures in the posterior surface of the lip is that the sharp ends are apt to cause painful irritation. For this reason some prefer silk sutures. These, however, are perhaps more likely to lead to sepsis along the track of the suture.

Dressing.—The parts having been wiped clean of blood and well dried, are now painted with collodion. Over this a pad of gauze is placed which is kept in position by a dumb-bell-shaped piece of strapping. This tends to keep the parts at rest, and to relieve tension. It should be long enough to reach from ear to ear. Opposite the lip it should be narrower than the lip itself, so as neither to encroach upon the mouth nor to obstruct the nasal orifices. Sometimes both pad and strapping are dispensed with, and the collodion dressing alone employed.

II. Single Incomplete Harelip

(1) If the nostril and upper part of the lip are quite normal in all respects it is sometimes unnecessary to do any under-cutting. The edges of the cleft should be pared and a flap or flaps formed in the manner already described. Even though the cleft involve but a small portion of the lip it is generally not enough to pare only the edges of the actual cleft. The incisions should be carried

upwards into the healthy tissues nearly as high as the nostril. If this be not done and the incisions be confined to the margins of the actual cleft, it will be found that when the sutures are tied the tissues at the apex of the cleft are mechanically

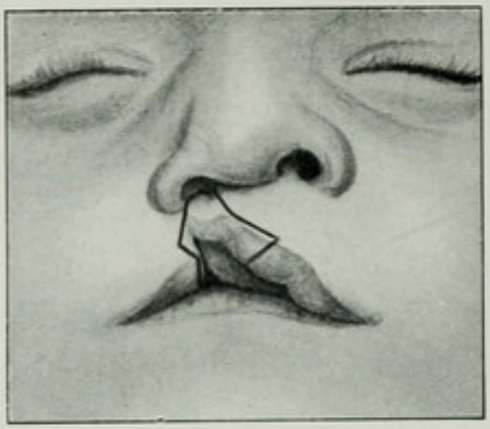


FIG. 91. Single incomplete harelip, with lines of incision showing how the bridge of tissue at the upper end of the cleft should be completely excised.
Christian C., aged 11 weeks. Royal Free Hospital, 1910.

pushed forward. An ugly prominence is the result.

In many text-books of surgery may be found drawings of an operation for incomplete harelip, which consists in making an inverted V-shaped incision just over the cleft. The wound thus made is then converted into a diamond-shaped space, and themargins are approximated laterally with sutures. The result of such an operation is never perfect. At the upper part of the scar there will be the ugly prominence above mentioned. At the lower part the free edge of the lip will present much irregularity as regards both form and colour.

There are very few cases of incomplete harelip in which it is not best to prolong the incisions nearly or quite up to the nostril.

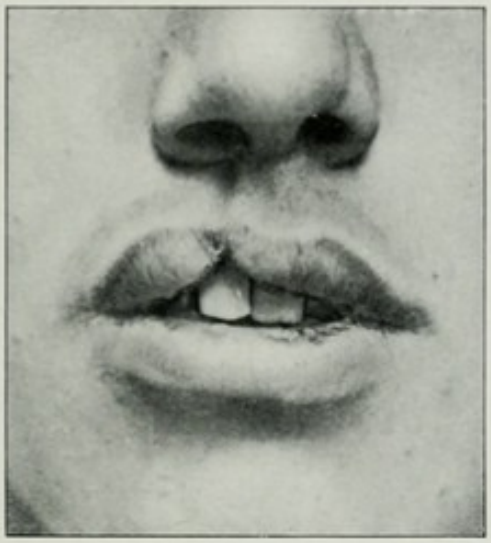


FIG. 92. Single incomplete harelip. Note the thinness of the tissue above the cleft.
Aldo M., aged 18 years. Royal Free Hospital, 1910.

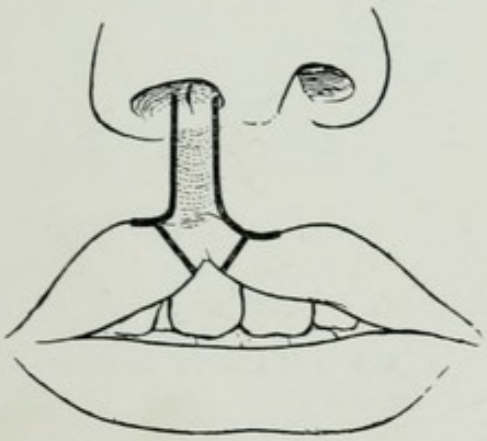


FIG. 93. Showing the incisions made in the preceding case.

(2) In all those cases in which the tissues of the lip above the cleft are not normal, but are thin, red, or scar-like, or are represented by a narrow bridge of white skin, all this abnormal tissue must be cut freely away (Figs. 91, 92 and 93). The cleft is thus

converted from an incomplete into a complete harelip. It is then treated in the manner already

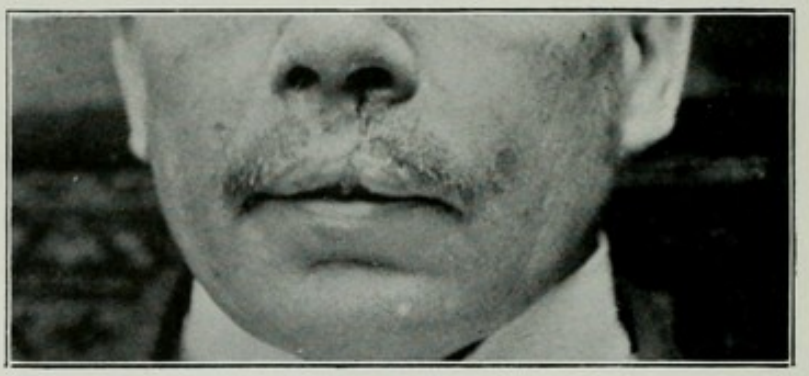


FIG. 94. Patient one week after operation for single incomplete harelip. The apparent notches in the lip and in the nostril are due merely to temporary darkening from blood. (For condition before operation, *see* Fig. 27, p. 38.)

Mr. G., aged about 40.

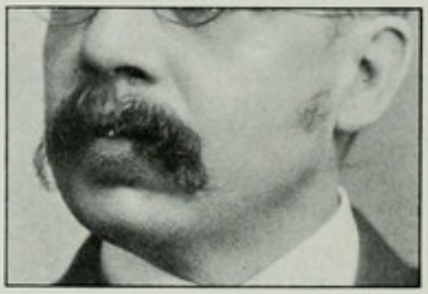


FIG. 95. The preceding some months after operation.

described under this heading. A certain amount of under-cutting on the outer side is nearly always necessary.

III. Double Harelip

Most cases of double harelip are associated with cleft palate. The principal difficulty in the operation is due to the prominence of the premaxillary

bones. The treatment of these will be discussed later (p. 127). We are concerned here only with the treatment of the soft parts. In some cases of

FIG. 96. Double complete harelip and cleft palate after operation on the lip at the age of 8 months. Showing how the philtrum can be utilised in the formation of the columna nasi ; also how the flattened nostrils should be rounded up.

For condition before operation *see* Figs. 33 and 34, pp. 42, 44.
(*See also* Appendix, 32.)

Wm. T. M., aged 4 years. Royal Free Hospital, 1901.

incomplete double harelip the treatment is much the same as in single harelip, except that the operation is performed on both sides. In the great majority of cases, however, the central portion of the lip is not sufficiently large to reach as far as the lower border of the lip. It can be utilised in the formation only of the upper part of the centre of

the lip. The outer edges of the two clefts must be brought together below this central portion.

If the attempt be made to bring this central portion too low the tip of the nose will be drawn down, and an ugly flattening of this part results.

In some cases of bad double harelip in which the central portion is small it is best to utilise the latter in the formation of the columna nasi (Fig. 96).

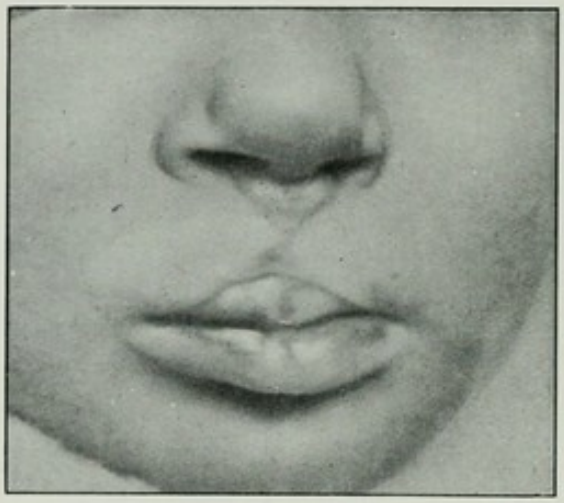


FIG. 97. Double complete harelip and cleft palate. To show the Y-shaped scar after the operation on the lip. Note the symmetry of the muco-cutaneous line.

Dorothy D., aged 2½ years. Royal Free Hospital, 1910.

The lateral portions of the lip are alone used in the formation of the restored lip. In most cases, however, the central portion is kept in the upper part of the lip, the resulting scar having a Y shape (*see* Fig. 97).

The central portion of the lip is pared symmetrically on either side, the lines of incision forming a V or U with the convexity downwards (Figs. 98, 99, 100 and 101). Free under-cutting of the alæ

and outer parts of the lip is usually necessary before the edges of the cleft can be brought together

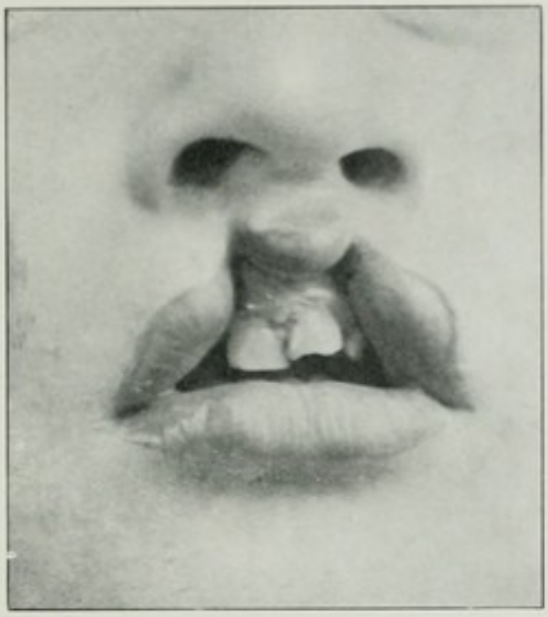


FIG. 98. Double incomplete harelip without cleft palate. Ernest H., aged 4½ years. Royal Bucks Hospital, 1910.

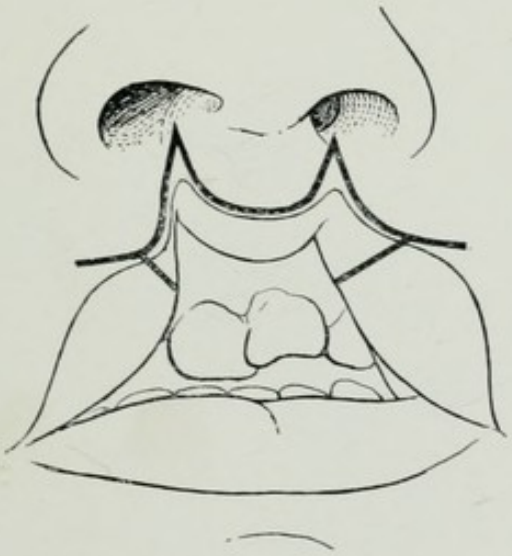


FIG. 99. Showing incisions made in the preceding case.

without undue tension. If the cleft is so wide that the edges cannot be brought together without

fear of a dangerous amount of tension, it may be better to operate at first on one-half only of the

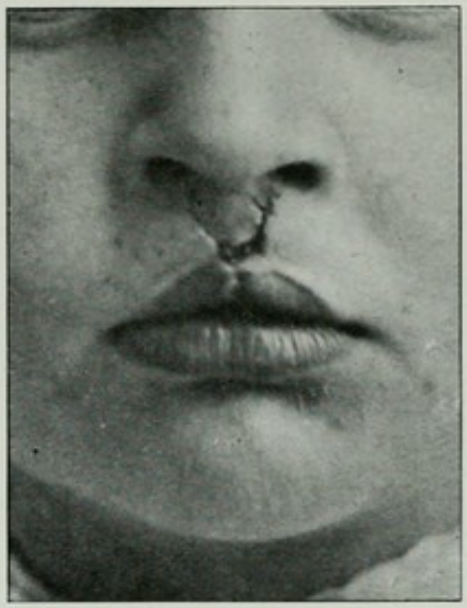


FIG. 100. The same patient one week after the operation.

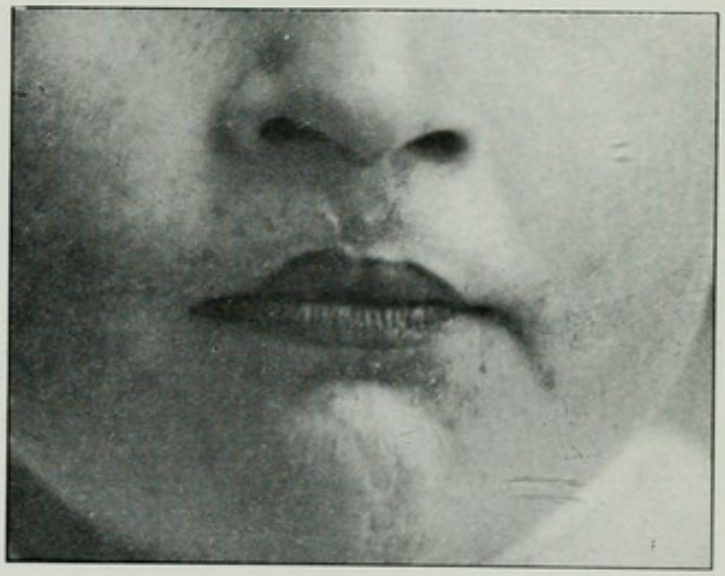


FIG. 101. The same patient somewhat later.

double cleft. When firm union has been obtained and there is no risk of subsequent stretching of the

line of union, the other half of the cleft is then dealt with in a similar manner. The interval between

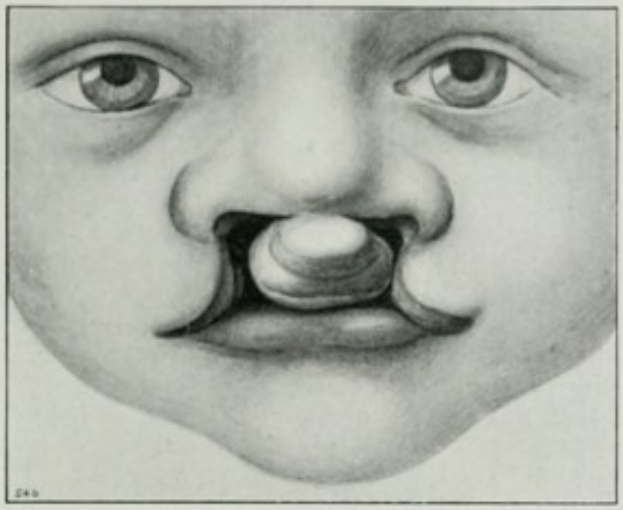


FIG. 102. Double complete harelip and cleft palate with prominent premaxillary process.
Edward G., aged 11 weeks. Royal Free Hospital, 1909.

the two operations should be some five or six weeks as a rule (Figs. 104, 105 and 106).

This two-stage method of operating is especially useful in bad cases in order to retain the projecting

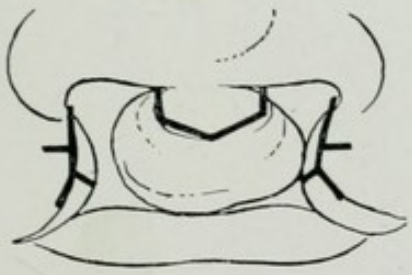


FIG. 103. Showing the incisions made in the preceding case.

premaxillary bones, instead of cutting them away or bending them backwards after removal of a wedge of septum (*see* p. 131).

Preliminary treatment with strapping in the

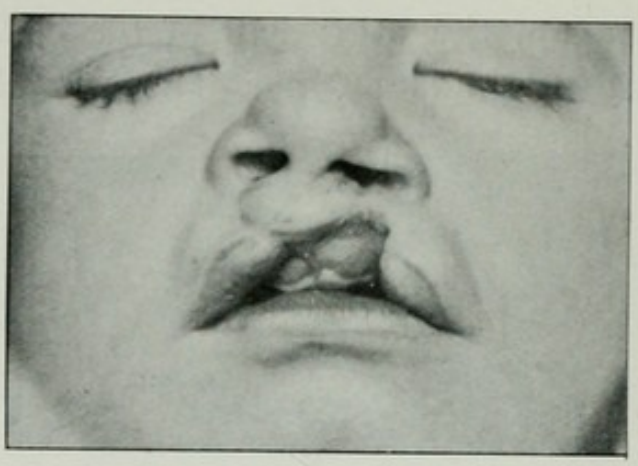


FIG. 104. A case similar to those shown in Figs. 33, 34, 68 and 70, illustrating the intermediate stage of the operation for double harelip with prominence of the premaxillary process, without operative interference on the latter. The right side of the lip and part of the left have been closed.

Reginald R,, aged about 6 months. Royal Free Hospital, 1909. Appendix, 137.

FIGS. 105 and 106. Double harelip and cleft palate. To show the result of operating on the lip by the two-stage method. There is none of the undue falling in which is so noticeable in Fig. 107.

Reginald R., at the age of 2½ years. For other illustrations of the same patient, *see* Figs. 104, 111 and 205–207.

manner mentioned on p. 101 is often highly desirable in the case of a really wide double harelip with much prominence of the premaxillæ.

IV. Treatment of the Projecting Premaxillary Bones

(1) **Single harelip.**—If single harelip be continuous with a cleft of the palate the gap in the latter will be between the maxillary and premaxillary bones of the same side, never between the two premaxillary bones. The premaxilla of the affected side being unattached to its corresponding maxilla, tends to project forwards and to carry with it its fellow premaxilla. An oblique prominence is thus formed which pushes forwards the lip and tends to widen the cleft in it.

If this forward projection be slight it may be disregarded and the harelip closed over it. Free under-cutting of the lip and nostril is necessary if the gap in the lip is at all wide.

If the projection be marked it may be difficult or impossible to close the cleft in the lip without previous reduction of the premaxillary deformity. Such reduction may be effected—

(i.) By pressure of strapping, applied for many weeks or months, across the lip in the manner mentioned on p. 101. As the bones grow, the premaxillæ, under the influence of the continuous pressure, tend gradually to recede towards their

normal position. This procedure is slow, and not altogether satisfactory.

(ii.) A more common method is to partially separate with a pair of bone-forceps the conjoined premaxillary bones from the maxilla to which they are attached. The blades of the forceps should be blunt, so as to crush the tissues rather than to cut them. One blade should be applied on the outer, or labial, side of the alveolus, the other on the inner, or palatine, side. The blades should be approximated very slowly. As they are being slowly closed the surgeon should gently rotate the forceps, so as to press the premaxillary bones back towards the palate. The blades should not be closed entirely, the object being to divide partially, and not completely, the alveolar margins. We do not now often employ this method.

It is not possible or desirable to effect complete reposition of the premaxillary bones. They should, however, be repressed sufficiently to enable the harelip to be closed over them. The soft tissues of the gum should be cut or lacerated as little as possible. The subsequent pressure of the lips and the growth of the maxilla will eventually correct the remaining deformity of the alveolar border (Figs. 83 and 85, pp. 110, 111). Sometimes it is desirable to freshen the contiguous surfaces of the alveolus and to unite the bones by a fishing-gut or wire suture. This should be done, if the premaxillæ are very loose, after the above separation has been effected.

(2) **Double harelip.**—In this case the associated cleft palate is usually also of the double variety. The two conjoined premaxillary bones, completely detached on either side from the maxillæ, project prominently forwards. They are, of course, directly

FIG. 107. A side view of a young woman, many years after an operation for double harelip, showing falling in of the upper lip. The premaxillary process appears to have been completely removed. Operator unknown.

continuous with the septum of the nose. Here again, by the pressure of strapping, something may be done to diminish the projection.

It is a great advantage to the child if the lip can be united without any operative interference on the premaxillæ. Unless the two-stage method described on pp. 124, 125, be adopted, it is, however,

often impossible to do this. If the bones are unusually prominent even the two-stage method

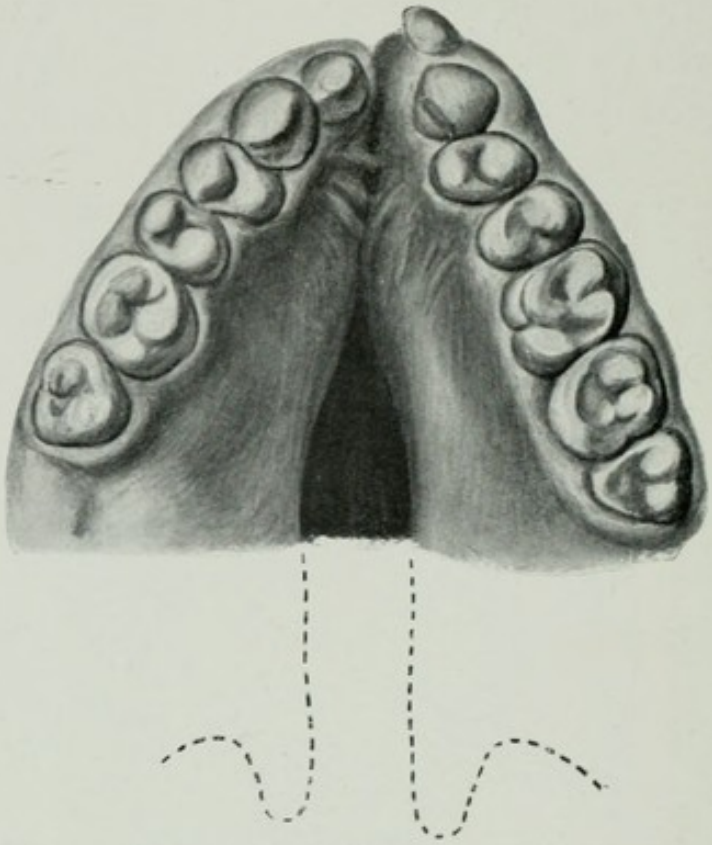


FIG. 108. A cleft palate of an adult showing the falling together of the alveolar margins after the disappearance of the premaxillary process. A left lateral incision remains attached to the alveolus. (From a cast No. T4 F1 Odontological Collection, Royal College of Surgeons.)

cannot be adopted, and one or other of the following methods must be employed:

(i.) The premaxillary bones may be removed.

This involves the loss of the incisor teeth, and is also objectionable because it leads to falling in of the upper lip. This causes a disagreeable underhung expression of the face (Fig. 107). Further, the loss of the premaxillæ leads to approximation

of the maxillæ, and causes the alveolar arch to assume subsequently a narrow angular form (Fig. 108), which interferes with correct articulation, especially of the linguo-dental and anterior linguo-palatine consonants. It also causes pronounced mal-occlusion of the teeth. It is much better, therefore, to preserve the premaxillæ if this can possibly be done.

(ii.) Another method of diminishing the size of projecting premaxillæ is to remove the incisor teeth, leaving only their sockets. This cannot be recommended.

(iii.) A wedge-shaped piece of the cartilaginous septum of the nose may be removed from behind the projection.

An incision about $\frac{3}{4}$ inch long is made in the middle line along the free edge of the septum, a little behind the premaxillæ (Fig. 109). The soft parts, including the periosteum, are then detached with a raspatory on either side of the septum. The blades of a pair of bone-scissors are then passed up on either side of the septum, which is cut through by two incisions, so arranged as to meet at an angle in the deepest part of the wound. The triangular piece of septum included between these incisions is then removed. The base of the triangle corresponds to the incision along the free margin of the septum. The bleeding from this wound is trivial and is easily controlled by pressure exerted for a few minutes. No stitches

are inserted, the wound being left open to allow of drainage. The removal of this triangular piece of cartilage permits the premaxillæ to be pushed back sufficiently to allow of the closure of the harelip.

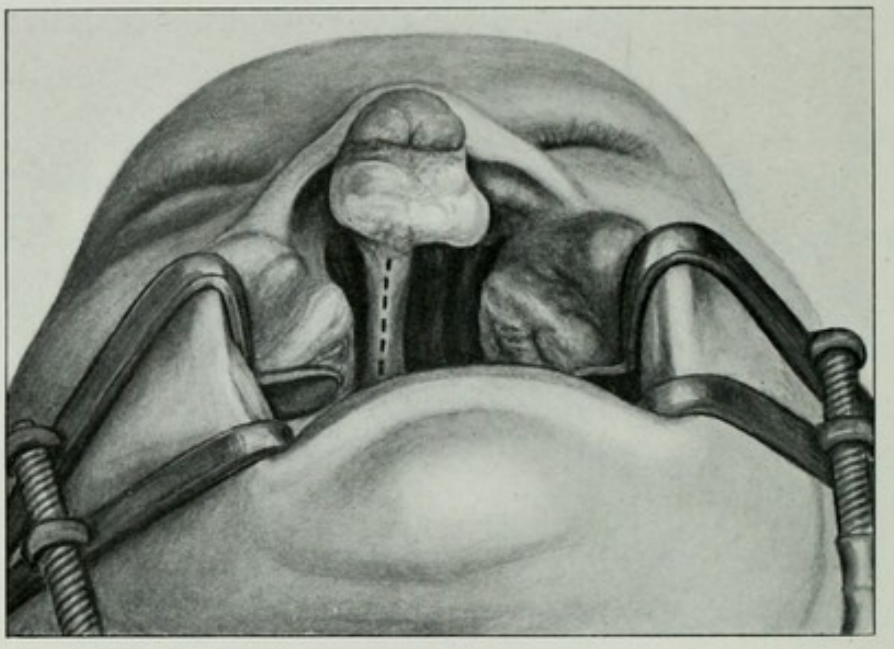


FIG. 109. Double complete harelip and cleft palate, showing the manner in which repression of the premaxillary bone may be effected by removal of a wedge-shaped portion of the cartilage of the septum. The dotted line shows the incision. For side view of the patient *see* Fig. 70, p. 79

We think this is a better method than that of simply cutting out a wedge of septum, including the muco-periosteum.

Another method of repressing the premaxillary process is to make an oblique section through the septum and to slide one piece upon the other. An objection to all these procedures is that the premaxillary prominence, when pushed back, is necessarily rotated on a transverse axis. The

incisor teeth, when they erupt, tend to project backwards towards the mouth (Fig. 110). This backward displacement of the teeth must be corrected later by dental measures, or an ugly deformity results.

FIG. 110. To show the obliquity of the incisor teeth after repression of the premaxillary process, at the age of 2 months. The drawing shows the condition 16 months after the operation.

FIG. 111. To show how, without any operative interference, the prominent premaxillary bone has assumed almost its natural position some months after the closure of a double harelip. The direction of the front teeth should be compared with that of those in the preceding figure.

Reginald R. *See also* Figs. 104–106, p. 126.

Complications after Operation for Harelip

These are few. The most frequent are either an immediate failure of union or subsequent breaking down of a temporary line of union. Failure of union is usually the result either of sepsis or too early removal of the stitches, specially when there is too great a tension from insufficient freeing of the upper lip from the jaw. Sepsis shows itself by inflammation of the parts adjacent to the line of union, and by redness and swelling extending some distance into the tissues of the lip. After the stitches have been removed, the lip may become inflamed, and the line of union be completely or partly dissolved, and the deformity be more or less reproduced. In all these cases further operation must be postponed until the inflammation has completely subsided. It is generally useless to do the operation again at once: failure is almost certain to follow unless all signs of inflammation have subsided, and this may take some weeks. If however the failure of union is due to premature removal of stitches and the parts are healthy, an immediate secondary suture may be crowned with success. Hæmorrhage is a very rare sequela, though we have known one case in which secondary hæmorrhage occurred.

If the child is weakly or marasmic, not only is the operation likely to be a failure, but the child may die as a result of the operation.

CHAPTER VI

SECONDARY OPERATIONS FOR HARELIP

Single harelip : Faulty union at the upper part : At lower part : Double harelip

We are both of us frequently called upon to perform operations for the improvement of a hare-lip that has already been operated upon, but in which the result has not been as good as it might have been. These cases are usually sent to us primarily for the closure of a cleft palate. The lip has usually been operated upon in early infancy, months or years before we have seen it.

Less often the patients are brought or sent primarily for the condition of the lip, with which the parents (or, if in an adult, the patient) are not satisfied. Many of these patients are young adults, especially young women. Although well satisfied during childhood with a mal-united harelip, when they grow up and learn that their personal appearance can be greatly improved by a comparatively small operation, they not unnaturally are anxious to have this done.

Sometimes the results of our own primary operations have not satisfied us, and we have done

small secondary operations to improve the patient's appearance. In some cases of extreme deformity, especially in double harelip, it is very difficult or impossible to obtain a thoroughly satisfactory result from a single operation. A small trimming operation, usually of the margin of the lip, may be well worth doing.

Sometimes a primary operation which has seemed quite satisfactory when first completed has been followed by a bad result, owing to yielding of a portion of the line of suture, from septic inflammation of the parts, from cutting out of one or more sutures, or from some other cause. A triangular red area near the nostril, or undue splaying of the nostril, is the commonest result of such a mishap, and is that which most often demands a secondary operation.

We will now consider the different kinds of faulty union for which a secondary operation may be required.

Single Harelip

(1) **When the whole line of union is faulty.**—The two sides of the lip may have been incorrectly adjusted, as in Fig. 112. In this patient it will be seen that the left side of the lip is on a higher level than the right. In such a case nothing short of re-division of the lip and doing the whole operation over again is of any use. No mere

trimming of the margin of the lip will yield a satisfactory result. The lip must be divided from

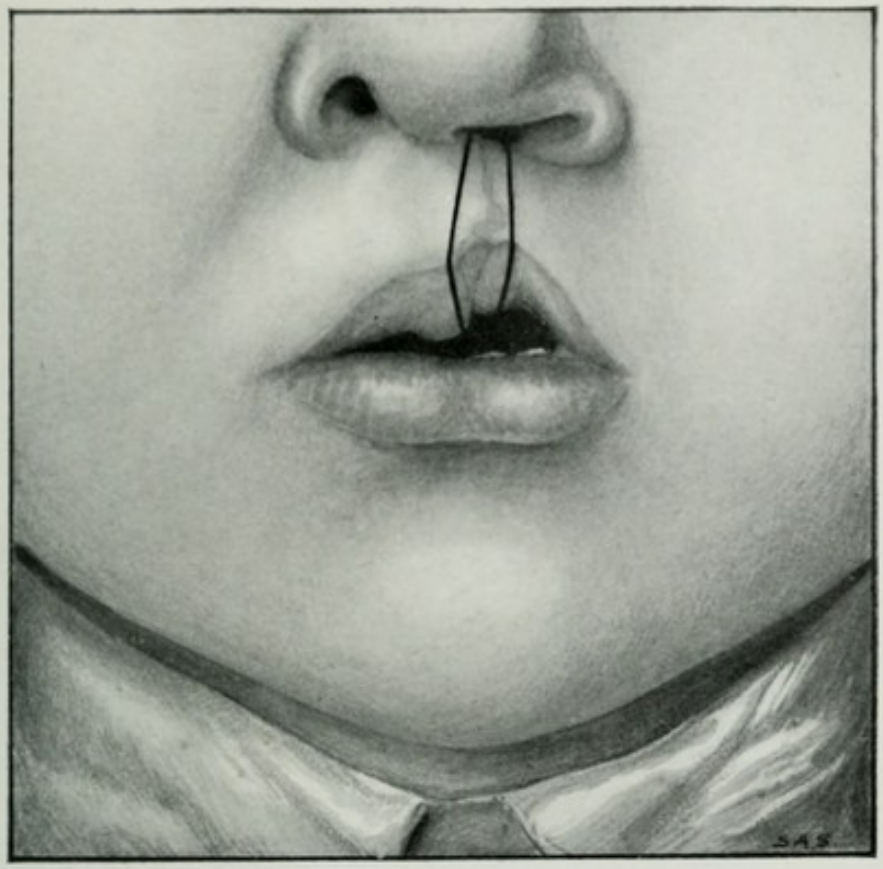


FIG. 112. An old badly united harelip, showing great irregularity of the muco-cutaneous line and of the scar above this. The lines of incision that were made to remedy this deformity are indicated. The incision of the left might have been carried with advantage a little more to the left at the muco-cutaneous line.

the nostril to the mouth by two parallel incisions embracing and removing the old scar, and the operation then done as if it were a primary one (Figs. 113 and 114). In the figure it will be seen that much flattening of the nose is present. This must be remedied by free under-cutting.

The greatest care must be taken that the line of

muco-cutaneous junction, so irregular and faulty in Fig. 115, shall be correctly restored. It should form an even, unbroken curve (Fig. 116).

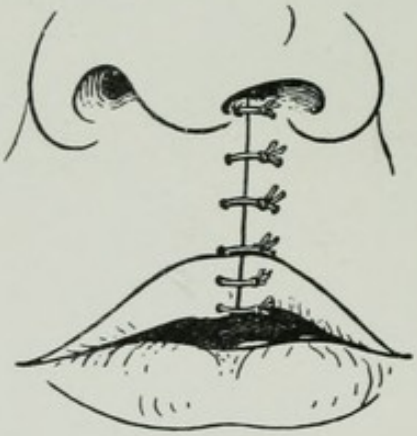


FIG. 113. Diagram to show how the muco-cutaneous line should form an unbroken curve.

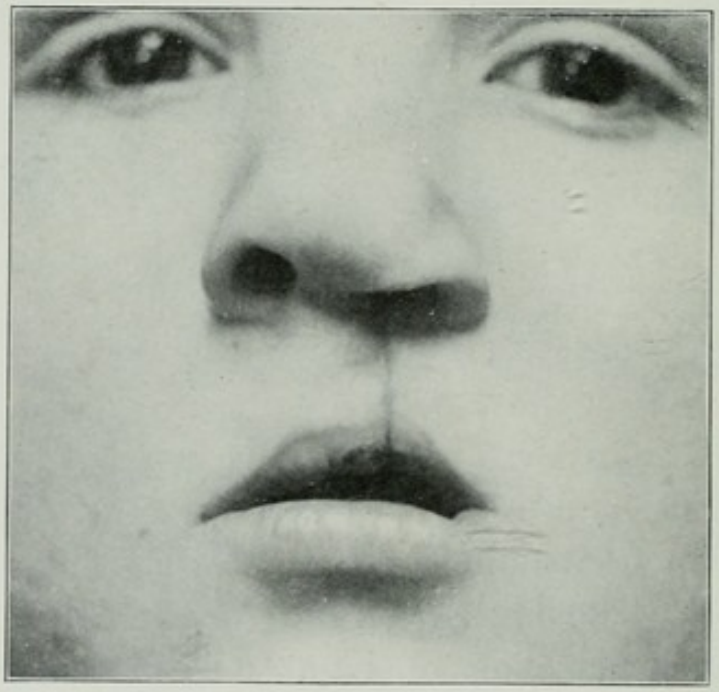


FIG. 114. The result obtained in the case shown in Fig. 112. The muco-cutaneous line is still not quite perfect and the nostril might have been more rounded up.

The whole line of union may be faulty because the scar is wide and the tissues of the lip thin (Figs.

FIG. 115. An old badly united harelip. No attention appears to have been paid to the muco-cutaneous line, a triangle of white skin having been left projecting downwards into the mucous area.

FIG. 116. The preceding after operation.

117 and 118). This is due to incomplete union of the muscular parts of the lip. In this case also nothing less than complete excision of the whole

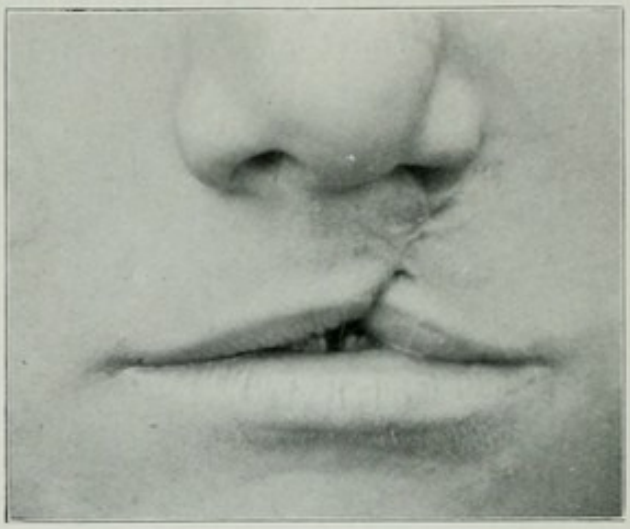


FIG. 117. Old badly united harelip, the whole line of union is faulty, and necessitated complete excision of the scar, and reconstruction of the lip.

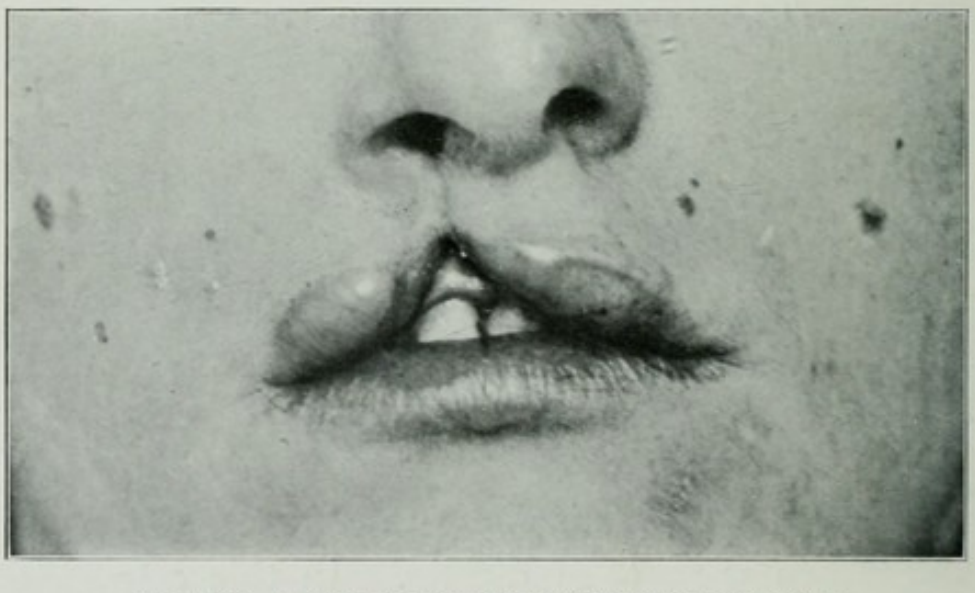


FIG. 118. A very badly united harelip many years after operation.

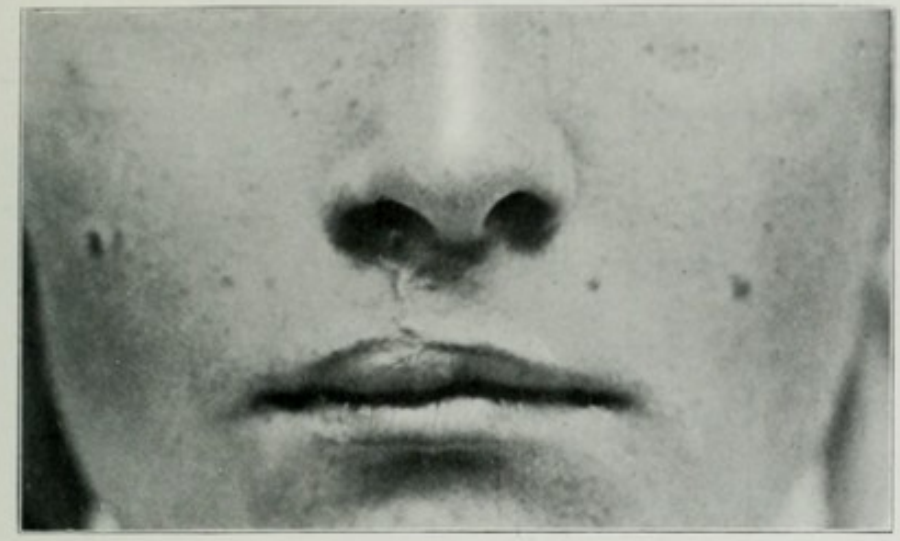


FIG. 119. The preceding shortly after excision of the scar, and reconstruction of the lip.

scar and reconstruction of the lip will be sufficient (Fig. 119).

(2) Part of the lip only may have been correctly restored, a defect existing at the lower or upper border (Fig. 120), sometimes at both.

FIG. 120. To show faulty union at the upper part of the lip.

Such deformities are extremely common, and constitute the majority of the cases in which we have been called upon to operate.

(i.) **Deformity at the upper part of the lip**, in the neighbourhood of the nostril.—A triangular

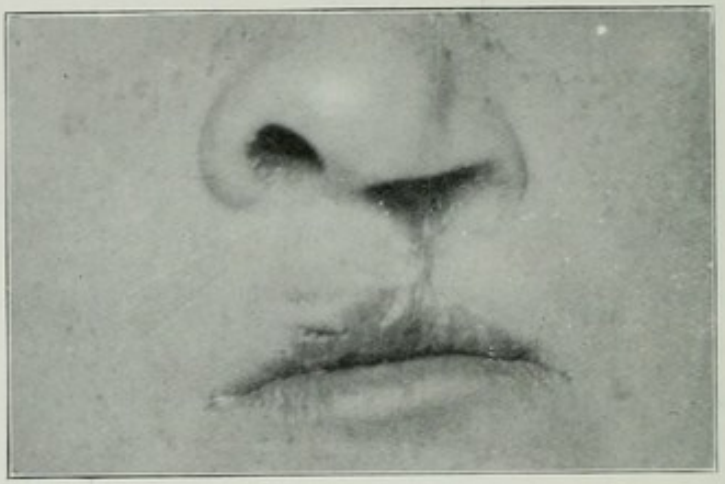


FIG. 121. Badly united harelip. A broad triangular portion of mucous membrane extends downwards from the widened left nostril.

red area exists at the upper part of the line of union. Its base is at the nostril, its apex downwards (Fig. 121). With this deformity there is always widening of the nostril. The defect is due to separation of the upper part of the line of union, or to the edges of the cleft never having been properly joined together.

This common fault is due to:

(*a*) Insufficient paring of the margins of the cleft, or insufficient under-cutting of the nostril and lip, so that the parts could not be brought together without undue tension.

(*b*) Omission of the important suture within the nostril (see p. 114).

(*c*) Premature removal of the upper suture, so that the muscular action of the upper lip has drawn asunder the recently united surfaces before their union was sufficiently firm.

(*d*) Carelessness in the manner of removal of the upper suture.

(*e*) Septic inflammation of the wound, leading to non-union or cutting out of the sutures.

If the deformity is marked, so that the triangular area involves a considerable part of the lip, it may be better to divide the whole lip and to reconstruct, as in (1). But if the triangle be small, and especially if the lower margin of the lip and the muco-cutaneous line be perfect, then it is unnecessary and unwise to divide the whole lip. Such a proceeding involves the risk of spoiling that part of the work which has already been well done. It is sufficient to remove the whole of the faulty area by a V-shaped incision, the base of which is at the nostril, and the apex just above the muco-cutaneous margin. Through the space thus obtained there will not be much difficulty in doing as much undercutting of the nostril as will suffice for the restoration of the nostril to its proper shape. Such a wound need not necessarily open the cavity of the mouth. When sutured, primary union may be expected.

If fear be entertained of sepsis occurring in such

a wound which is open only at the upper part—that is, into the nostril—it is easy to provide for drainage below by making an incision behind the lip through the fold of mucous membrane that unites the lip to the gum. Similarly if suppuration takes place in this wound, it can easily be dealt with at any time by a small incision in the same region. But we do not remember ever having had to make such an incision for suppuration.

When the undercutting has been completed to the satisfaction of the operator and the freshened edges of the lip can be brought together easily without undue tension, sutures must be passed through the lip in the usual manner. The first and most important suture is placed within the nostril.

(ii.) **Deformity at the lower part of the lip.**—Deformities of this class are usually due to

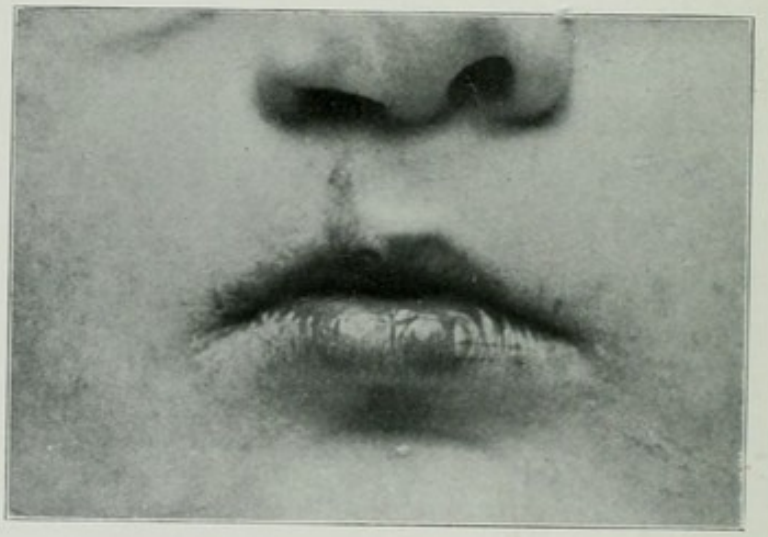
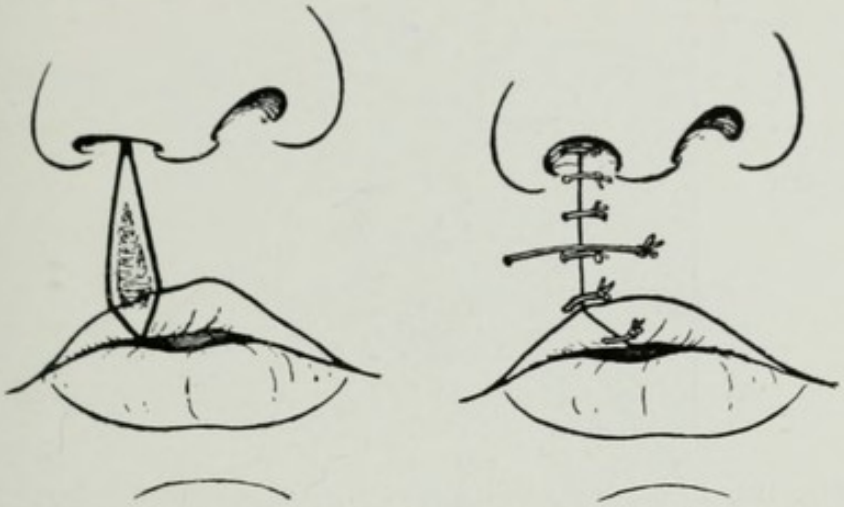


FIG. 122. Showing a triangle of mucous membrane extending upwards into the lip, due to insufficient paring at the operation.

insufficient paring of the margins of the cleft, the operator being afraid lest he should cut away too



FIGS. 123 and 124. Showing incisions made in previous case and the method of suturing.

much tissue, and thus violate an important rule of plastic surgery, that of not sacrificing tissues un-

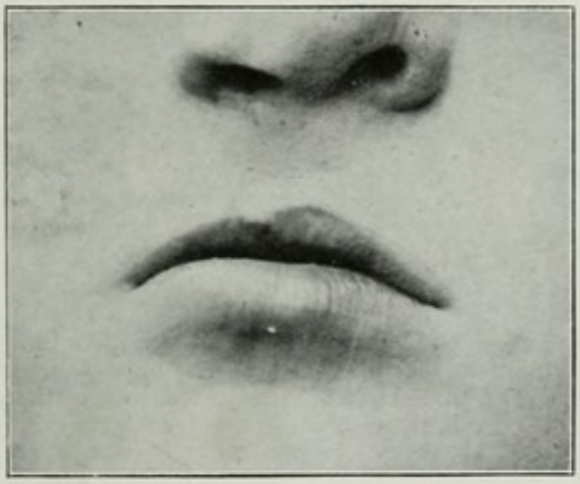


FIG. 125. The preceding after secondary operation.

necessarily (Fig. 122). Or the deformity is due to want of skill in the fashioning of the necessary flap or flaps. A third, and perhaps the most

common and important cause of the deformity is inaccurate or careless adjustment of the parts during

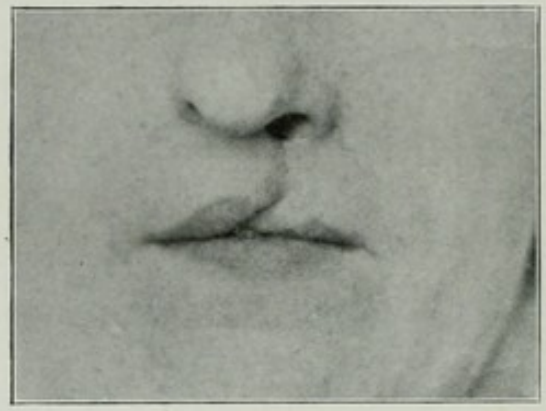


FIG. 126. An old badly united harelip. The mucous membrane of the right side has not been cut away sufficiently freely, and little or no attention appears to have been paid to the muco-cutaneous line. On the left side a large triangle of white skin extends downwards into the mucous area and reaches nearly to the free border of the lip.

Alice K., aged 31 years. Royal Free Hospital, 1910.

FIG. 127. Diagrams showing the method of dealing with the deformity illustrated in the preceding figure. The whole of the scar tissue and some of the mucous membrane have to be removed, by the incisions shown in A. In B the flaps thus formed are shown. In C, the parts have been adjusted to their new positions and the sutures are indicated.

the suturing, and especially want of care in the adjustment of the cut edges of the muco-cutaneous line of junction.

Comparatively seldom is deformity in this region due to cutting out of sutures, since the amount of

tension at this part is not likely to be nearly so great as at the upper part of the lip. It is not uncommon to meet with cases of old harelip in which it is evident that the operator must have done the operation without any regard whatever

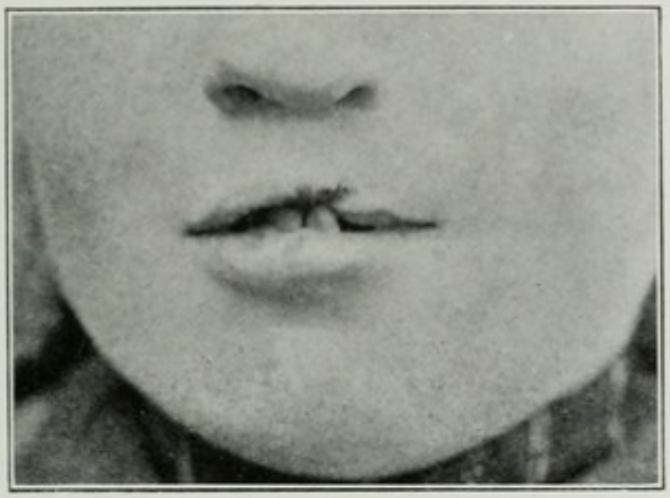


FIG. 128. A badly united harelip The lower border of the lip is very irregular and no attention has been paid to the muco-cutaneous line.

for the important line of muco-cutaneous junction (Figs. 115, 117, 126 and 128).

We would point out that the distinction between the white skin and the red mucous membrane is not nearly so obvious in the delicate tissues of a baby at the time of operation, when the parts are comparatively bloodless, as it is later on, when the parts have healed.

A not uncommon result of a badly executed harelip operation is that in which a red triangle of mucous membrane extends upwards into the lip while a white triangle of skin extends

downwards into the mucous area (Figs. 126 and 128).

Such a deformity may often be remedied by a

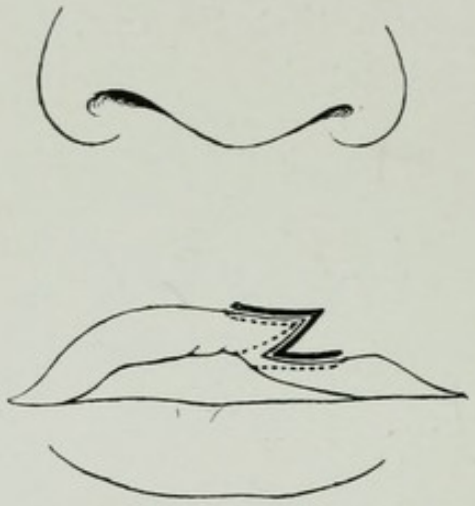


FIG. 129. The preceding showing the lines of incision.

Z-shaped incision carried along the margins of the two faulty triangles. The two triangular flaps thus formed generally require some fine trimming along their edges to remove any remaining vestiges

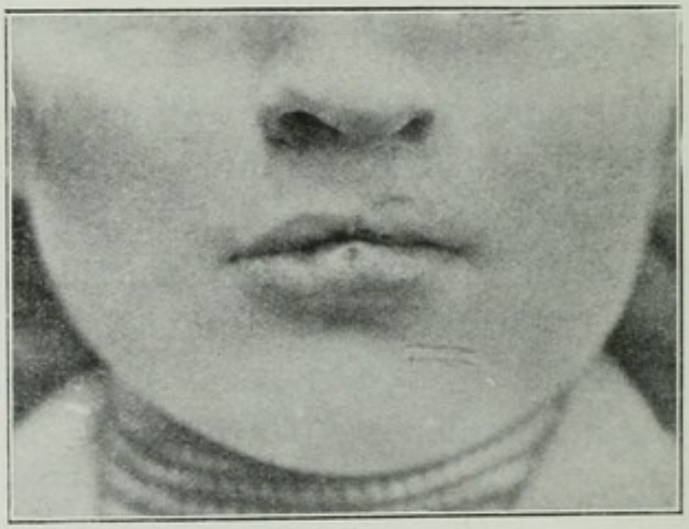


FIG. 130. The preceding a few days after the secondary operation by Z-shaped incision.

of red or white. The flaps are then transposed and fitted into their new positions with fine sutures (Figs. 127 and 129). It must be understood that these two triangles do not embrace mere skin and mucous membrane. The incisions must be carried deeply into the substance of the lip, so as to form thick flaps.

Double Harelip

The same faults that we have just been discussing in connection with single harelip may also be met with in cases of the double variety. But it is in this variety especially that we meet with faults connected with the premaxillary bones.

In single harelip the premaxillary bones do not, as a rule, project forwards sufficiently to be a very serious obstacle to the closure of the cleft in the lip. The prominence can also be dealt with without much difficulty in the manner described on pp. 127, 128.

With the extreme prominence so often found in connection with double harelip (Figs. 33, 34, pp. 42, 44) the difficulties in the way of the operator are much greater. Unless the projection is removed or pushed back, or very free under-cutting of the nostrils, lips, and cheeks be resorted to, great trouble may be experienced in getting the edges of the cleft into apposition without tension. If there be undue tension, some part of the line of union

fails. If such failure occurs we get deformities which may be divided into two classes:

(1) Those in which the lower margin of the lip is faulty. Either a notch is present in the free margin, or a triangular area of mucous membrane passes up into the region where only true skin should be present (Fig. 131). Indeed, in most cases of double harelip a certain amount of this faulty triangle is almost always present after operation. It is difficult to avoid such a result without drawing together the two halves of the lip so much as to make it unduly narrow. Too much narrowing of the upper lip causes the lower lip to project in an unsightly manner.

But in the course of time, after the parts have healed, and the lip has developed and accommodated itself to the altered conditions, its stretched, tense condition subsides. Then a further operation can often be done with advantage. The upper part of the triangle can be removed, and the median line of junction between the skin margins of the cleft can be prolonged downwards towards the mouth.

Such an operation is perhaps best illustrated by diagrams (Fig. 132), where the line AB represents the junction of the skin margins, and the shaded area CBD is the mucous membrane of the upper lip drawn up to a point at B. For this condition some form of triangular or diamond-shaped incision is most suitable, according to the amount of tissue that it seems desirable to remove at

the apex of the triangle. The wound thus made is united by two or three fine silkworm gut or horse-

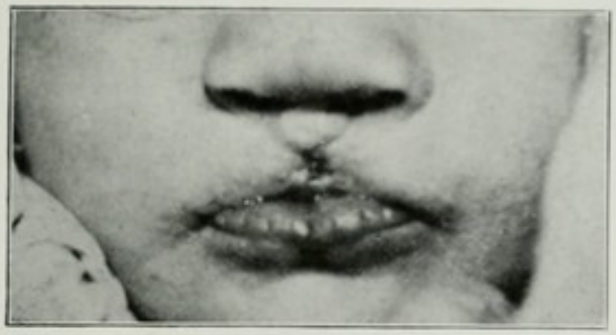


FIG. 131. To show the faulty union and triangular area of mucous membrane, so often seen after operation for double harelip.

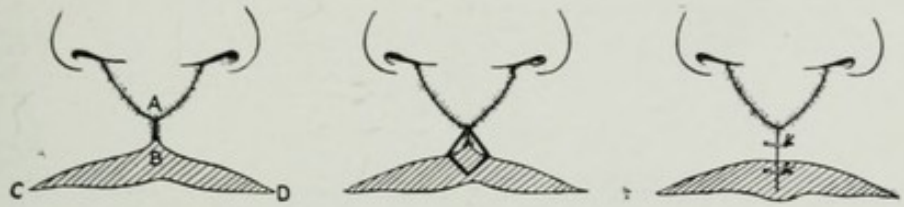


FIG. 132. Diagram showing how the notch in centre of the lip as in Fig. 131 can be treated by a diamond shaped incision.

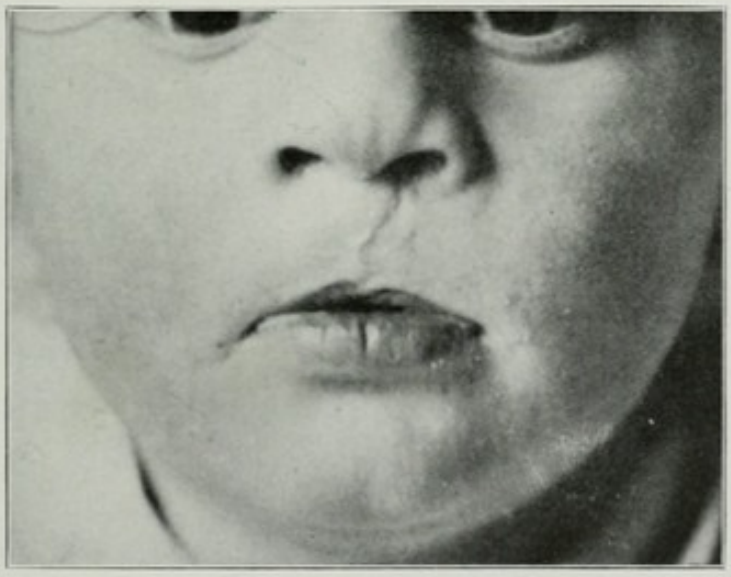
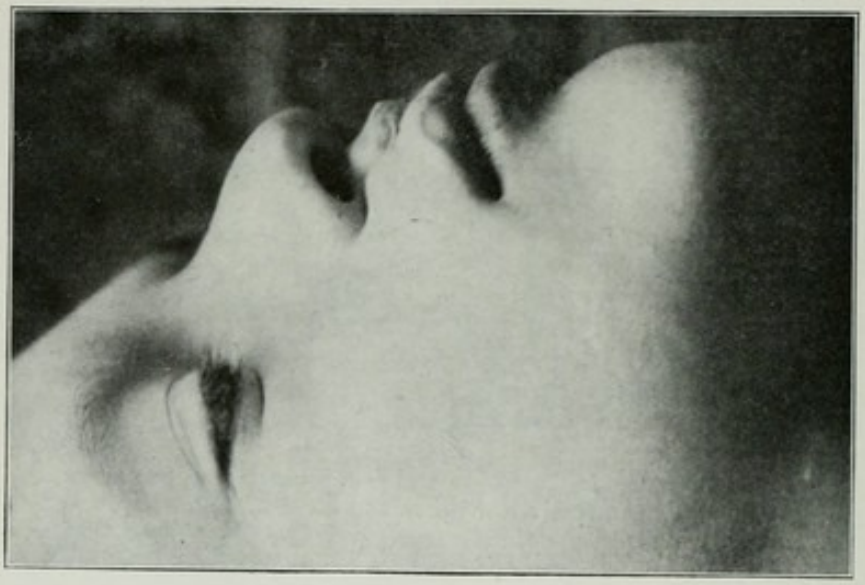
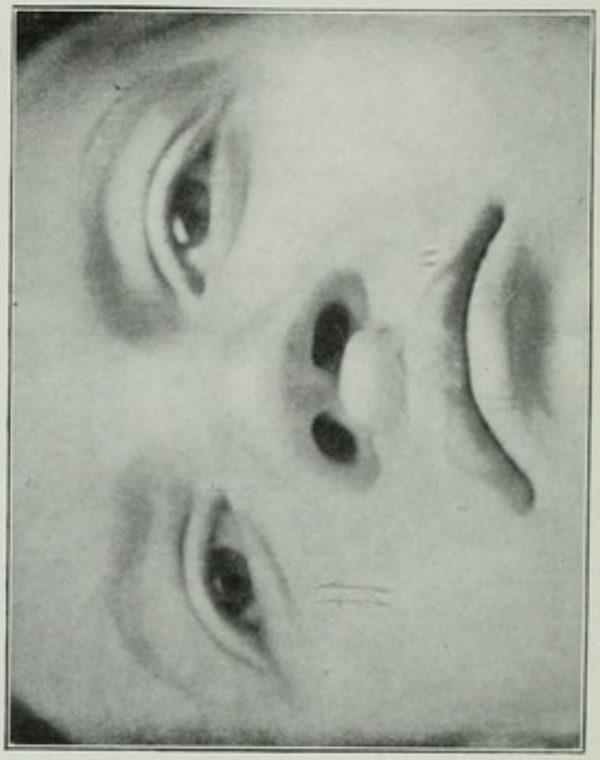


FIG. 133. The preceding several months after the secondary operation.





FIGS. 134 and 135. Old faulty operation for double harelip. The prolabium has been insufficiently pared and has been left on a plane anterior to the remainder of the lip. It projects as an unsightly red lump.

hair sutures, care being taken that the cut ends of the muco-cutaneous line are accurately adjusted. A slight prominence downwards at the centre of

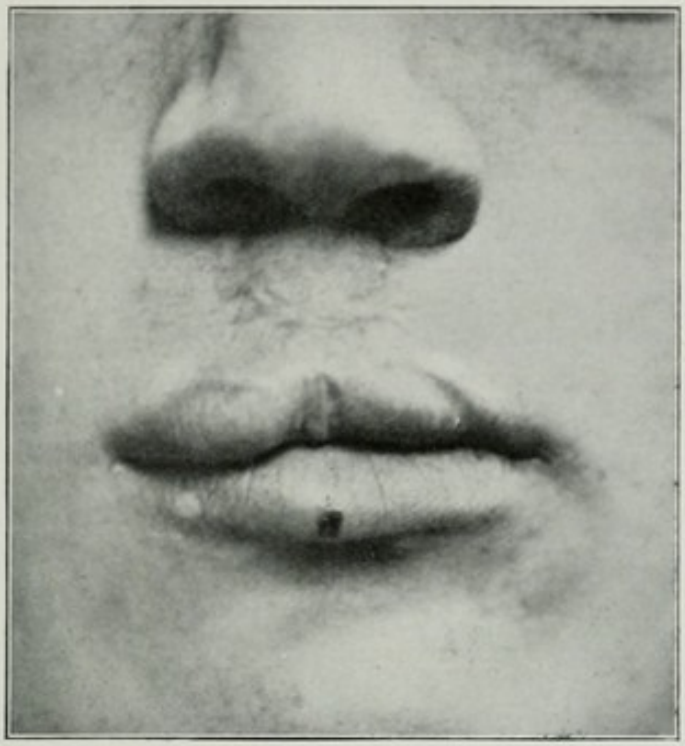
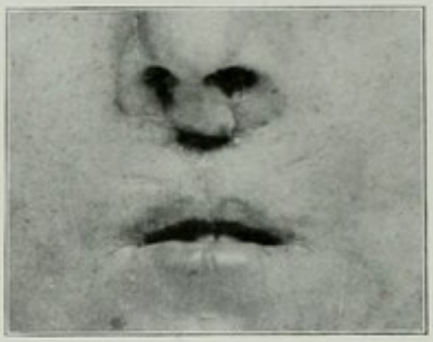


FIG. 136. The same some years after a secondary operation. The projecting philtrum has been detached completely from the lip and inserted on the proper plane.

the free margin of the lip is an advantage rather than otherwise.

(2) The second class of deformity met with as the result of a faulty double harelip operation is a much more serious and important one. It is that in which the central part of the lip and the premaxillary prominence project through the upper part of the line of union. Figs. 134, 135, 137, 138 and 139 are good illustrations of this condition. In Figs.

134 and 135, the edges of the philtrum have been insufficiently pared, and this structure itself has



FIGS. 137, 138, 139. A case somewhat similar to the preceding. In this not only the prolabium but also the premaxillary bone has been left as an unsightly projecting mass.

been left on a plane anterior to that of the rest of the lip. This deformity was treated by a rather extensive reconstruction of the lip. The exposed mucous membrane was completely removed by two crescentic incisions above and below it. The rest

of the lip below and on either side of the projecting part was then freely undercut until it could be lifted forwards, and sutured without undue tension

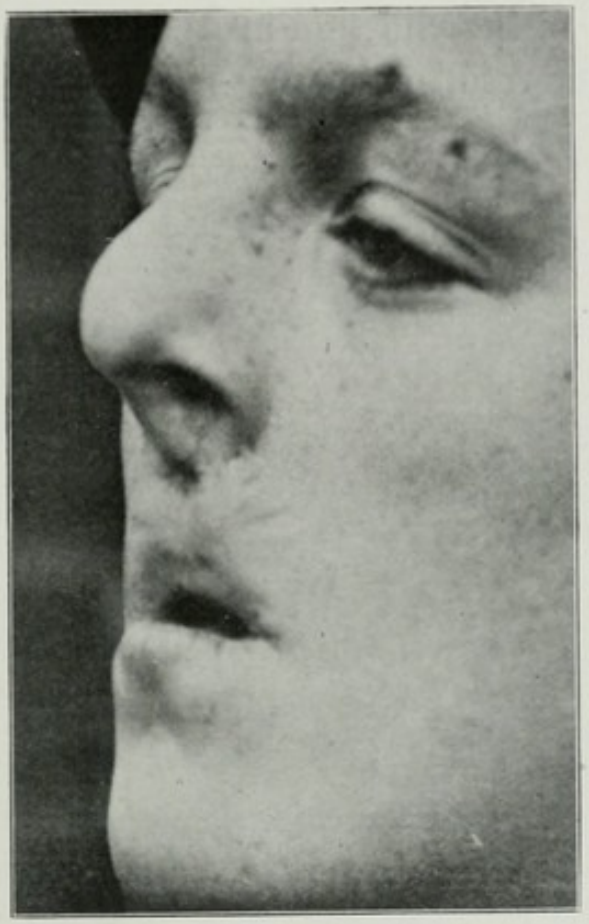


FIG. 140. The preceding 3½ years after secondary operation.

to the pared surface of the philtrum. The result is seen in Fig. 136.

Figs. 137, 138, 139 show a more common variety of prominence of the premaxillary process. The upper part of the line of union has yielded (or perhaps the cleft had never united here), so that the premaxillary process projects forwards as an

unsightly red mass. This patient was treated by partial removal of the projecting mass and by freely under-cutting the lip all round it, till the soft parts could be brought forward and easily united to the remainder of the philtrum in front of the projecting bone. The result is seen in Fig. 140.

CHAPTER VII

TREATMENT OF CLEFT PALATE

Operation or obturator : Relative advantages : Treatment by operation : General considerations : General health and nutrition : Local condition of oral and nasal passages as regards sepsis : Width of the cleft : Height of arch : The operation : Position of patient : Of operator : Of assistants : Anæsthesia : Smith's gag : Proper method of holding it : Instruments : Steps of the operation : Detachment of muco-periosteal tissues from the oral surface of the hard palate : Detachment of soft palate from palate bones : Paring margins of the cleft : Suturing the pared edges : Making lateral incisions

THE treatment of cleft palate is either by operation or by mechanical apparatus (obturator). In most cases—indeed, in almost all which are seen sufficiently early—the treatment should be by operation. We have neither of us ever seen a cleft palate, however wide, which could not be closed by operation, provided that the palate had not previously been operated upon and spoilt by the occurrence of sloughing.

A well-executed and successful operation restores both hard and soft palates to their normal shape. As regards the soft palate, not only should the normal shape be restored, but its mobility and functional utility should be as complete as possible. It must be admitted, however, that in certain

difficult cases it may be impossible to restore completely the function of this part.

A certain amount of shortening and a certain amount of impairment in the movement of the muscles, are almost necessarily the result of the extensive operation which may be required for the closure of a really bad cleft. The success or otherwise of the operation will, however, in the great majority of cases, depend upon the manner in which the operation is performed. The object of the operator should always be to restore as completely as possible not only the shape, but also the functions of the soft palate. In proportion as he is successful in this aim, so will his patient benefit as regards speech.

If the cleft has been closed successfully in early life, and the movements of the palate are good, the advantage to the patient is inestimable, and he is in a much better position than one who is condemned to wear an obturator.

It is rarely possible for children of tender years to wear an obturator. The rapid development of the jaws renders such treatment impracticable. It must further be remembered that although an obturator will close the cleft of the hard palate just as efficiently as an operation, yet no mechanical apparatus hitherto invented will act as an efficient substitute for the normal movable soft palate. An obturator can be made which will mechanically block up the cleft, but it will not take the place

of a muscular palate capable of voluntary movement.

Before an operation is undertaken for the closure of a cleft in any given case there are four points which should be carefully considered:

(1) The general health of the child, and especially the condition as regards general nutrition.

(2) The local condition of the oral and nasal passages as regards sepsis.

(3) The width of the cleft.

(4) The height of the palatine arch.

(1) General health and nutrition of the patient.—It need scarcely be said that before any plastic operation is undertaken the general health of the patient should be as good as possible. If the child be suffering from a cold or any other temporary indisposition the operation should be postponed until normal health has been restored. If the general health be not good the wound is more likely to become infected, powers of repair are less active, and a partial or complete failure of the operation will probably occur.

The statement that has recently been made with marvellous assurance, that a feeble and ill-nourished infant will benefit by the immediate performance of an extensive operation, and that such an operation is to be regarded as a "life-saving" measure, scarcely needs serious consideration.

It has been asserted that as the malnutrition of an infant with cleft palate is due to the presence of

the deformity the best way to treat it is to operate upon the palate at once. This line of argument is quite erroneous. The malnutrition of an infant may be due to insufficient feeding connected with the presence of a cleft palate. If so the proper remedy is to feed the child in a rational manner (as explained on p. 83), not to inflict upon it an extensive wound which is necessarily an open one, and consequently liable to infection, which will tend to make the child worse instead of better.

The following case is a good illustration of the beneficial effect of proper feeding:

Margaret G., aged six weeks, was sent to one of us at the Royal Free Hospital by Dr. Ethel Vernon on account of a cleft of the soft palate. The child was emaciated and weighed only 7 lb. It was recommended that it should be fed carefully and the operation postponed. At the age of nine months, the child being then in excellent health, the operation for closure of the cleft was performed, and complete union took place. When seen again at the age of 3½ years it was perfectly healthy, the palate was quite normal, and speech was as good as that of other children of the same age. (Appendix, 105.)

Figures 71 and 72 (pp. 82, 83) also illustrate the same point.

The state of general nutrition has another and perhaps less obvious effect upon the operation. The thickness of the soft tissues on the oral surface of the hard palate varies according to the state of nutrition of the rest of the body. In a plump, well-nourished child the palatal tissues are thick; in a thin, badly nourished child the palatal soft tissues are also thin (Fig. 21, p. 27). It is obvious that if the flaps of tissue that are

dissected off the hard palate are thin, they will be more likely to slough, and there will be a greater tendency for their edges to separate instead of uniting.

Let the general health and nutrition of the child be in as good a condition as possible before the operation is undertaken.

(2) The condition of the mouth and pharynx should be as healthy as possible. Any local source of sepsis may lead to serious infection of the wound and thus prevent normal healing. Carious teeth should be removed or stopped. Any ulceration or inflammatory condition of the gums, palate, or tonsils should be treated before the surgeon undertakes the operation upon the cleft palate.

Enlarged tonsils may require removal. If so, the wounds thus produced should be allowed to heal completely before anything is done to the palate. It is often stated that the hypertrophied glandular tissue in the naso-pharynx known as adenoids should be removed. If the adenoids be in an inflamed or suppurating condition, and thus likely to lead to infection of the palate wounds, it may be necessary to remove them. But a considerable interval of time, at least several weeks, should be allowed to elapse between the operation for the removal of the adenoids and that on the palate. The wound produced by an adenoid operation is an open and more or less septic one which takes some time to heal. To operate on the palate

while an unhealed wound is present in the naso-pharynx is not good practice. Further, an operation for adenoids is often attended by a considerable loss of blood, which for a time weakens the child, and diminishes its power of repair.

The mere presence of adenoids in a case of cleft palate is rather beneficial than harmful, provided that they are not inflamed or suppurating. By helping to block up the naso-pharynx they hinder the passage of air into the nose, and thus improve the speech of a cleft palate patient. After an operation for adenoids a patient with cleft palate usually speaks worse than before. This was well illustrated in the case of a young lady with a cleft palate, whose mother volunteered the statement that her daughter had been operated upon some little time before for adenoids, and that afterwards her speech was much worse (Appendix, Case 55).

As a general rule, then, it may be stated that the mere presence of adenoids does not demand any operation for their removal as a preliminary to the cleft palate operation. Treatment for a few days with a local application of chlorate of potash (gr. x ad $\bar{3}$j) or some similar remedy, may be desirable. Otherwise they may be left alone without any fear that they will exert a prejudicial effect upon the cleft palate operation.

(3) **Width of the cleft.**—It is not so much the absolute as the relative width of the cleft that

is important. A cleft, for instance, of $\frac{3}{4}$ inch in a young infant would be a wide one from an operative point of view. A cleft of the same width in a child of six or seven years—that is, in a child whose jaws were much larger—would not be unusually wide. In measuring the width of a

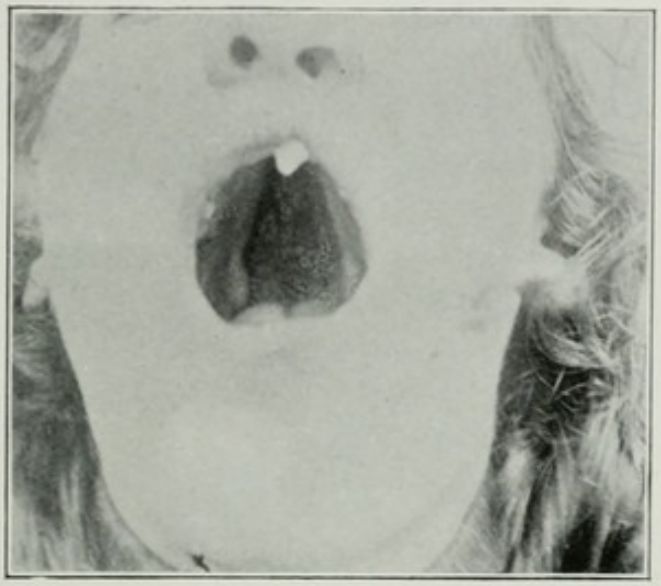


FIG. 141. Complete single cleft of hard and soft palate, closed by median operation at the age of 16.
Ethel W. Royal Free Hospital, 1901. Appendix, 31.

cleft, it is well to measure also the distance between the inner margins of the alveolar borders, or between the inner borders of the last molar or premolar teeth, if they have erupted. Thus in Fig. 141 the width of the cleft itself was 23 millimetres (nearly 1 inch), and the width between the molars was 33 millimetres. This patient was sixteen years of age, and the cleft was closed without unusual difficulty.

As a general rule, a single cleft palate is more easy to close than a double one, partly because the cleft in the former case is usually narrower, and partly because the attachment of the septum to one edge of the cleft allows the operator to make use of

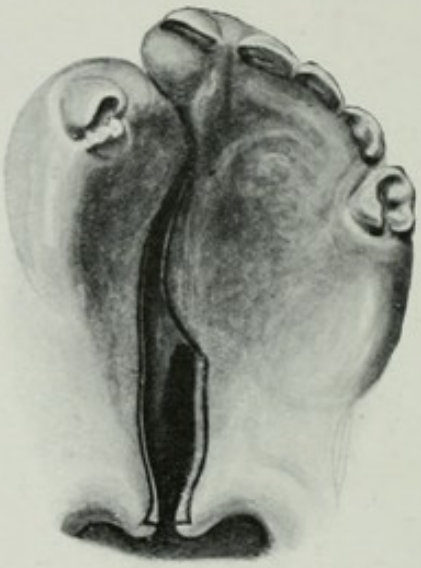


FIG. 142. Single complete right cleft palate with lines of incision showing how the septal tissues can be utilised to close the anterior part of the cleft.

the septal soft tissues in the closure of the anterior portion of the cleft (Figs. 142 and 195, p. 216).

The most difficult clefts to close satisfactorily are usually not complete clefts. They are those wide median ones which stop short of the incisor teeth, the alveolar arch being normal. These clefts are often very wide, and have a broad rounded anterior extremity which is difficult to deal with (Figs. 143 and 63, p. 73). Such clefts are seldom associated with harelip.

Other things being equal, the narrower the cleft in proportion to the total width of the palate, the more easy will be the operation for its closure. But in estimating the ease or difficulty with which

FIG. 143. Wide cleft of the soft and most of the hard palate. The alveolar border and lip are not cleft.
Janet W., aged 10. Royal Free Hospital, 1898. Appendix, 7.

an operation for cleft palate will be attended in any given case, we have to consider other points as well, such as the thickness of the palatine soft tissues and the height of the arch.

(4) **Height of the palatine arch.**—Of much greater importance than the actual width of the cleft is the height of the palatine arch. The lower

the arch—that is, the flatter the palate—the more difficult will be the operation. As regards the height of the arch, palates differ within wide limits.

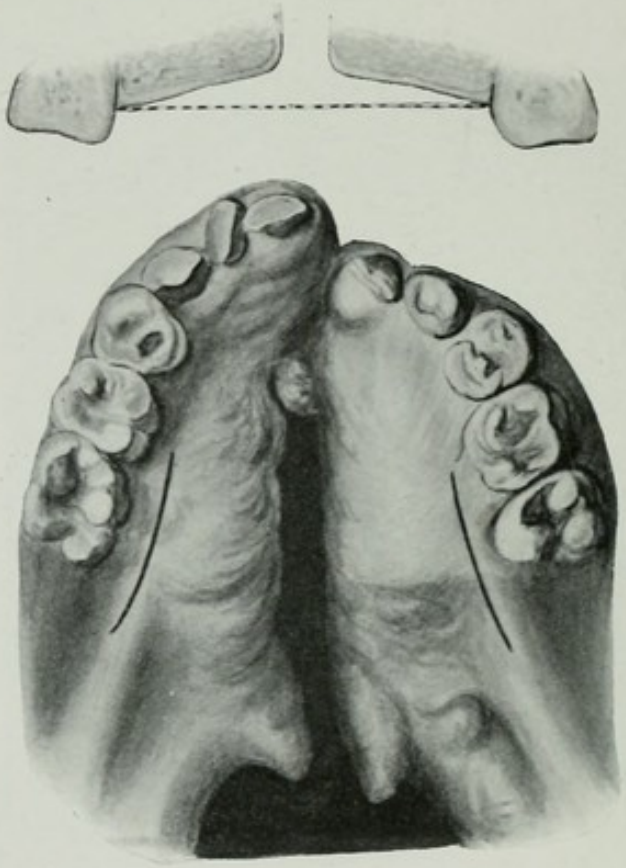


FIG. 144. A narrow single cleft with unusually flat arch. The irregularity of the edges of the cleft make it probable that some operation had been performed on the palate when the harelip had been closed.

Louis W., aged 6. Royal Free Hospital, 1910. Appendix, 132.

The oral surface of the palatine arch (in architectural language, the soffit) is always concave. But while in some the arch is a very low one, approaching the flat (Fig. 144), in others it is high. Indeed, in some cleft palates the sides of the arch very nearly approach the vertical (Fig. 146). The

difference between the two kinds of arch has been compared to the difference between the Norman (or Romanesque) arch and the pointed or Gothic arch.*

An essential feature of the operation consists in the bringing down of the muco-periosteal tissues

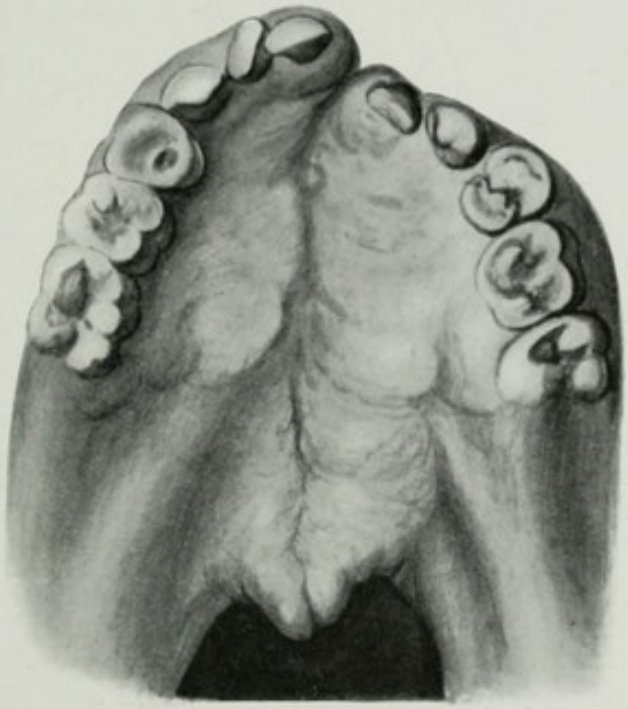


FIG. 145. The same patient shortly after median suture of the palate.

from the oral surface of the palate. It follows, therefore, that the higher the arch the more easily can these tissues be brought down, and the more readily can they be brought together in the middle line. The diagrams in Fig. 147 are drawn to scale from two actual cases. The examples chosen are,

* Early English arch would be a more correct term, since some Gothic arches (*e.g.* the Late Perpendicular) are nearly flat.

of course, extreme ones, but they serve very well to illustrate the principle upon which the operation for cleft palate is founded.

Another factor of some importance for the success of the operation is the tractability of the

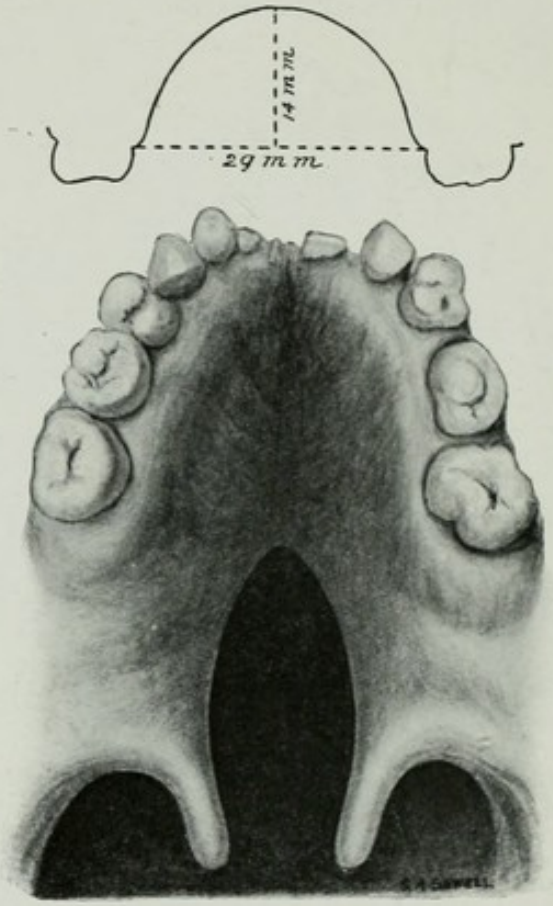


FIG. 146. Cleft of soft and posterior edge of the hard palate. The arch of the latter is high.
Elizabeth R., aged 8. Royal Free Hospital, 1900. Appendix, 26.

child. It is well that the child should be for some days under the care of the nurse who will subsequently take charge of the patient, so that they may get to know each other. It is also a good plan for the nurse to accustom the child to the

method of feeding that will be adopted after the operation. The surgeon should also endeavour, before the operation, to gain the confidence of the

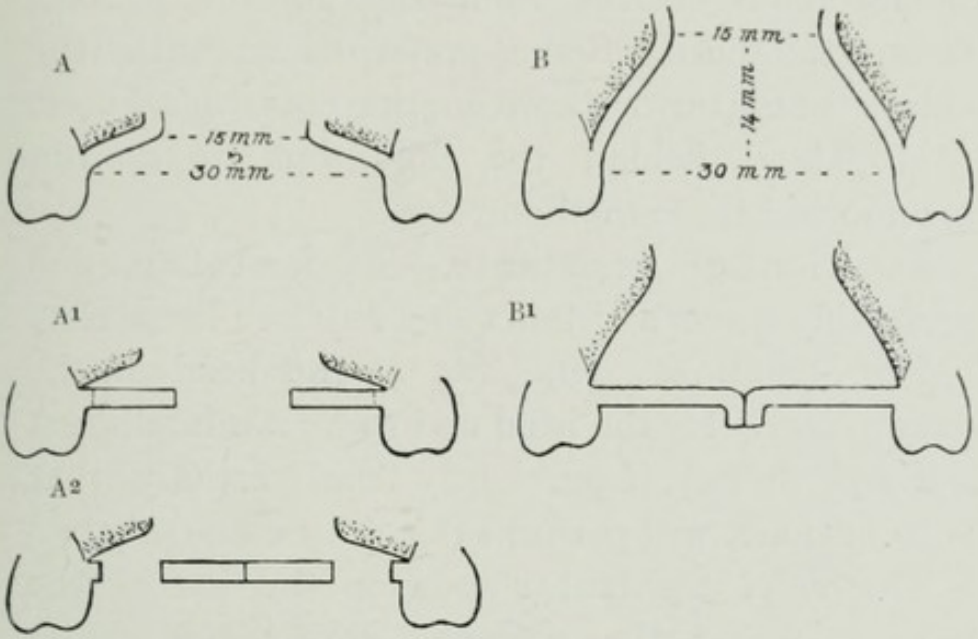


FIG. 147. A series of diagrams showing transverse sections through clefts of the palate, illustrating the point that the higher the arch the more easily is closure effected by median suture. The clefts in A and B are of exactly the same width. In B, with high arch, the detached muco-periosteal tissues meet easily in the middle line (B′) ; in A, on the other hand, with a low arch, they do not meet (A′) until lateral incisions have been made to allow them to be displaced towards the middle line (A^2).

child, so that his subsequent visits may not cause undue alarm.

The Operation

Position of the patient.—The child should lie on its back with the shoulders well raised on two or three firm pillows. The head should be fully extended, so that blood may tend to run towards the naso-pharynx rather than towards the larynx,

and it must be held firmly by an assistant, who also holds the gag.

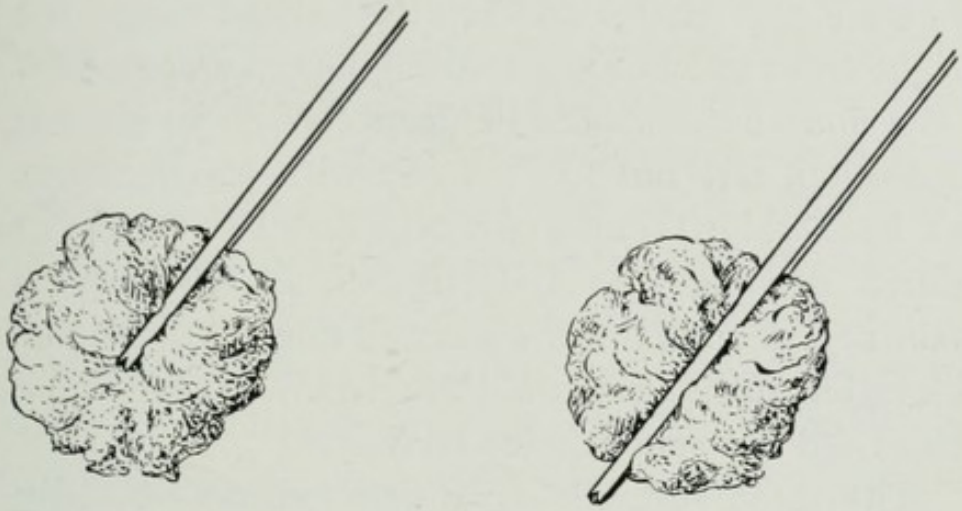
Position of the operator.—The operator should stand on the right side of the patient, facing the head. Some prefer to sit with the child's head on or between the operator's knees, or to stand behind the child, but we do not recommend these methods.

Position of assistants.—At least two, and preferably three assistants are required for a cleft palate operation. One sits at the head of the patient and holds the head and gag. An intelligent nurse or dresser, if previously taught exactly what is to be done, will perform this duty efficiently.

The chief assistant stands on the left of the patient, facing the operator during the earlier stages of the operation. His principal duty is to keep the pharynx free from blood by frequent sponging. Marine sponges of various sizes from one inch in diameter downwards should be used for this purpose. They should be held in long forceps. The ordinary sponge-holders with sliding catch are not good, as the catch is apt to slip, and the sponge may become detached and cause trouble in the pharynx.

After the soft palate has been sewn up, the sponges should be passed with care into the pharynx close to the root of the tongue. Careless sponging at this stage may lead to the sponge and forceps being driven against the freshly united palate and

tearing out of the sutures. Care should also be taken in grasping the sponge with the forceps. The end of the forceps should be at the middle of the sponge, and not project beyond it. If attention be not paid to this small detail, it is possible to damage the palate and pharynx with the end



A B

FIG. 148. Showing (A) the right, and (B) the wrong way of holding the sponge in the forceps.

of the forceps. Fig. 148 illustrates the right and wrong ways of holding the sponge in the forceps. The sponges should be wrung out of warm saline solution or weak boracic lotion.

In the later stages of the operation, when the bleeding is usually less troublesome, the chief assistant can aid the operator by sponging the edges of the pared cleft with minute sponges, by catching up the sutures as they are passed, and by everting the edges of the line of suture as the stitches are being tied. A third assistant is useful

for threading needles, handing instruments, &c. He should stand on the operator's right hand on the other side of the table on which are the instruments and sutures.

Anæsthesia.—Whenever possible the services of a skilled anæsthetist should be obtained. It is not an easy matter to keep the patient at just the right stage of anæsthesia throughout the operation. The anæsthesia should be deep enough to abolish sensation, but not to do away with cough reflex, at least while there is any likelihood of blood or saliva running into the larynx. A tendency to faintness is sometimes observed, due partly to the elevation of the head and shoulders. Unless severe this need not cause undue anxiety.

The most suitable anæsthetic is undoubtedly chloroform, owing to the facility with which it can be administered. We have sometimes employed ether for induction, but the tendency to the secretion of mucus and saliva, as well as the increased venous congestion caused by ether, is a distinct objection in an operation where venous hæmorrhage is apt to be troublesome.

The chloroform may be administered at first on a Skinner's mask or other apparatus, or by means of a simple square of lint. During the progress of the operation it should be given through a Junker's tube inserted either into one nostril or preferably at one corner of the mouth. The anæsthetist should take care that his tube does not interfere

with the surgeon's view of the field of operation. He should also avoid putting the end of the tube too near the upper opening of the larynx, lest laryngeal spasm should be induced thereby. There are certain stages in the operation when the operator may interfere so much with the anæsthetist that the latter may have temporarily to discontinue the administration. On the other hand, there are periods, such as that of sponge-pressure on the palate, in which the operator temporarily discontinues his active work, and of these the anæsthetist should make full use, if necessary, to get the patient more deeply under the influence of the anæsthetic.

An experienced anæsthetist will often be able to lend a hand with the sponging, and must carefully watch the condition of the pharynx, reminding the chief assistant at times that it requires sponging.

If the bleeding be unusually free and should get beyond the control of the assistant, or if vomiting occur (which should not be the case), it may be advisable to suspend the operation for a short time while the child is turned on its side, although with a capable anæsthetist, a good assistant, and a reasonably skilful operator this should very rarely be necessary. The naso-pharynx can then be cleared, while sponge-pressure is exerted upon the palate in the manner depicted in Fig. 149.

Throughout the operation the surgeon and the anæsthetist should work together, each helping and making allowances for the difficulties of the other.

The difference to the surgeon between doing a cleft palate operation with a thoroughly experienced anæsthetist and an inexperienced one is the difference between pleasure and pain.

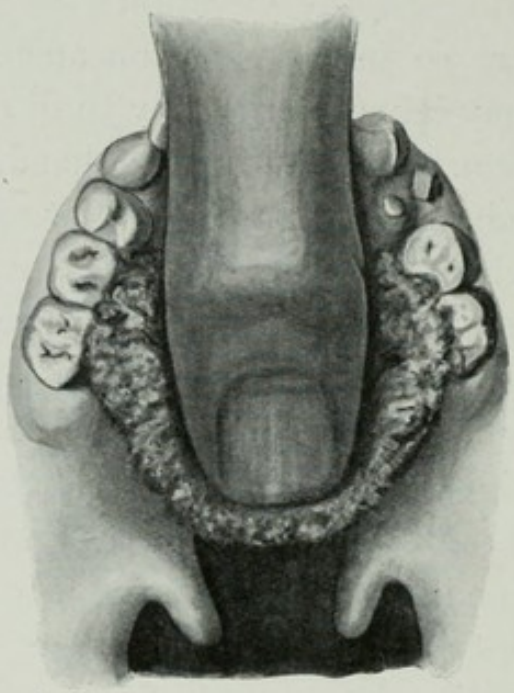


FIG. 149. Showing the method of controlling hæmorrhage by the left thumb and a sponge.

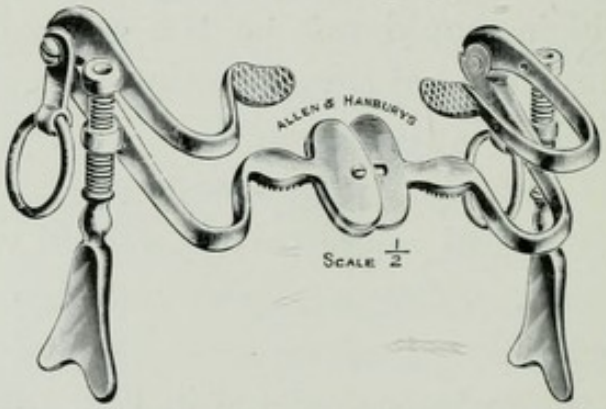


FIG. 150. Smith's cleft palate gag, which opens the mouth, depresses the tongue, and reflects light upon the palate.

The gag.—By far the best form of gag for a cleft palate operation is that introduced by the late

Sir Thomas Smith and commonly known by his name (Fig. 150). By its means the mouth is kept

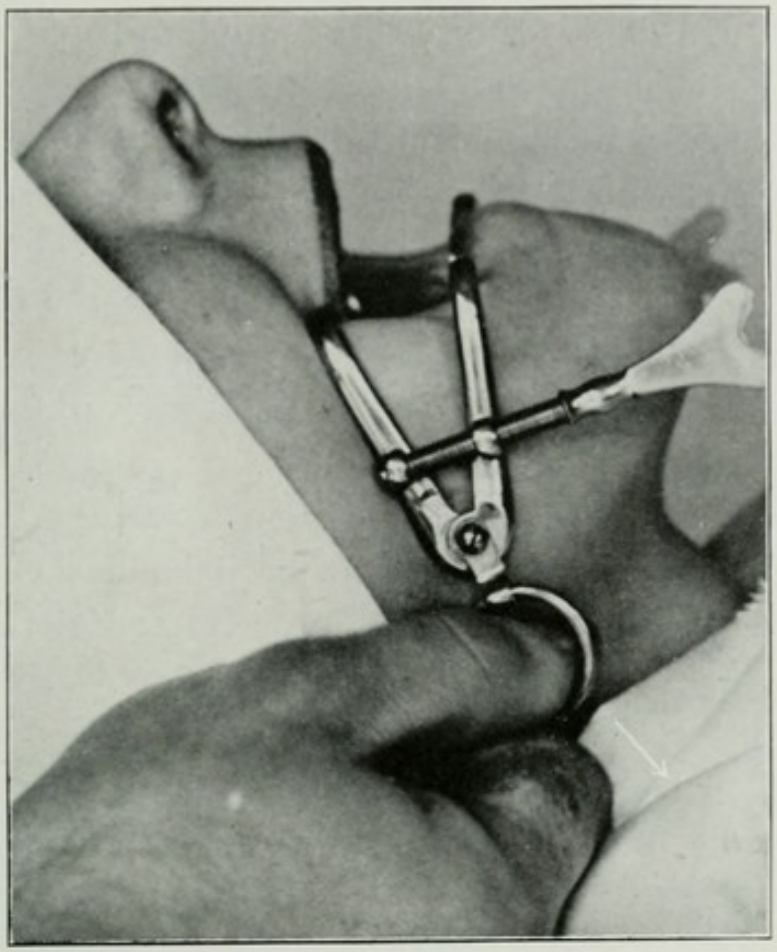


FIG. 151. Showing the method of holding Smith's gag in position. The tips of the thumbs lie in the rings, whilst the tips of the index fingers are on the angles of the jaw. By pressing the thumbs downwards and forwards the tongue is depressed. If difficulty in breathing occurs this is relieved by pushing the jaw forwards and extending the head. Sometimes it will be found more convenient to place the index finger above the ring, instead of below it, as shown in the figure.

widely open, while at the same time the tongue is depressed and kept out of the way, and the smooth, shiny surface of the tongue-plate reflects light towards the palate. These three functions are

performed by no other gag with which we are acquainted. There are, however, objections to the use of the gag, and these have led some operators to discard it and to use some simpler form.

The chief objection to Smith's gag is that it is difficult to hold in the right manner. The assistant who is to hold the gag has to learn how this should be done before the operation is begun.

The assistant sitting at the head of the patient holds the sides of the head between his wrists, the thumbs being inserted into the rings on the gag that are provided for the purpose (Fig. 151). In order to prevent the gag from slipping forwards the little and ring fingers of each hand should be placed behind the head in the occipital region. By this means the gag and head are held firmly as in one piece, and the gag is not allowed to slip forwards, which it has a great tendency to do. The assistant must keep the head well extended, and the rings of the gag should be pressed downwards and forwards—*i.e.* away from the assistant (Fig. 151). The gag must not be drawn backwards towards the assistant. An untrained assistant is very apt to draw it backwards and to let the head slip into a flexed position. Troubles with respiration are then apt to occur. It is also very important that the gag be rightly placed as regards the tongue, lest the latter be pressed downwards upon the larynx and interfere with the breathing.

This trouble is best guarded against by seeing

that the gag is correctly inserted in the first instance. The mouth should be widely opened and the closed gag inserted as far back as possible.

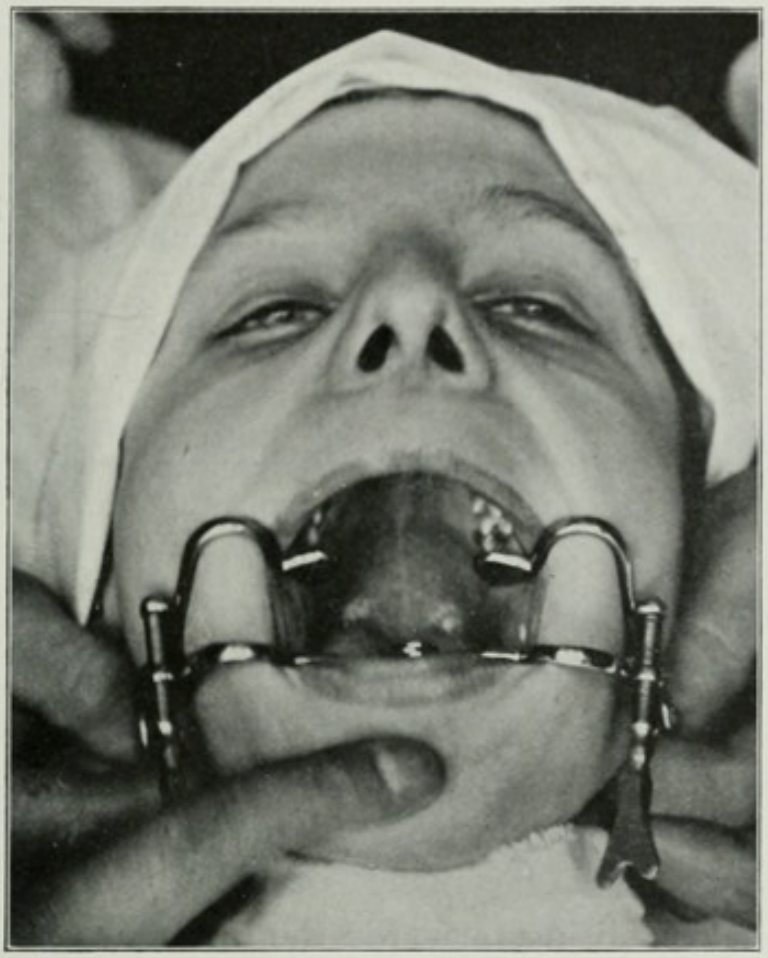


FIG. 152. Smith's gag in position, showing how a good view of the whole palate can be obtained. Light is reflected on to the palate from the tongue plate, of which only the anterior extremity is visible. In this case the palate is not cleft, and the gag is not opened to its full extent.

In doing this the tongue must not be pushed backwards. If the tongue does not lie in the correct position, and seems to be pressed against the larynx, it should be seized at its tip with a pair

of forceps and drawn forwards so that the tongue-plate rests upon the posterior part of the tongue. If necessary the tongue may be drawn forwards by means of a piece of silk passed through its substance.

The gag having been correctly placed in position, should now be handed over to the care of the assistant, who should hold it in the manner already described. The operator then opens the gag to the desired extent by means of the screws on either side. It will then be found that an excellent view is obtained of the whole field of operation, while, if the tongue be in the proper position, no obstruction to the breathing occurs. The assistant must learn to depress the posterior part of the tongue-plate when the operator is working far back, at the soft palate and uvula. This is done by the movement of pressing the rings downwards and forwards, as already described.

Too much pressure in this direction will occasionally cause laryngeal obstruction. This is relieved by tilting forwards the lower jaw with the tips of the assistant's forefingers, which are to be kept on the angles of the lower jaw. Only the forefingers should be used for this purpose, and care must be taken not to compress the sides of the pharynx (which is easily done with the middle fingers by a careless assistant), or respiratory trouble will occur.

This rotation of the gag round a transverse axis

is important, since by its means the tongue is depressed or relaxed. Extension of the head and depression of the posterior part of the tongue-plate are the two points which the assistant should constantly bear in mind. He should watch the breathing continuously, and if the least sign of obstruction occur, relieve it at once by tilting upwards the lower jaw, or relaxing to a slight extent the depression of the tongue-plate.

The assistant must hold the gag firmly throughout the operation, never relaxing his hold for a moment. If he does, the gag will slip forwards, and it cannot be pushed back into its place without fear of pushing the tongue back over the larynx. If, from momentary inattention on the part of the holder, the gag has become displaced forwards and the tongue allowed to slip backwards, the operation must be suspended while the operator removes the gag, closes it, reinserts it, and reopens it in the proper position. With well-trained dressers, such as we are in the habit of employing, it is but rarely necessary to remove and replace the gag during the course of the operation.

The task of holding the gag is an arduous one, as the authors well know from personal experience on many occasions in their younger days. But the task is not beyond the powers of a dresser or nurse of average intelligence and strength. The aching thumbs are not easily forgotten by any one who has ever held the gag during a long cleft

palate operation. Should the operation be unusually long, it is quite easy to transfer the care of

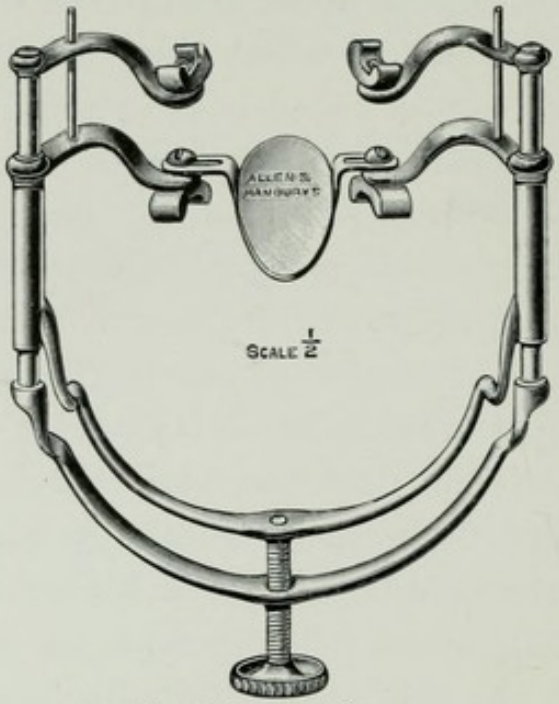


FIG. 153. Trelat's gag.

the gag to another assistant, the operator himself taking hold of the gag and lower jaw while the transference is being effected.

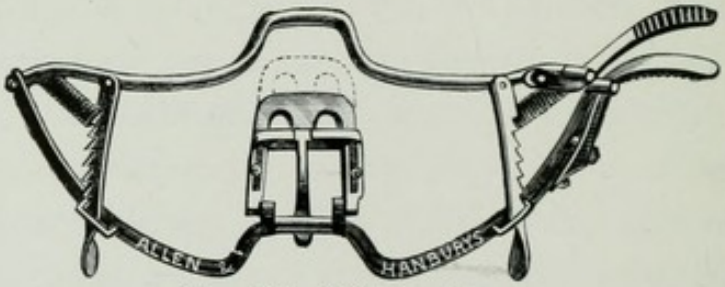


FIG. 154. Whitehead's gag.

Some gags are furnished with small spikes intended to stick into the gums and prevent forward displacement. We have never used these, believing

that the spikes cause unnecessary laceration of the toothless gums or damage to the enamel of the erupted teeth. If Smith's gag be properly held, then spikes are unnecessary.

Other forms of gag that may be used for this operation are Trélat's (Fig. 153), Whitehead's

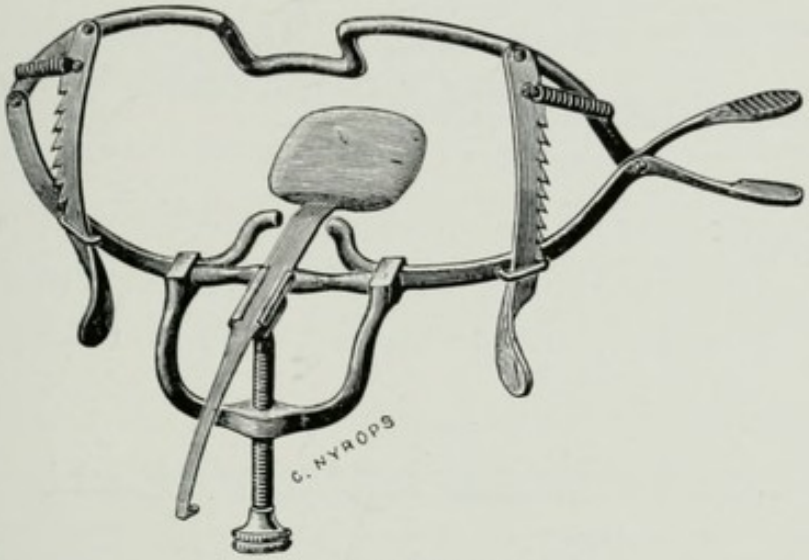


FIG. 155. Geffer's gag.

(Fig. 154), and Geffer's (Fig. 155). The latter is the gag usually employed by Dr. Ulrich of Copenhagen, a recognised authority on the subject of cleft palate. Brophy's tubular gag is also a useful instrument.

Instruments.—Besides the gag there are several special instruments* that are necessary for the proper performance of a cleft palate operation. These are :

Long-handled forceps, one or two with small

* Messrs. Allen and Hanburys, of Wigmore St., London, W., keep all these instruments in stock, and supply them either singly or together in a case.

teeth at the ends (Fig. 156), and one without (Fig. 157).

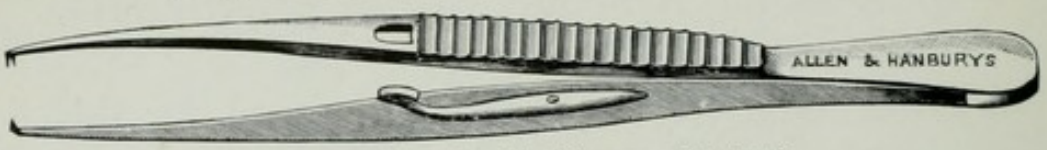


FIG. 156. Long-handled forceps with teeth.

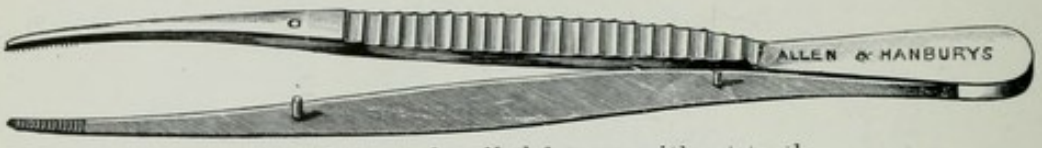


FIG. 157. Long-handled forceps without teeth.

Raspatories for the detachment of the soft parts from the bones (Fig. 158). A stout aneurism needle is also useful for this purpose.

FIG. 158. Raspatory for detachment of muco-periosteum. The left end is most generally useful, the right end being employed only in the region of the incisor teeth.

Blunt-pointed scissors, sharply curved on the flat (Fig. 159).

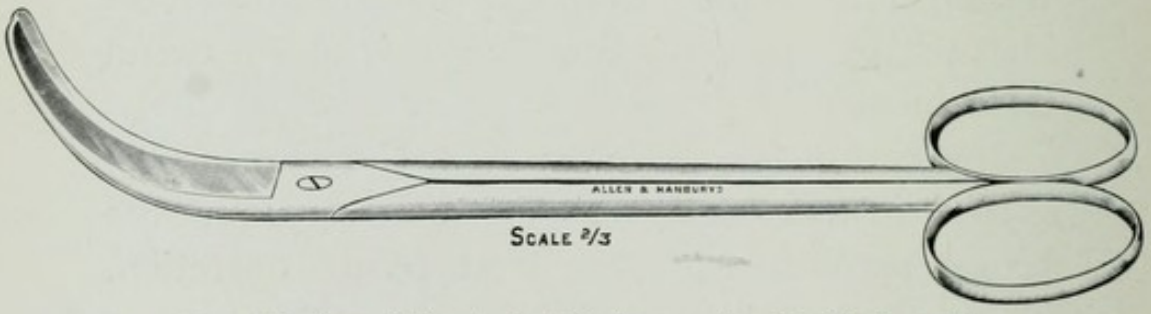


FIG. 159. Curved blunt-pointed scissors. Smaller blades and more curved than those in the figure are preferable.

Two small, sharp hooks, one single and one double, mounted on long handles: used for

retraction of the cut edges as the sutures are being tied (Figs. 160 and 161).

FIGS. 160 and 161. Single and double sharp hook for retraction of pared edges of palate during suturing.

A rectangular knife, of the form shown in Fig. 162.

One sharp-pointed tenotomy knife for paring the edges and for making the lateral punctures (Fig. 163).

One blunt-pointed tenotomy knife for enlarging the lateral incisions at the end of the opera-

FIG. 162. Rectangular knife.

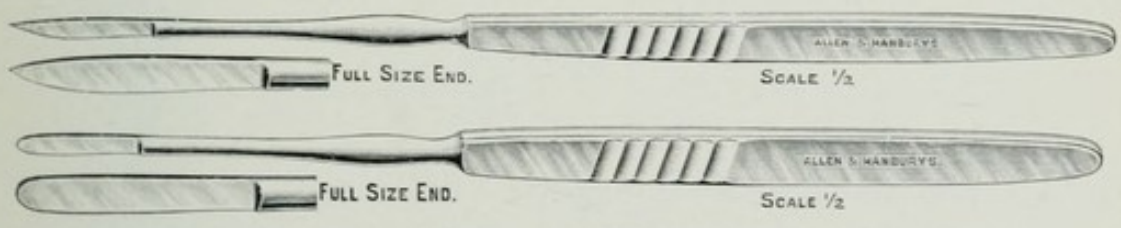


FIG. 163. Sharp and blunt pointed knives. The blades in the figures are unnecessarily large.

tion (Fig. 163). All these knives should be mounted on long handles.

Two or three long-handled rectangular or curved needles (Figs. 164 and 165), for passing the sutures; one with a double elbow (Fig. 166)

is often useful. Instead of these needles, the small curved ones recommended by Mr.

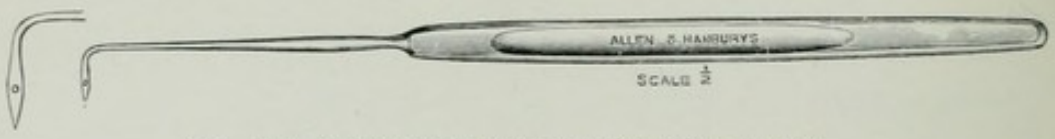


FIG. 164. Rectangular needle for inserting sutures.

FIG. 165. Curved needle for inserting sutures.

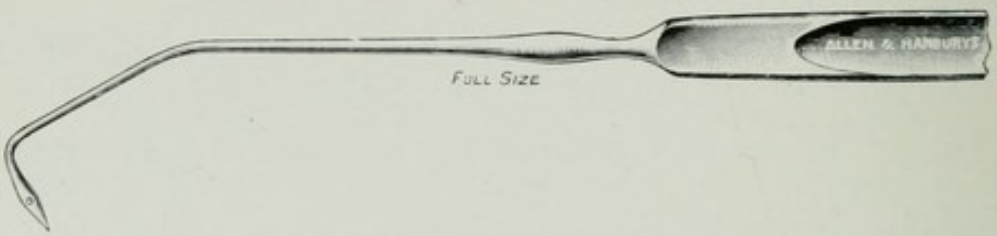


FIG. 166. Needle with double elbow : specially useful for passing wide tension suture through the soft palate.

Arbuthnot Lane may be employed. They should be held in his special needle-holder.

A few pairs of ordinary pressure forceps are also useful for holding the ends of the sutures after they have been passed and before they are tied.

We pass now to the steps of the actual operation, and it is well to point out that gentleness in the handling of the tissues is important. If the cut edges of the flaps be much bruised or lacerated they are less likely to unite. The raw surfaces should be kept as clean as possible. For this reason it is better to do the actual paring of the edges at a comparatively late stage of the operation, after

the muco-periosteal flaps have been completely formed, not at the beginning of the operation, as was formerly the custom. The assistant who sponges out the pharynx should be careful not to touch with his more or less dirty sponges the raw edges of the cleft after they have been freshened and are ready for approximation.

The actual operation may be divided into five stages:

I. Detachment of the muco-periosteal tissues of the palate from the oral surface of the bony palate.

II. Detachment of the soft palate from the posterior edge of the palate bones.

III. Paring the margins of the cleft.

IV. Suturing the pared edges.

V. Making, if necessary, lateral incisions to relieve tension.

I. Detachment of Muco-periosteal Tissues from the Oral Surface of the Bony Palate

This may be done either from the edge of the cleft, working from within outwards, or through a puncture near the alveolar margin, working from without inwards—that is, towards the middle line. Describing the latter procedure first, the operation is begun by making a puncture with the sharp-pointed tenotomy knife (Fig. 167). This puncture should be made either inside or outside the poste-

rior palatine artery, according to the situation in which it is intended subsequently to place the lateral incisions for the relief of tension. If the cleft is a narrow one and the arch of the palate high—that is, if it is thought that there will be no

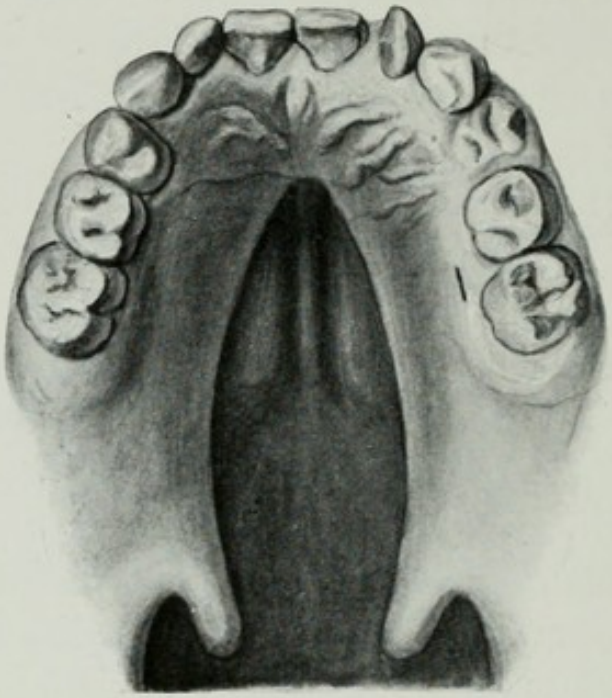


FIG. 167. Wide cleft of the soft and part of the hard palate, showing turbinated bones and thin nasal septum. The short black line near the molar teeth shows the first incision made in the operation for closure of the cleft. For the subsequent steps of the operation in this patient *see* Figs. 169–180, and Fig. 215, p. 250.
Gladys L., aged 10. Royal Free Hospital, 1907. Appendix, 95.

great difficulty in getting the pared edges of the flaps together—the puncture may be made inside the line of the artery at the point shown in Fig. 168. In this case the short lateral incision shown in the same figure will subsequently suffice.

If, on the other hand, the cleft is a wide one, and

especially if the arch be low, it will be necessary to make the lateral incision of considerable length, in order that the flaps may be shifted laterally towards the middle line. In such a case it is best to make the preliminary puncture close to the alveolar

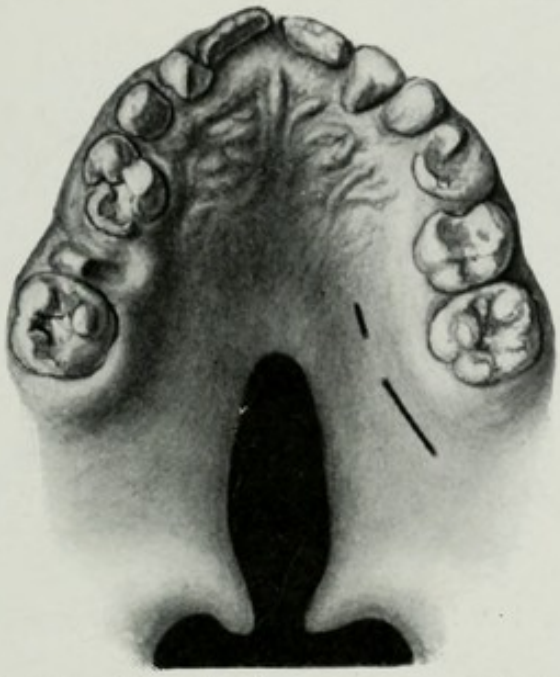


FIG. 168. Cleft of the soft and posterior part of the hard palate. The dark lines show the preliminary puncture for the detachment of the muco-periosteum and the subsequent incision for the relief of tension.
Sylvia D., aged 6. Royal Free Hospital, 1911. Appendix, 145.

margin and near its posterior extremity, as shown in Fig. 167.

Smart hæmorrhage may occur from this little wound, but it is easily arrested by pressure of a sponge upon the bleeding-point, while the assistant sponges out any blood that may have run into the pharynx. If this hæmorrhage is so considerable as to make it probable that the posterior palatine

artery has been punctured it is well to lengthen the incision a little, to ensure that the artery is cut completely across, and not merely notched by the knife. The cut ends of the artery are thus enabled to retract, and bleeding soon stops. The puncture should be made right down to the bone.

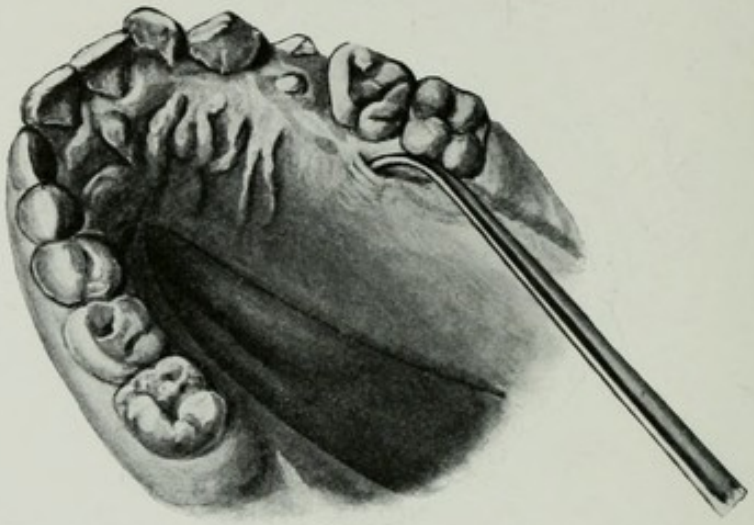


FIG. 169. Insertion of raspatory for separation of muco-periosteum.

Into the little wound the end of a curved raspatory is then inserted (Fig. 169), taking care that it also passes down to the bone—that is, beneath the periosteum. By means of this raspatory the muco-periosteal tissues are then raised from the bone, the separation being continued inwards until the edge of the cleft has been reached. The point of the raspatory, which hitherto has been kept closely applied to the bone, is then pushed through the soft tissues and appears in the cleft (Fig. 170). The point of an ordinary blunt aneurism needle is then

inserted into the opening at the margin of the cleft, the raspatory being used as a director to guide the aneurism needle into the wound already made between periosteum and bone. By means of the aneurism needle the muco-periosteal tissues are

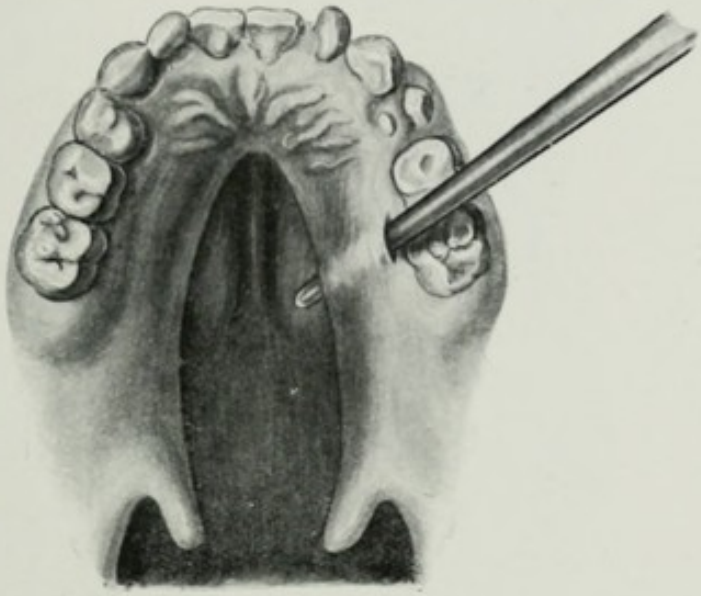


FIG. 170. The point of the raspatory appearing in the cleft.

separated more fully both forwards and backwards (Fig. 171).

The opening made by the raspatory at the margin of the cleft may be enlarged by cutting along this margin with the rectangular knife (Fig. 172). The separation of the soft tissues is completed as far back as the posterior edge of the palate bone. Here the aneurism needle is arrested by the firm attachment of the soft palate to the bones (Figs. 171 and 174). In front the separation is continued to the anterior end of the

cleft, or beyond this point if the cleft be incomplete.

If at any time the hæmorrhage is considerable it can be arrested either by packing a piece of gauze

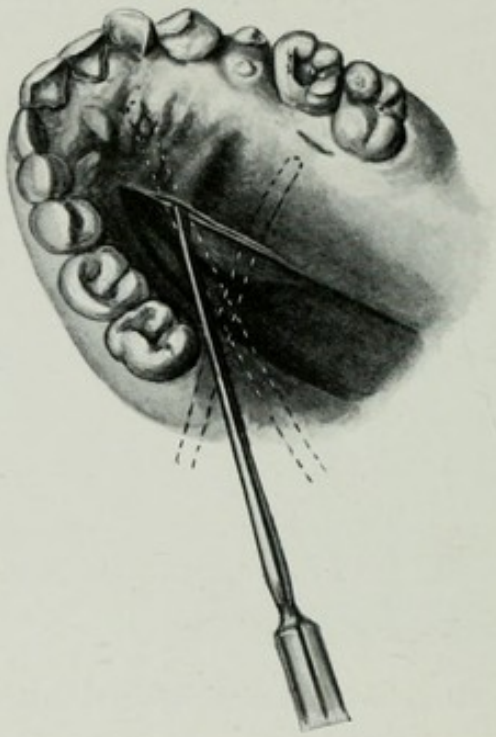


FIG. 171. Aneurism needle separating the muco-periosteum.

into the wound, or, better, by placing a sponge of the size of a large walnut against the palate and applying pressure for a few minutes with the left thumb, as shown in Fig. 149, p. 174.

This short interval may be utilised by the assistant in clearing the pharynx of blood, and by the anæsthetist, if necessary, in getting the patient a little more deeply under the influence of the anæsthetic.

Exactly the same procedure is now repeated on the other (usually the right) side of the palate.

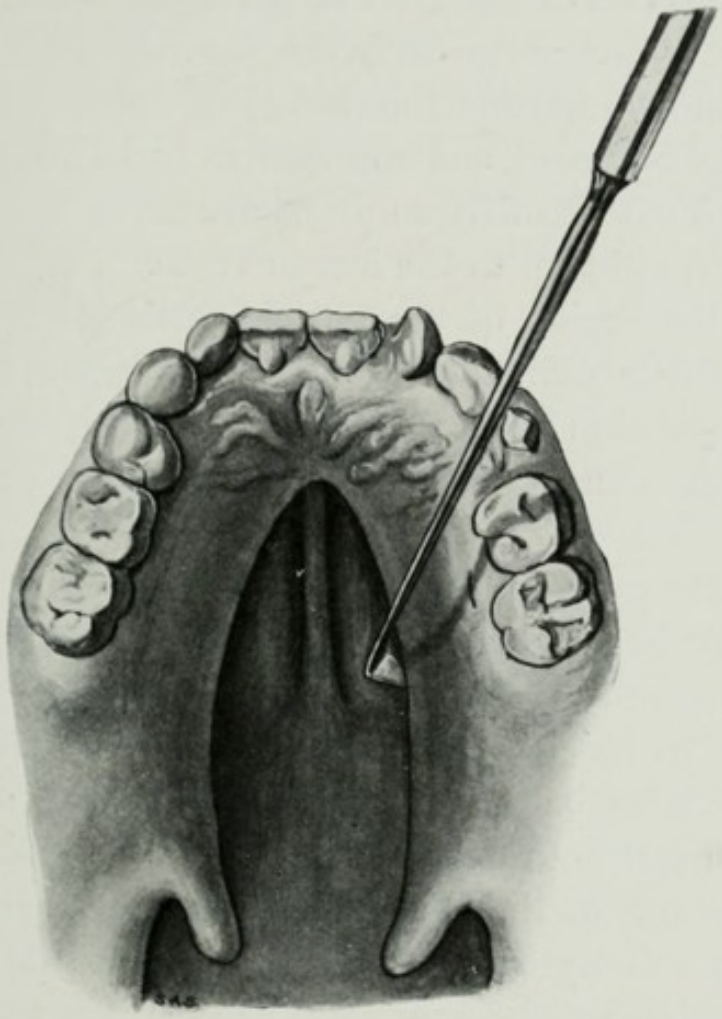


FIG. 172. The rectangular knife enlarging the opening made by the raspatory along the margin of the cleft. It may be used in the same manner to make the preliminary puncture through which the aneurism needle is introduced to separate the muco-periosteum from the margin of the cleft.

The soft tissues have now been detached on both sides from the bony palate as far backwards as its posterior edge, and as far forwards as the anterior end of the cleft, or, if the cleft be incom-

plete, as far beyond its anterior extremity as may be judged necessary to bring down the soft parts.

If this end of the cleft be narrow and pointed it will be sufficient to carry the separation for about half an inch beyond the cleft (Fig. 188, p. 211). If the end be broad and rounded as in Fig. 63, p. 73, a large extent of tissue may have to be separated, perhaps right up to the incisor teeth.

In the region of the anterior palatine foramen some little difficulty is sometimes experienced in the separation of the periosteum, which is continued into the canal, and a snip may have to be made with scissors.

If the operator prefers the alternative method, he may begin the operation by drawing the rectangular knife along the margin of the cleft, cutting down to its bony edge, as in Fig. 172. He then proceeds as before, using the aneurism needle for the separation of the muco-periosteum. The objection to this method is that it is not always easy to hit off exactly the margin of the bony palate, and to introduce the aneurism needle into the right place between the bone and periosteum.

II. Detachment of the Soft Palate from the Posterior Edge of the Palate Bones

This step, which is one of the most important in the whole operation, appears often to be ill-understood, and is apt to be imperfectly

executed by inexperienced operators. But a very little consideration will suffice to show that unless the soft palate be freely detached from the bony palate, the edges of the cleft cannot be approximated satisfactorily. As the anterior part of the soft palate is firmly attached to the bone by an aponeurosis, it cannot be brought down like the soft tissues that have been detached from the oral surface of the hard palate.

If the tissues of the soft palate be traced forwards they will be found to divide into three layers (Fig. 173). One, on the oral surface, is continuous with the soft tissues covering the hard palate. Above this is a tough fibrous aponeurotic layer which is attached to the posterior margin of the palate bones. The third layer, on the naso-pharyngeal aspect of the soft palate, is continuous with the mucous membrane lining the floor of the nose. It is these last two layers that have to be divided by means of scissors. To do this, one blade of a blunt-pointed pair of scissors sharply curved on the flat nearly to a right angle is introduced into the space between the palate bone and the already detached muco-periosteal tissues of the hard palate. The other blade is inserted into the naso-pharynx on the upper or nasal surface of the soft palate (Figs. 174 and 175). When the blades are closed the soft palate is cut away from the posterior margin of the bony palate (Fig. 173c). The separation is continued outwards as far as is neces-

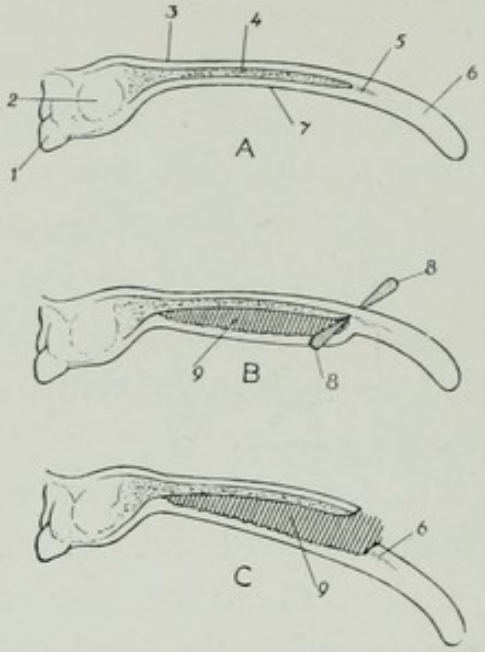


FIG. 173. Sagittal semidiagrammatic section through the palate of an infant near the middle line. To show how the detachment of the soft palate from the posterior edge of the hard palate and nasal mucous membrane is effected by means of scissors.

1. Temporary incisor tooth; 2. Permanent incisor; 3. Mucous membrane on floor of nostril; 4. Bony palate; 5. Aponeurosis of soft palate; 6. Soft palate; 7. Muco-periosteum of the hard palate; 8. Blades of a pair of scissors; 9. Space formed by detachment of periosteum.

A. Parts before operation; B. The muco-periosteal tissues of the hard palate have been detached by the raspatory, but the soft palate remains attached to the hard palate. Blades of curved scissors inserted; C. After division of the aponeurosis and nasal mucous membrane the soft palate descends to the required position.

sary to enable the edges of the cleft to be brought down and approximated in the middle line without undue tension.

In most cases it is sufficient to carry the detachment laterally to a point just short of the posterior palatine artery, where it emerges from the posterior palatine foramen. With a very wide cleft and a low arch it may be necessary to cut through the artery, and even as far as the alveolar margin itself.

Division of the artery is, however, to be avoided, if possible, as the vitality of the detached soft tissues is thereby impaired and risk of gangrene ensues.

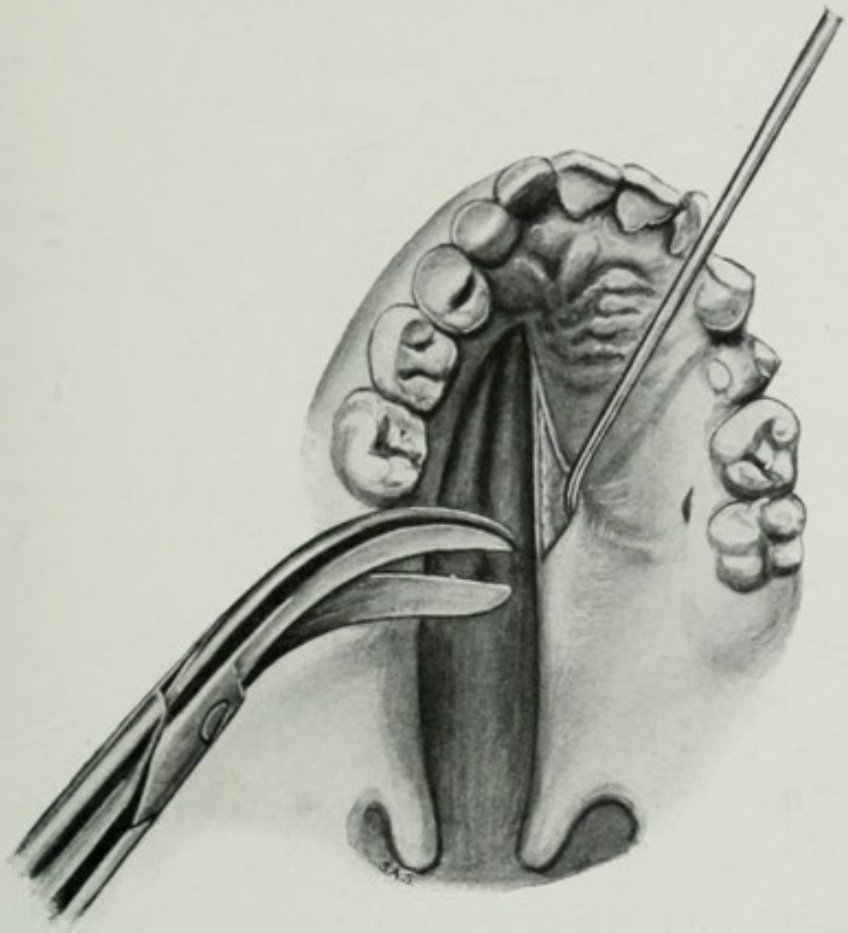


FIG. 174. The detached muco-periosteum is being held forward by an aneurism needle, and the curved scissors (here drawn a little too large) are about to be inserted.

The tensor palati muscle in the majority of cases should not be divided at this stage.

In making this cut with the scissors great care must be taken to avoid cutting through the whole thickness of the soft palate, especially at the edge of the cleft, or of making the flap too thin at this point.

This mishap is best avoided by rotating the scissors just before cutting, so that the plane of section is directed upwards and backwards. The scissors must be kept close to the palate bone, so as to avoid undue

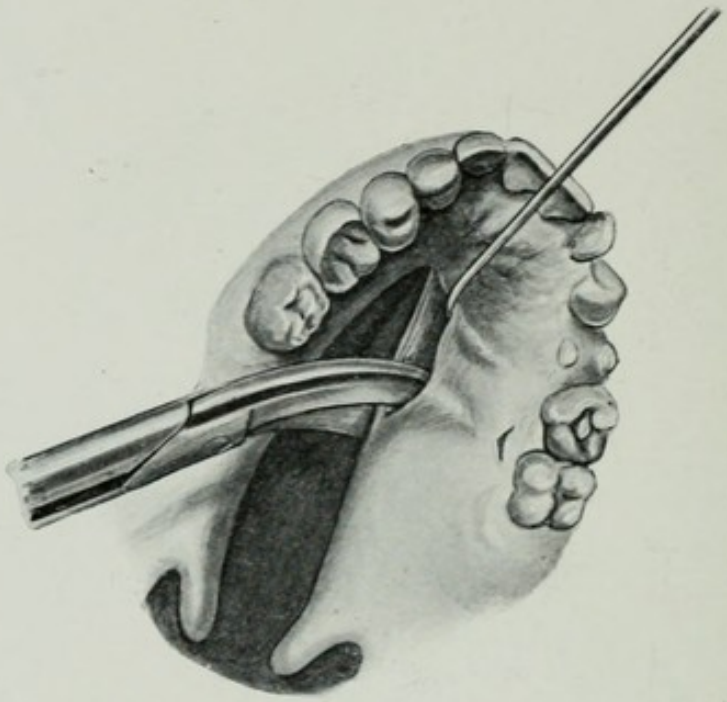


FIG. 175. Scissors inserted and about to separate the soft palate from the posterior edge of the hard palate. Note the rotation of the scissors on their long axis.

thinning of the palatine soft tissues at the junction of the hard and soft palate at the edge of the cleft. Neglect of this precaution is one of the causes of the hole that is so often seen in this situation after the operation. The separation, of course, has to be made on both sides of the cleft.

The soft tissues of both hard and soft palates have now been freely detached from the bony palate, and hang down like a pair of curtains.

III. Paring the Margins of the Cleft

The next step is to pare the edges of the soft palate and of the muco-periosteal tissues that have been detached from the bony palate.

Formerly it was the custom to perform this step at the beginning of the operation, the paring being somewhat facilitated by the attachment of the soft parts to the bone. This slight advantage is, however, more than counteracted by the freshness of the edges when the paring is effected just before the sutures are inserted. If the edges are pared before the detachment of the soft tissues from the bones, they are exposed to injury and infection from sponges and instruments during the subsequent stages. The bruising and infection of the raw surfaces, that under these circumstances is almost unavoidable, diminishes the probability of successful union. The only objection to late paring is that it is a little more difficult to cut neatly along the edge of a loose fold.

The paring should be effected as follows:

The inner edge of the soft palate on the patient's *left*, close to its junction with the hard palate, should be grasped with a long pair of finely toothed forceps, so as to steady the loose flap of tissue (Fig. 176). The sharp-pointed tenotomy knife is then passed nearly vertically, but with a slight outward inclination, through the curtain-like flap of tissue close to its edge and just in front of

the forceps (Fig. 176, 1). The knife is then carried forwards with a gentle sawing movement and a narrow strip of tissue is shaved off as far as the front end of the cleft. This strip should be

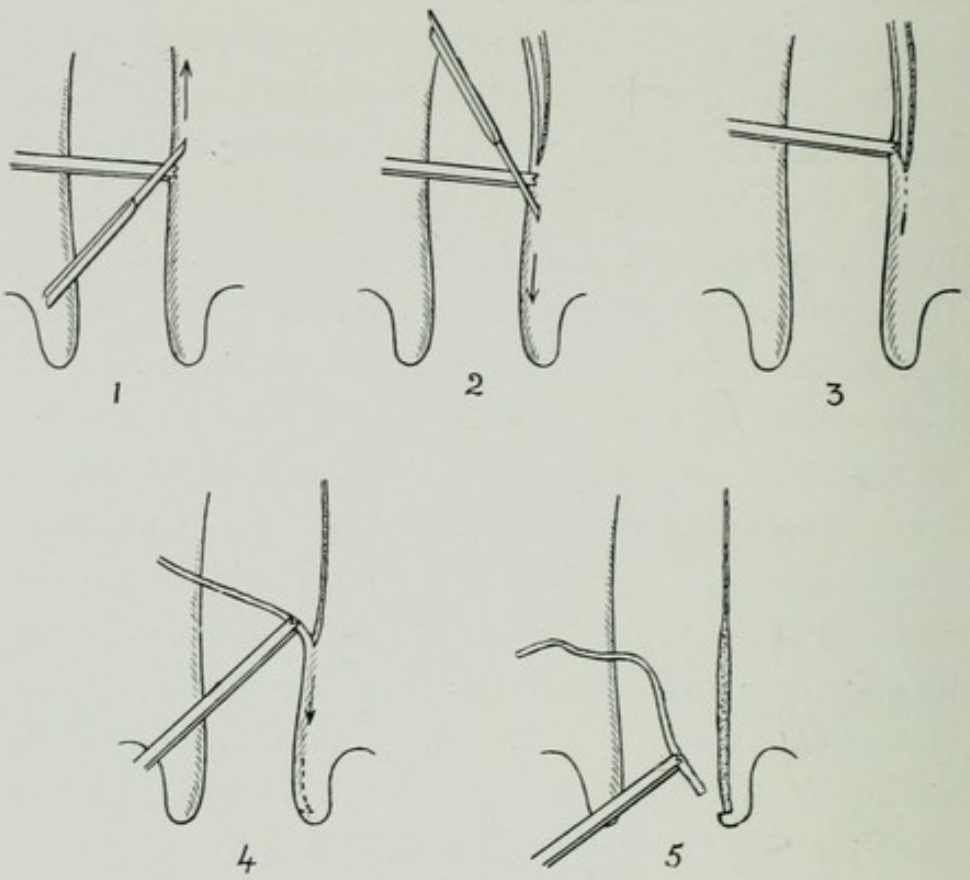


FIG. 176. Method of paring edges (diagrammatic).

detached, if possible, in one piece, so as to ensure that no part of the edge is left unpared. The forceps being still in position, the knife is now reinserted just behind them in a similar manner (Fig. 176, 2), and the cut is made backwards along the edge of the soft palate. After cutting for about a quarter of an inch, it will be found that the soft

palate wobbles too much to permit of further accurate paring. The forceps are now detached, shifted forwards, and made to seize the back part of the already detached strip (Fig. 176, 3). The little bridge of tissue opposite the previous attachment of the forceps is then divided. The strip is then drawn inwards and backwards by the forceps so as to steady the soft palate (Fig. 176, 4). The paring of the latter is then resumed, and will proceed without difficulty. As the knife nears the posterior extremity of the uvula it should be turned sharply inwards to complete the final separation of the strip (Fig. 176, 5).

The opposite (right) edge of the cleft is now pared in a similar manner. To do this, the operator (unless ambidextrous) will find it convenient to change his position and to stand behind the patient's head.

To do the paring neatly and to avoid undue laceration of the pared surface it is essential that the knife should be very sharp and have a thin blade. It is undesirable and unnecessary that the knife should be boiled, as the process blunts the edge. Care should be taken that the strip removed should embrace the whole thickness of the palate, especially of the thicker soft palate.

If the cleft be an easy one to close—that is, if it be fairly narrow and the arch high, it will now be found that the pared edges can be brought together in the middle line and are ready for

suturing. In the more difficult ones, however, the edges may still be too far apart to admit of their approximation by sutures. If it seems necessary, the scissors should be reintroduced on the nasal surface of the soft palate, and the fold of mucous membrane and muscle which runs from the soft palate to the side of the pharynx must be partially divided to allow the pared edge to be brought still nearer to the middle line. This fold contains fibres of the palato-pharyngeus and levator palati muscles. Care should be taken to divide these muscles close to the soft palate, so as to interfere as little as possible with their nerve-supply. This is especially important as regards the levator palati, the nerve to which enters at its upper end—that is, the end attached to the bone. Complete section of the muscles cuts off the nerve-supply from that part of it which is situated below the place of section. It is also very important that the successive snips of the scissors should be made in one plane, so that the muscle is not cut in several places and thus destroyed.

As a rule the lateral incisions (*see* below) through the palate for the relief of tension should not be made until all the sutures have been passed. In bad cases, however, it will be necessary to make these incisions before the sutures are tied.

IV. Suturing the Pared Edges

The best material for suture is fishing-gut. It should be fairly thick, as fine gut is apt to cut through the tissues. Some surgeons prefer to employ silk, but we think that this material is more likely to absorb septic matter and to produce suppuration in the stitch-holes. Formerly we employed silver wire for some of the stitches. Its advantages are that it can easily be passed by means of a Chassaignac's tubular needle (often called Smith's) (Fig. 177), and that the sutures can

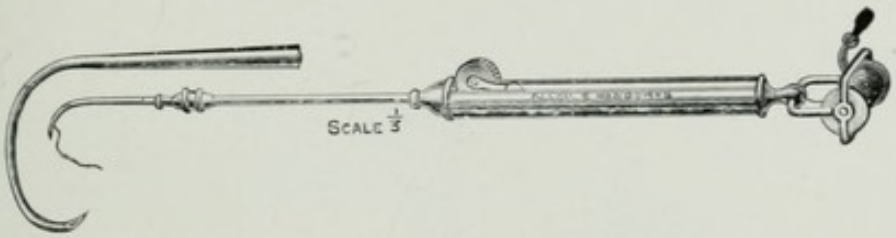


FIG. 177. Tubular needle for silver wire sutures.

be further tightened up by twisting with a pair of forceps at the very end of the operation, after the lateral incisions have been made. The tubular needle is, however, a somewhat clumsy instrument:

FIG. 178. Instrument for twisting up silver wire sutures.

it is difficult to sterilise and makes unnecessarily large holes in the palate. The form of needle that we recommend is Smith's rectangular needle (Fig. 164, p. 184). That part of it that is passed through

the palate should be as slender as is consistent with the requisite degree of strength. The pared edge is steadied with the long forceps, and the needle (armed with the suture) should be inserted at a distance of 3–5 millimetres from the margin (Fig. 179). The point should be directed first upwards

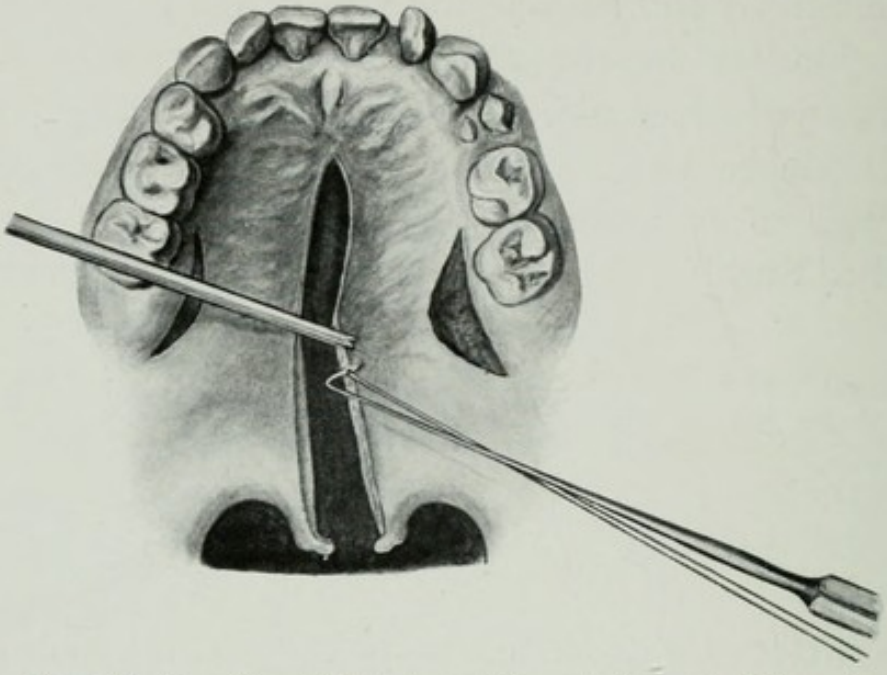


FIG. 179. Insertion of first suture at the anterior part of the soft palate. Note the outward direction of the point of the needle. In this case as the cleft is wide the lateral incision for relief of tension has already been made.

and outwards to ensure that the whole thickness of the palate is included in the suture. The needle should then be rotated through 180°, and the point carried across the middle line, and, if possible, passed in a similar manner, but from above downwards (that is, from the nasal to the oral surface) through the opposite half of the palate. In dealing with the soft palate there is usually no difficulty in

thus carrying one suture through both halves of the palate (Fig. 180).

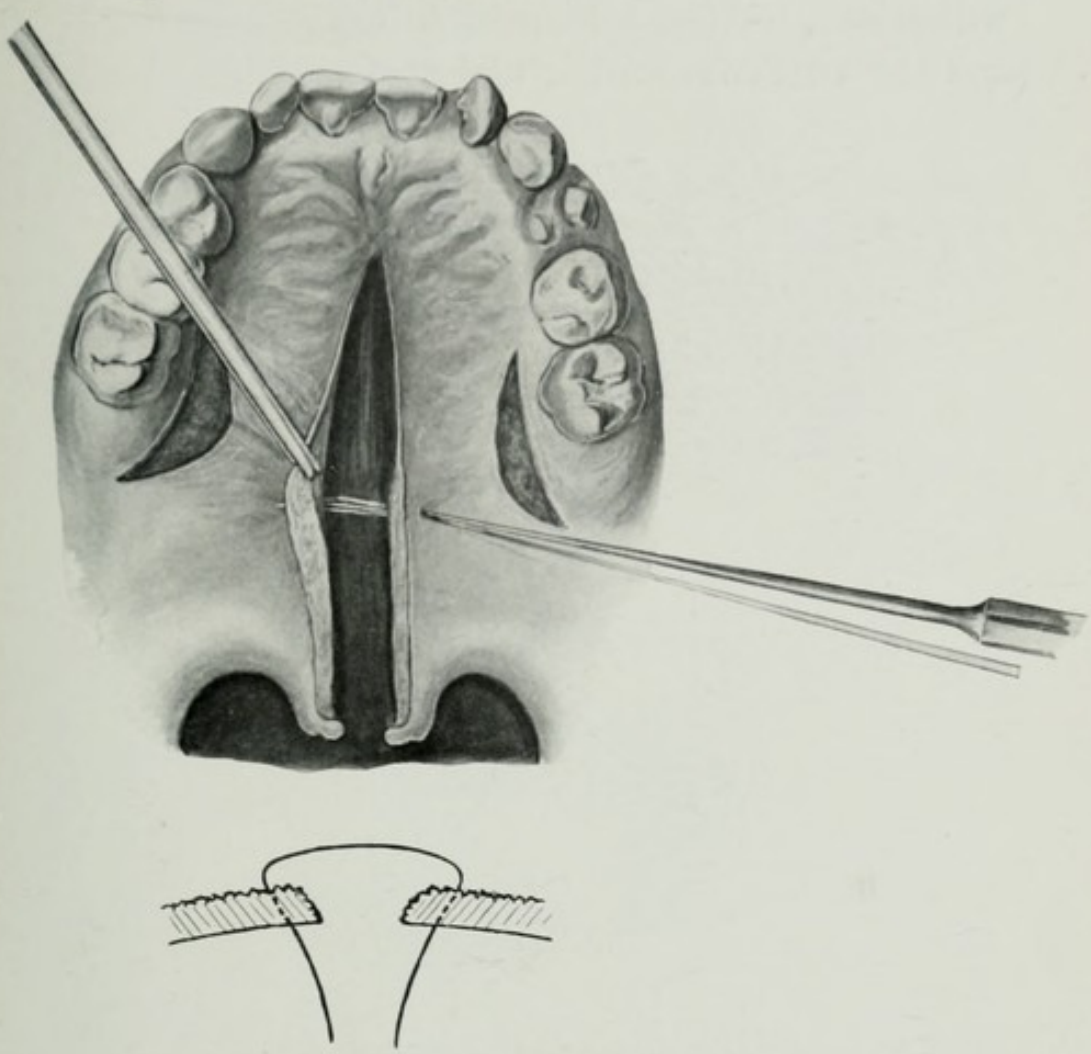


FIG. 180. The needle having transfixed the left half of the palate is rotated through 180°, carried across the cleft, and passed from above downwards through the right half of the palate, inserting the point some distance from the edge and bringing it out close to the edge.

The lower figure—a coronal section through the cleft—shows the obliquity of the sutures.

In many cases, however, and usually when dealing with the anterior part of the hard palate, this cannot be done. The old-fashioned loop

method of passing the suture must then be employed, thus: One suture is passed and the needle withdrawn, leaving a loop of suture on the nasal, and the two ends on the oral surface (Fig. 181A).

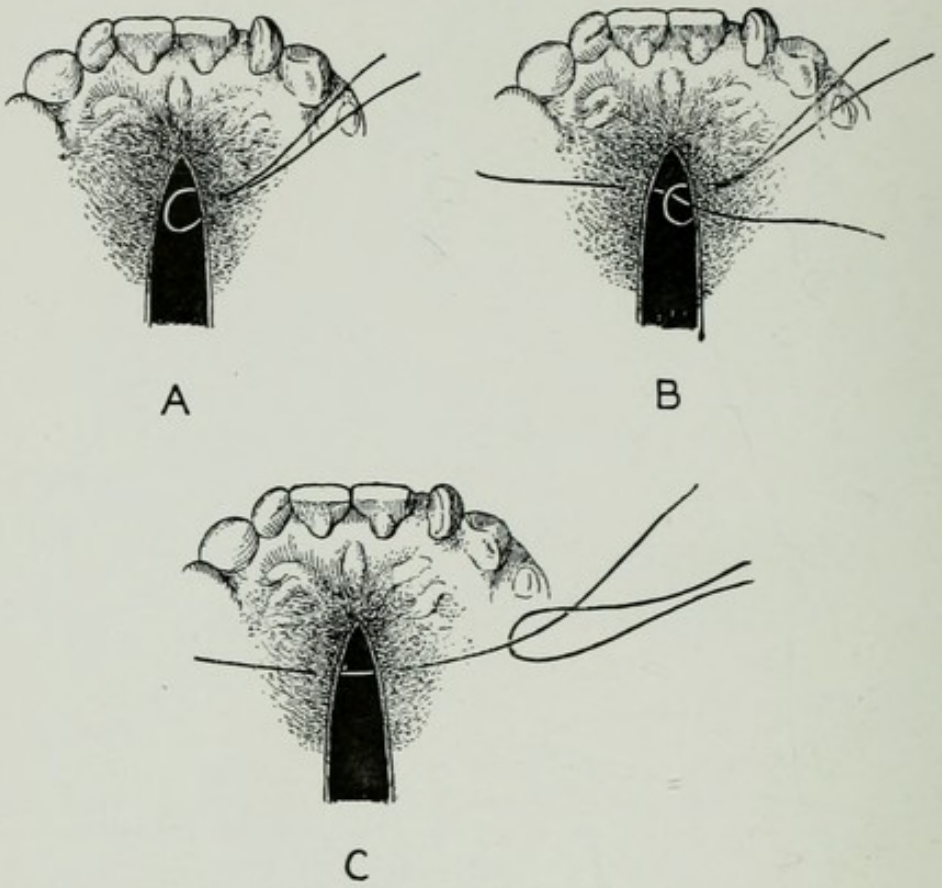


FIG. 181. Loop method of passing sutures.

This loop and ends are then given temporarily to the assistant. Another suture is then passed through the opposite half of the palate and the needle withdrawn, leaving one end on either surface of the palate. The upper or median end of the latter is then passed through the loop of the first suture (Fig. 181B), and both free ends of this are pulled

upon. The loop is thus drawn back through the palate, carrying with it one end of the second suture, which now passes through both halves of the palate (Fig. 181c).

As each suture is passed its ends are brought forwards and held temporarily in a pair of pressure

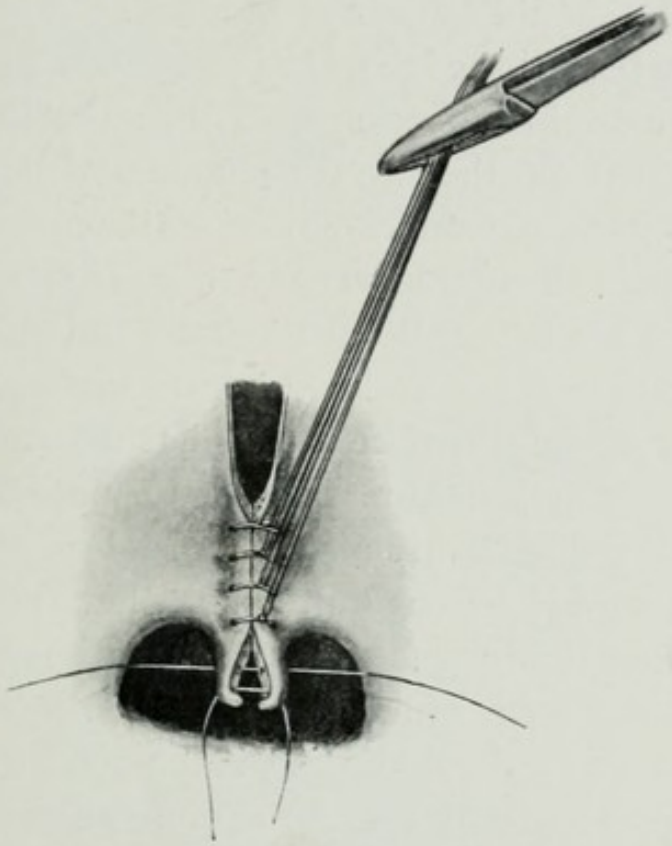


FIG. 182. Sutures temporarily held in a pair of pressure forceps. The sutures have been passed transversely through the uvula.

forceps (Fig. 182), which are then allowed to hang over the patient's forehead. It is best to begin the suturing at the anterior end of the soft palate and to pass the sutures successively from before backwards. Those that have already been passed may conveniently be used as tractors. They draw the soft

palate forwards, steady it, and facilitate the introduction of other sutures. The intervals between them should be about 5–6 millimetres ($\frac{1}{4}$ inch).

When the base of the uvula is reached care should be taken that the sutures do not strangulate this part. The suture in the soft palate nearest the uvula should be passed at a sufficient distance from the posterior edge of the soft palate to permit of adequate blood-supply. When dealing with the uvula itself the sutures should not be passed through its whole antero-posterior thickness. It is best to pass them transversely (Fig. 182), entering the point of the needle at the outer margin of the uvula rather than on its anterior surface. The posterior or nasal surface is thus left unsutured.

The hindmost suture should be passed transversely through the tip of the uvula (Fig. 182), and its ends should be cut quite short, lest they touch the back of the tongue and cause irritation. When two or three sutures have been passed through the soft palate they should be tied, if the margins can be easily approximated, before the more posterior ones are inserted.

The ends of the sutures in the uvula and soft palate are cut short, with the exception of two or three in front, which are left long to act as tractors. The ends of these, together with the forceps holding them, are now brought forwards and allowed to hang over the chin, so as to permit the operator to pass the sutures of the hard palate.

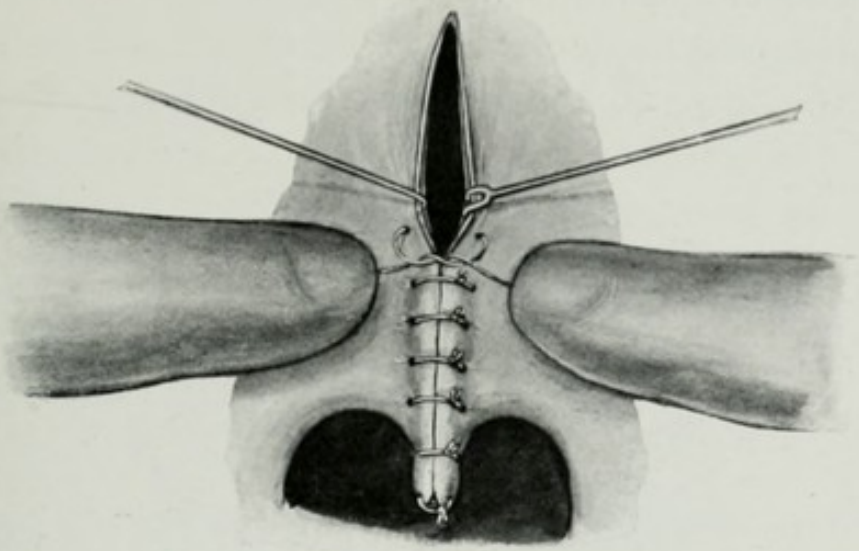


FIG. 183. The soft palate has been sutured. The first stitch in the soft tissues of the hard palate is being tied while the assistant everts the edges of the cleft with little hooks.

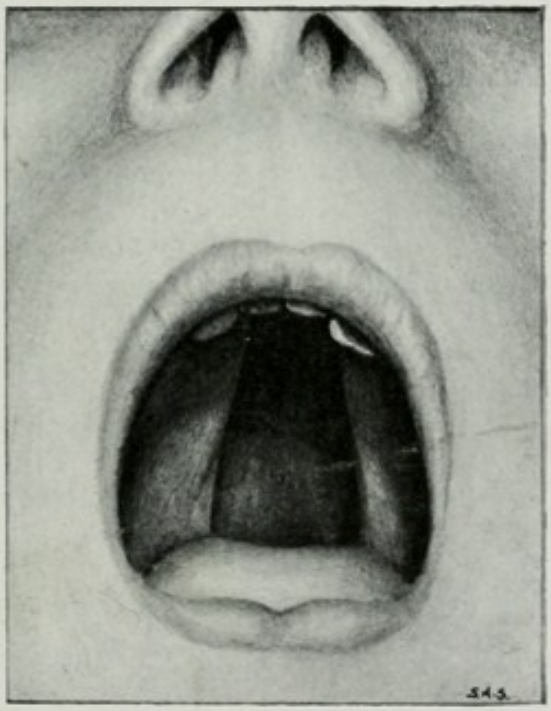


FIG. 184. A cleft of the soft and most of the hard palate, drawn from a photograph.
Edith P., aged 13. Royal Free Hospital, 1910. Appendix, 129.

These are usually passed from behind forwards. They must be inserted with great care and gentleness, owing to the thinness and delicacy of the

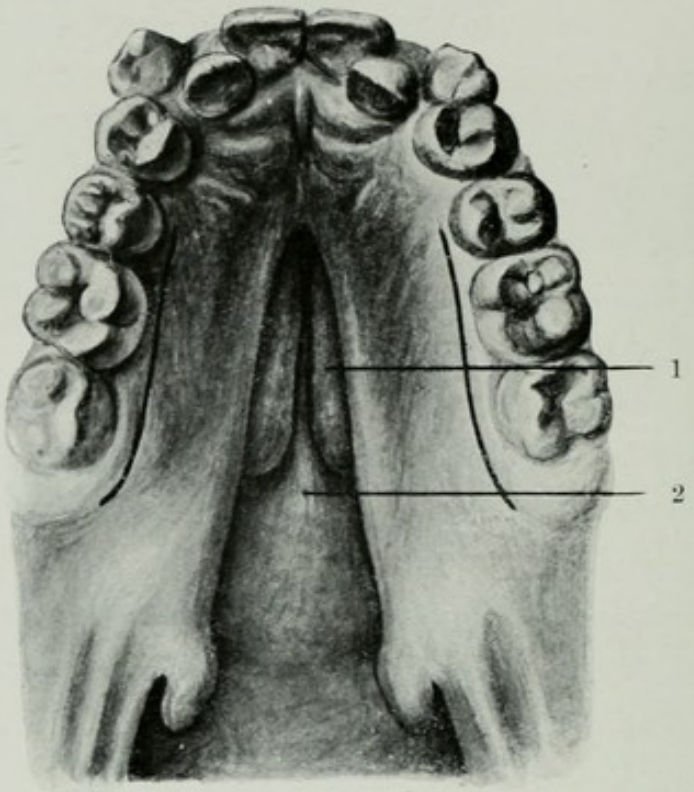


FIG. 185. The preceding seen from below, showing the lateral incisions made close to the teeth. These incisions need not have been carried so far forwards.
1. Middle turbinated bone ; 2. Posterior end of septum.

muco-periosteum in this region and the ease with which it can be lacerated.

Before each suture is finally tied the pared edges should be carefully everted by the assistant, who uses a pair of small single or double hooks for this purpose (Fig. 183). When all the sutures have been tied the edges should form a slightly projecting ridge along the centre of the palate (Figs. 183 and 186).

At the anterior part of the hard palate the sutures will generally have to be passed by the loop method already mentioned.

When all the sutures of the soft palate and uvula have been inserted and tied, another rather stout

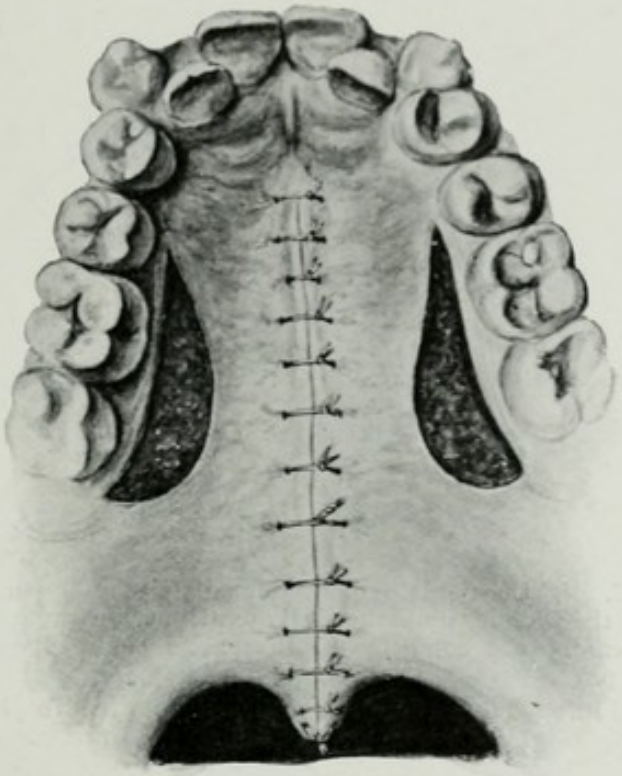


FIG. 186. The same case as the preceding, immediately after operation. The gaping of the lateral wounds and the slight central ridge produced by the suturing are well shown.

suture should be passed through the soft palate at some little distance (generally about 15 mm.—$\frac{3}{5}$ inch) from the middle line (*see* Figs. 187 and 189). This suture, which should be tied only moderately tightly, takes off some of the strain from the other sutures. It may sometimes be used instead of the lateral incision to be mentioned later. In passing

it we generally employ the doubly bent needle depicted in Fig. 166, p. 184.

Figures 191 and 192 show another method of using sutures for relief of tension, namely, by means of lead plates and silver wires. The wires

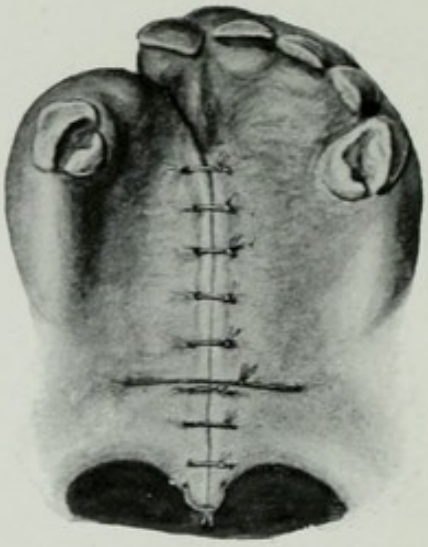


FIG. 187. Right complete cleft immediately after suture and showing the wide tension stitch. Lateral incisions were not made in this case. For condition of the palate before operation *see* Fig. 61, p. 71.

Winifred B., aged 2 years and 3 months. Royal Free Hospital, 1910. Appendix, 130.

must be inserted as far out as possible. Thus the use of lateral incisions may be avoided.

Great care should be taken not to tie any of the sutures so tightly as to cause strangulation of the sutured edge. This is probably a frequent cause of failure of union.

Just before each suture is tied the cut edge should be gently wiped with a small bit of sponge, about 5 mm. ($\frac{1}{5}$ inch) in diameter, to remove adherent blood-clot or any other extraneous matter

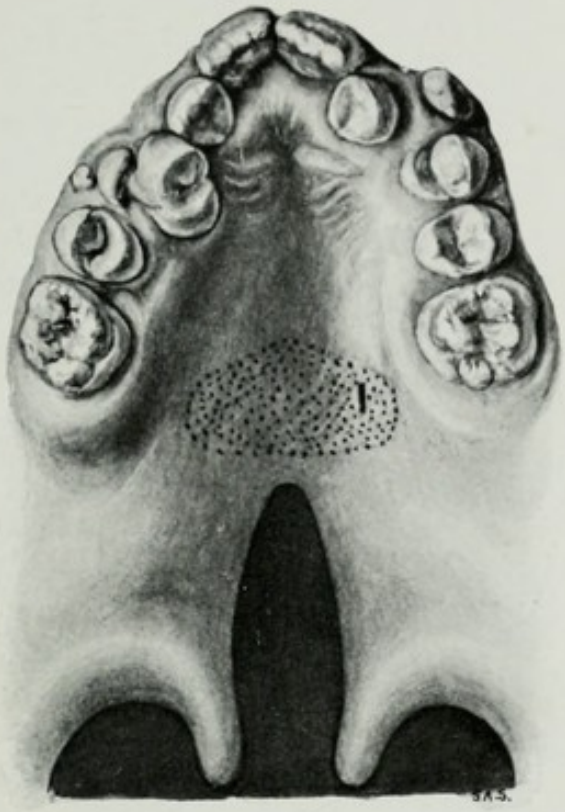


FIG. 188. Narrow cleft of the soft palate. The dotted area shows approximately the extent of the separation of the muco-periosteum from the underlying bone. The separation was effected partly through the small puncture seen on the left side, and partly from the nasal surface of the palate. Note the irregularity of the teeth on the right side, and compare Fig. 190, which shows the same patient after treatment by a dentist.

William C. B., aged 13. Royal Free Hospital, 1911.
Appendix, 140.

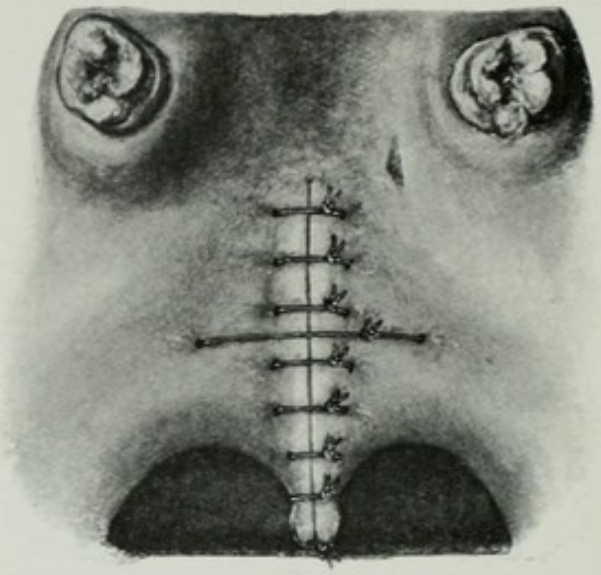


FIG. 189. The same as the preceding immediately after operation, showing the exact number and situation of the sutures used and especially the wide tension suture. The last stitch but one passes through the oral half only of the uvula so as not to strangulate it. In this case no lateral incisions were made.

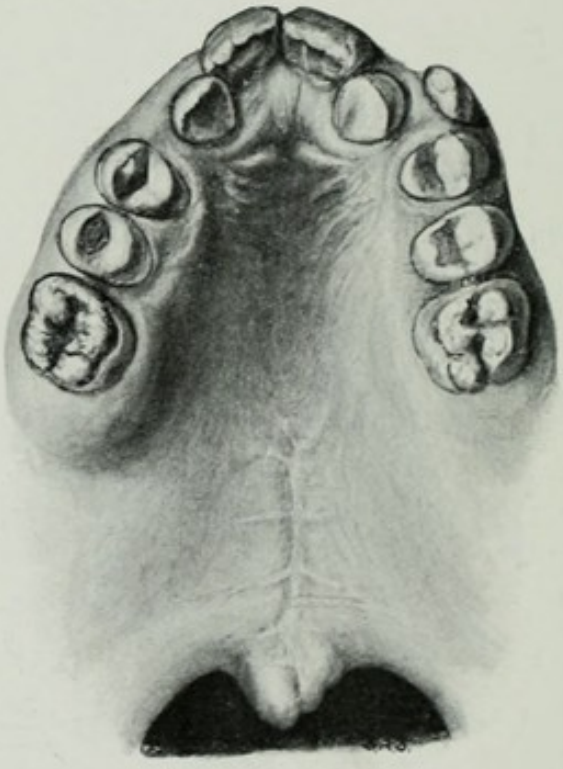


FIG. 190. The same patient eleven weeks after operation.

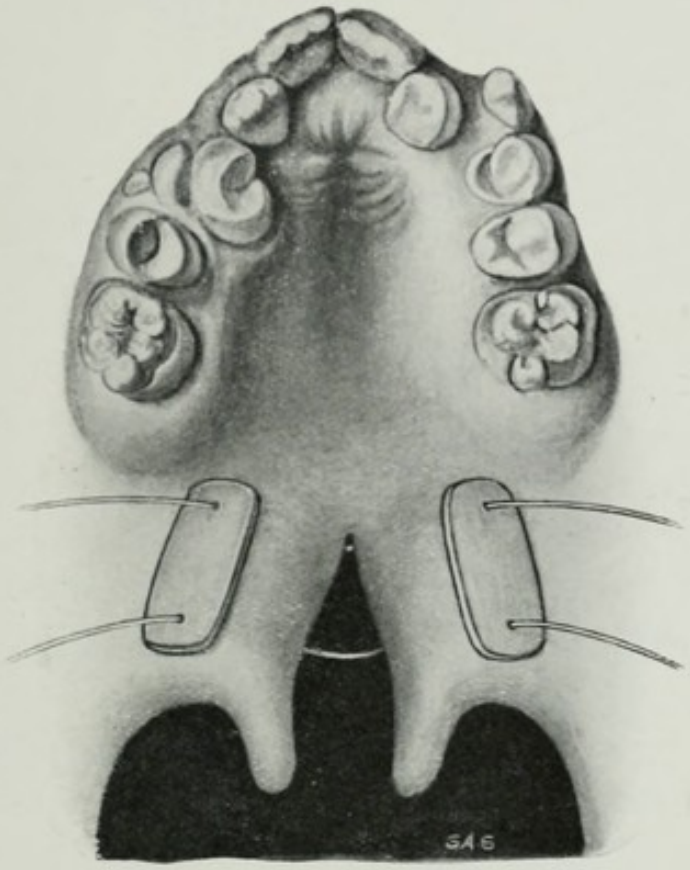


FIG. 191. Cleft of the soft palate, showing the use of lead plates and silver wires. By free detachment of the soft palate from the posterior part of the bony palate, the tissues just in front of the cleft have been brought down and the original rounded anterior end of the cleft has been converted into a narrow pointed one. The wires should be passed as far outwards as possible, further even in most cases than is shown in the figure.

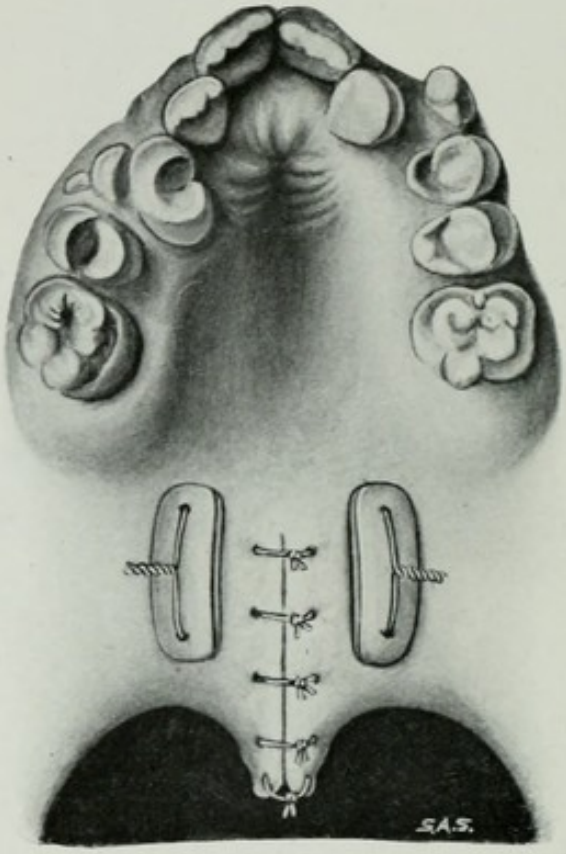


FIG. 192. The same after twisting up the wires and suturing the cleft.

that may be upon the raw surfaces. This sponge may be wrung out of 1 in 2000 biniodide of mercury lotion. All other sponges should be washed and wrung out of boracic lotion, or boiled saline solution.

The line of suture should now be carefully examined, and if at any place the edges of the mucous membrane are not in perfect apposition, a fine superficial suture may here be inserted.

We have until lately always used interrupted sutures in our cleft palate operations. Mr. Sinclair Kirk* has recently drawn attention to the advantages of continuous suture. He has used a continuous suture (No. 1 or 2 silkworm gut) in cleft palate operations for the last three years, and much prefers it to the interrupted suture. He performs the ordinary (Langenbeck) operation, and finds that "the continuous suture can be inserted more rapidly and easily than the interrupted one, and that the necessity for great care to insert the stitches exactly opposite to each other and to tie the sutures with the correct amount of tension is obviated. The ease and rapidity of operation make the operation less serious, and it can easily be done when the child is eighteen months old. The amount of tension to be put on this suture must be sufficient, after it has been put in, and before it is finally tied, to prevent the escape of any bubbles from the nose to the mouth in any

* "A Note on Cleft Palate Operations," *Brit. Med. Journ.*, Dec. 31, 1910.

part of the line of suture when the patient is breathing quietly."

For the use of the continuous suture Mr. Kirk claims that "it gets rid of two of the causes of failure of union in cleft palate operations, namely, (1) imperfect apposition of the flap edges, (2) necrosis of the flap edges from stitch-pressure, and that it considerably shortens the operation, thus materially diminishing the risk."

We think Mr. Kirk's suggestion a valuable one, and if we find after a sufficient trial that it really obviates the two above-mentioned causes of failure (which are very real as regards the hard palate) we shall probably adopt it.

With regard to the soft palate, it is usually so easy to adjust the edges with interrupted sutures and failure to secure union is so rare (we had only two failures in a series of a hundred cases) that we are not much inclined to change our practice. We doubt, also, whether the continuous suture does really save as much time in suturing a cleft palate wound as it undoubtedly does in the closure of an ordinary skin incision.

V. Making Lateral Incisions

We come now to the lateral incisions that in most cases have to be made on one or both sides for the relief of tension. It is not always necessary to make these (Fig. 187, p. 210). Narrow clefts of the soft

palate, and sometimes even narrow clefts of the whole palate, provided that the arch is high, may be treated without these incisions, especially if the tension suture, or the method of using lead plates and silver wires, mentioned on p. 210, be employed (Figs. 188, 189, 190, 191, and 192).

But in most cases lateral incisions are required. Their use is partly to prevent the tensores and levatores palati from dragging asunder the recently joined edges of the cleft. They also permit of a lateral shifting of the soft parts towards the middle line, thus relieving tension. In bad cases, as already mentioned, it is quite impossible to close the cleft until this lateral shifting has been effected. To leave the palate in a state of tension after it has been sutured is to court disaster. The stitches will cut out, and union fail to occur.

The exact position and extent of the incisions is a matter of much importance. If too extensive, or too near the middle line, they endanger the vitality of the newly formed palate. If insufficient, tension is not duly relieved.

The very extensive incisions that are figured in some text-books, extending almost from one end of a complete cleft to the other, are certainly not necessary. Indeed, with such incisions it would be well-nigh impossible to maintain a sufficient blood-supply. The commonest mistakes in the making of the incisions are to place them too far forwards, and too near the middle line. Probably

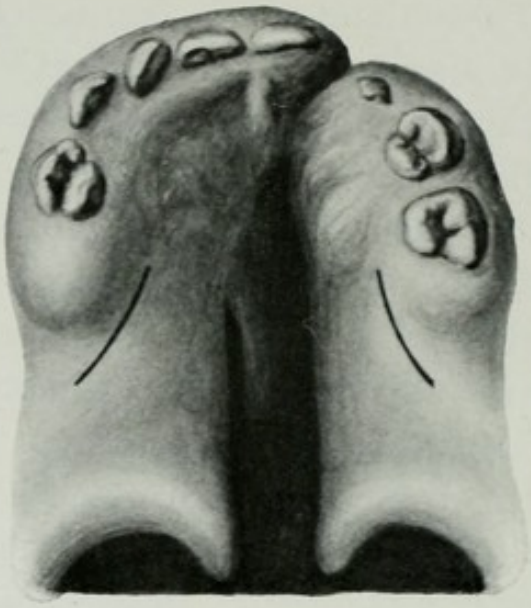


FIG. 193. Single complete cleft palate, showing the usual lateral incisions inside the line of the posterior palatine artery.
Ernest C., aged 21 months. Royal Free Hospital, 1910. Appendix, 131.

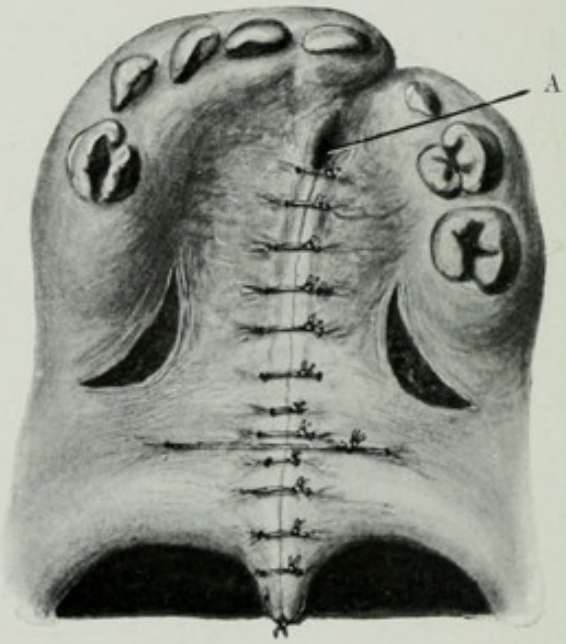


FIG. 194. The same immediately after operation, showing the wide tension suture. A small portion of the cleft (A) at the anterior end has been left unclosed.

a fear of damaging the soft palate leads to the former error, and anxiety to avoid the posterior palatine artery leads to the latter.

Figs. 193 and 194 show the incision that is best for most cases. Beginning a little in front of the junc-

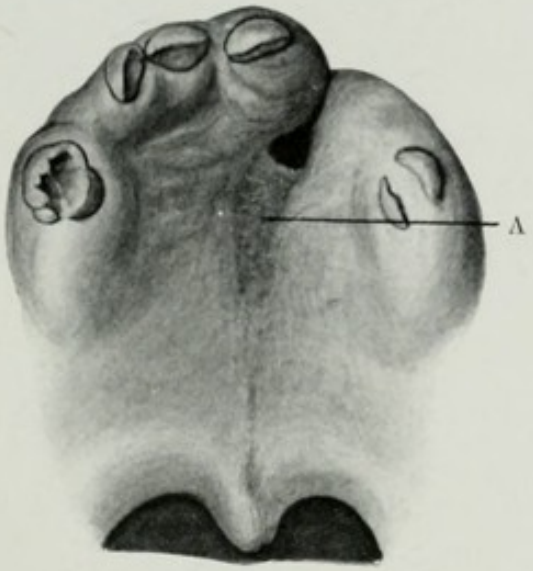


FIG. 195. Single complete cleft palate after operation, showing how the nasal mucous membrane may be used to close the anterior part of the cleft. This mucous membrane being of a dark red colour appears in the drawing as a dark triangular area (A). The extreme front part of the cleft had not yet been operated upon.

John M., aged 13 months. Royal Free Hospital, 1911. *See also* Fig. 54, p. 63, and Appendix, 139. Compare Fig. 142, p. 164.

tion of the hard and soft palates near the alveolus, but internal to the posterior palatine foramen, it should extend obliquely backwards to a point nearly halfway between the posterior end of the alveolus and the posterior margin of the soft palate. The incision may be straight or with a slight curve, the concavity of which is outwards.

In many cases it is also advisable to prolong the

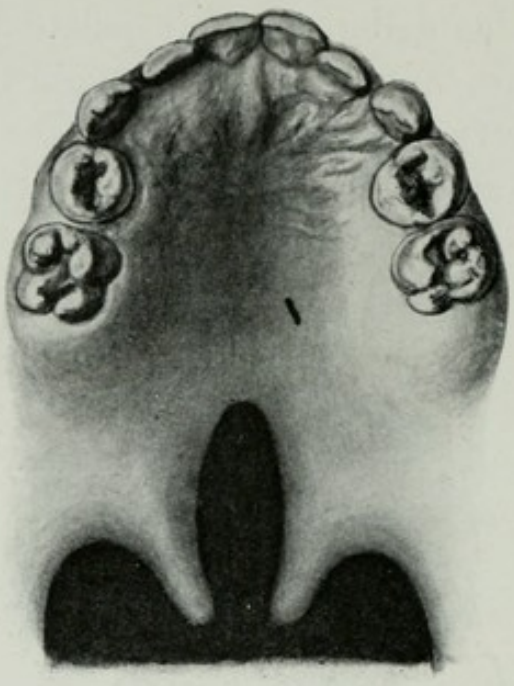


FIG. 196. Cleft of the soft palate. The short black line shows the situation of the puncture made for the separation of the muco-periosteum from the hard palate.
Phyllis McK., aged 2½ years. Royal Free Hospital. Appendix, 147.

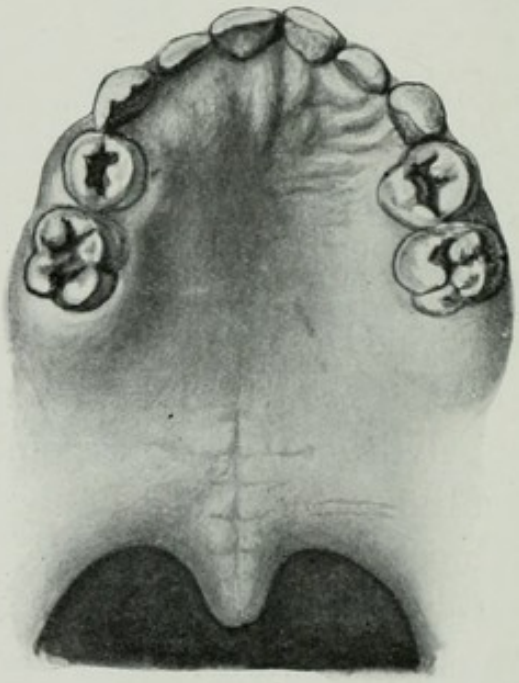


FIG. 197. The preceding, 17 days after the operation by median suture. A wide tension suture was employed, but no lateral incisions were necessary

incision forwards, but seldom for more than 10 mm. in front of the posterior edge of the hard palate.

In really bad cases, such as that shown in Fig. 198, p. 237, where two unsuccessful operations had been performed before the child came under our notice, and where much dense cicatricial tissue existed, it may be advisable to make the incisions quite close to the teeth, outside the line of the posterior palatine artery.

In certain difficult cases where the cleft is unusually wide a combination of these two incisions is necessary. In such cases the palatine artery is cut across.

CHAPTER VIII

AFTER-TREATMENT AND COMPLICATIONS OF OPERATIONS FOR CLEFT PALATE. TRAINING IN ARTICULATION

AFTER-TREATMENT

The success of the operation depends partly on the after-treatment, which demands therefore careful consideration.

Feeding.—If there is no evidence that the child is thirsty or hungry, there is no necessity to administer liquids or any food, at least for a few hours; but if it is crying because of thirst or hunger, water or milk should be given. It is unwise to allow a child to continue crying, and very often sleep will follow as soon as thirst or hunger has been relieved. Young infants generally require to be fed two hours after the operation. Older children should have nothing but water until the following day. The liquids must be given slowly by means of a spoon or mug. The quantity will vary in individual cases, a couple of ounces may be enough—sometimes more may be required, and to some extent the amount will depend on whether the child is vomiting or not. During the first few days after

the operation liquid food only should be given. This will be milk or egg and milk, the amount at each feed depending on the age of the child. It is better to give the food at short intervals—three to four hours—rather than at longer intervals, and in larger amounts: it must be given slowly. The child should always swallow some water after each feed, so as to wash away any remains of milk, &c. from inside the mouth.

At the end of a week custard pudding may be given; after a fortnight milk puddings, bread and milk made without crusts (the so-called "typhoid" bread and milk) and stewed fruit may be added to the diet. Later, minced meat, boiled fish, mashed potatoes may be taken if the child is old enough for such food. As this more solid diet is given, so must more care be exercised to see that particles of food are not allowed to remain in the mouth. The space between the gums and cheeks should be carefully cleansed after each meal, which should be followed by a good drink of water.

Sedatives may be necessary during the first few hours after the operation. A dose of potassium bromide, according to the age of the patient, is usually sufficient to enable the child to obtain a refreshing sleep. It may be repeated as required, and if inefficient, small doses of liquor opii sedativus may be given. Aspirin is useful in older children. But drugs of this nature are seldom required.

Saline infusions.—These also are rarely required. Unless the amount of blood lost has been unusually great, owing to undue prolongation of the operation, there is no shock or collapse. The salt solution may be administered per rectum or subcutaneously, although we personally have never had occasion to employ these methods after any cleft palate operation.

Fixation of upper limbs.—Many surgeons as a routine practice put the upper limbs into splints which reach from the hands to above the elbows. The object of this proceeding is to prevent the child putting its hands to the mouth. We do not think that such a method is necessary, and only occasionally employ it with very fractious children. In our experience the child does not often attempt to put the hands into the mouth, and if carefully watched by a well-trained nurse, can usually be prevented from doing so. In any case, the restraint should be employed for as short a time as possible, and if it appears to irritate the patient, it should not be continued. After the operation every means should be employed to keep the child from crying.

Irrigation of the mouth.—This is not generally necessary, nor should a spray be used save in exceptional circumstances. Irrigation or spraying of the mouth of a child will usually cause crying. The liquid is also liable to reach the upper part of the larynx and set up coughing. If it is necessary to cleanse the mouth and palate more thoroughly, this

can be done by a drink of water. A small swab of wool soaked in boracic acid lotion, or bicarbonate of soda (grs. x ad ℥i) may be gently used if necessary to wipe away extraneous particles or adherent mucus. In older children there is not so strong an objection to the use of irrigation and spraying, but such means should not be used without definite indication for their employment. When there is fœtor of the breath, spraying and irrigation may be required. Peroxide of hydrogen, or sanitas and water, or a weak carbolic lotion (1 in 80) may be used.

Constipation should be avoided. A laxative should be given on the second evening after the operation. Syrup of senna (℥i) is most generally useful. In young infants a soap suppository may be inserted or a small glycerine enema may be given.

Local examination.—Too much curiosity to see how the wound is healing should not be evinced. In young children especially, looking into the mouth is apt to frighten the child and to make it cry. Therefore several days should be allowed to pass before the mouth is examined. In the case of older children there is not much objection to inspecting the mouth.

Talking.—The patient should not be allowed to speak for at least a week after the operation. Where necessary, paper and pencil or a slate and pencil should be provided by which the patient may make known his desires and wants. Abundance

of toys and books should be at hand to amuse the patient.

Time in bed.—As soon as the immediate effects of the operation have passed away, the patient may be allowed to leave his bed, and if the weather is propitious, he may go out of doors, provided he is kept under proper supervision.

Taking out the stitches.—This may be done at the end of ten days or a fortnight. In many cases the stitches may be allowed to remain with advantage for a longer time. In young children an anæsthetic is not infrequently necessary. If the line of union shows a tendency to separate but the edges are still held together loosely by the stitches, the latter should on no account be removed.

COMPLICATIONS

In our experience, complications have been few, and for the most part unimportant.

Vomiting is one of the most frequent, and is in part due to swallowing of blood, but mainly to the anæsthetic. It rarely lasts for more than a few hours, and unless very persistent is of no great importance. A drink of bicarbonate of soda (a teaspoonful to the pint) is usually sufficient to arrest it.

Pyrexia.—Sometimes the operation is followed by a rise in temperature which may reach 101° F. or even higher. Such a rise usually occurs after a

prolonged operation, or when there has been much bruising of the tissues. If the febrile reaction subsides in the course of twenty-four or forty-eight hours, no untoward consequences will follow. When the fever is more persistent, the operation is not unlikely to be in part unsuccessful. In most cases after the operation the temperature remains normal, or does not rise more than one degree.

Hæmorrhage. — Persistent oozing of blood occurs sometimes. The slighter oozing which goes on for a few hours generally ceases spontaneously and gives rise to no after-effects. But when the oozing is persistent and abundant, vomiting and anæmia may result. These latter cases are important, because local means, chiefly pressure, have to be taken in order to arrest the hæmorrhage. The pressure has to be applied either by gauze plugs or by tampons held in forceps against the palate. In either case an amount of damage may be inflicted sufficient to prevent the union of the flaps. It can rarely be necessary to adopt the extreme measure of removal of the stitches to enable the pressure to be efficiently applied. An excessive loss of blood is itself liable to interfere seriously with the rapid healing of the wound. Adrenalin and such styptics as perchloride of iron should not be used to arrest the hæmorrhage; the former drug is likely to be followed by further oozing after its effects on the capillaries have ceased, and the latter is very likely to cause sloughing.

Sloughing of the flap occurs but very rarely if the operation has been properly performed. It is usually due to the lateral incisions having been placed too near the middle line, or to their having been made too long, thus cutting off too much of the blood-supply.

Tying the stitches too tightly, especially in the thin anterior part of the palate; septic infection; bruising and laceration of the tissues by a clumsily executed or prolonged operation; all these may lead to the same result. When sloughing does occur, it is usually only partial, resulting in the formation of an aperture most commonly near the junction of the hard and soft palate.

Failure of union, apart from actual sloughing, may occur throughout the whole length of the cleft. In our own practice, as will be seen from the list of cases in the Appendix, this has occurred but very rarely. More common is a limited failure of union, especially in the region of the hard palate and particularly near to its junction with the soft. It is generally due to careless or incomplete approxmation of the edges, to insufficient paring of the edges, to tying sutures too tightly, to inversion of the mucous membrane, whereby sufficiently broad surfaces of pared tissues are not brought into apposition, or to leaving the palate in a state of tension after all the stitches have been tied. Failure of union may occur from any of the above causes in the absence of any obvious sepsis. It is

most likely to happen in thin anæmic palates, and in young delicate children.

When the palate is thin and anæmic, and the child is weakly, the operation should be postponed until the patient is older and the general health has been improved. It is interesting to note that whenever union of the flaps fails, from whatever cause, the lateral incisions nearly always heal up quickly.

Secondary hæmorrhage has occurred only twice in our practice. In one case, that of a girl aged 9 years (Appendix, Case 75), the bleeding took place on the fourteenth day; it quickly stopped spontaneously and did not recur, the child making a good recovery. In the other case, that of a girl aged 10, the bleeding occurred on the ninth day and was easily arrested by inserting a strip of gauze into the lateral incision. This child also made a complete recovery. This complication is to be feared only in cases when fœtor of the breath denotes sloughing or unhealthy ulceration of the wound. If the hæmorrhage persists and is serious, an anæsthetic should be administered and the whole wound carefully examined with the aid of a good light. The hæmorrhage is nearly always from the neighbourhood of the posterior palatine foramen. If necessary, a slight enlargement of the lateral incision may be made so as to cut the bleeding vessel completely across, or a probe may be inserted into the canal and rotated so as to occlude the lumen

of the artery. In extreme cases, when all other measures have failed to arrest the hæmorrhage, a small wooden spigot may be inserted into the canal and left there for a day or two. A bit of an ordinary match sterilised by boiling serves this purpose well.

Chest complications.—Except in one patient (Appendix, Case 84), who developed an empyema four weeks after the operation and recovered, we have had no complications in the thoracic organs.

TRAINING IN ARTICULATION

After the palate wounds have healed there still remains much to be done. The child must be trained to speak correctly, as up to this point it can have very little power of doing so. This is often a matter of considerable difficulty and requires much careful attention for a long time, a period extending over several years.

If the circumstances of the parents permit, the services of one of the numerous professional teachers of speech should be obtained, and regular lessons should be given either daily or at least three times a week. Such a teacher will train the child to use the palatine muscles in the proper way and to pronounce correctly the consonants with which the child has difficulty. A teacher will probably begin with the articulation of simple labial consonants such as B and check the tendency for its conversion into M. Subsequently more difficult consonants,

such as K and G, will be taught, and then complex combinations of consonants. Assistance in the pronunciation will often be afforded by the light application of the teacher's finger to the child's nostrils just as the sound is being uttered. By thus checking the passage of air through the nose, the child can be taught the correct pronunciation.

The lessons should not be long, as a young child easily gets tired and cross, and nothing can be done unless the patient is a willing coadjutor. Failing the services of a skilled teacher, much may be done by the mother or by a competent and intelligent governess or nurse.

The child should be taught to recite poetry and when old enough, to read aloud. Care should also be taken to encourage the child to speak slowly, in a staccato manner, every consonant being given its full value in articulation. A cleft palate patient nearly always shows a great tendency to speak very rapidly and to slur over those consonants which are found to be inconvenient to pronounce. Faulty habits of speech are difficult to eradicate and their correction should be undertaken as early as possible.

When once the palate has been completely closed by a successful operation and a good movable soft palate has been given, there is no reason why the patient after careful training should not eventually obtain perfect speech. Of course, if the palate has been left with large holes in it, or if the soft palate

is stiff and contracted, or if the operation has been done late in life, much less is to be expected.

As the subject of speech-training lies beyond our own immediate province, we subjoin the following remarks, which have been kindly communicated by Mr. Harry W. White, the well-known teacher of articulation:

"The best age for a child to commence a course of speech-training is anything between 6 and 12 years, with a leaning towards the earlier period. It is quite impossible to deal with a child, where so much co-operation is necessary, until he is capable of fixed attention and powers of ready imitation.

"In no case should the training commence until six months after the operation is completed for fear that the violent action of the soft palate, which such training necessarily involves, should interfere with the permanent success of the surgeon's work.

"What is immediately obvious to any one is the inability of the child to get sounds directly through the mouth, the whole speech having more or less a thick nasal character. This is not to be wondered at when it is borne in mind that the cavity of the mouth has up to the present had very little share, and never an undivided share, in the passage of the breath during speech. This being so it is clear that the organs which produce the lingual and labial sounds must be undeveloped and incapable of immediate service, as it is only by the action of the breath upon the organs that a full

development of the muscles takes place. For instance, it is beyond the power of a child, whose breath has always found a ready outlet through the naso-pharynx, to raise the front or back of the tongue to the palate for the sounds G, T, and K, or press the lips together with the force necessary for the sounds of P or B. This muscular action can only be expected where resistance of the breath is necessary (as in the case of all the explosives), and this resistance can only be brought about by the elevation of the soft palate. It therefore follows that these explosive sounds, eight in number, which are entirely dependent upon the activity of the soft palate, must suffer in proportion where that organ is incapable of complete elevation.

"The child who has suffered from a cleft palate has never elevated the soft palate, and even after a successful operation this can only be accomplished by skilful training; *it will not come without.*

"It is a good plan in the commencement to get the child to blow at a feather, this being an object most easily affected by the breath, care at the same time being taken to exert a slight pressure upon the nostrils with the finger and thumb. By this means the breath will be diverted from the naso-pharynx to the mouth passage, and this must be established by constant practice. After the simple action of blowing, the sounds of F and TH may be employed, as in both elements there is a fricative sound and the pupil is conscious of a strong effect

of breath upon the teeth, a sensation previously unknown to him.

Labial sounds are more easy than lingual, so for the present the former only must be employed, leaving the latter to a later stage. It is very useful to ally the labial equivalents in the nasal and mouth groups, M and B, with the open vowel A (ah) manipulating the nose as previously when the B is required, but relaxing the pressure before the vowel sound is enunciated. After some time, which period cannot be stated with certainty, the lingual equivalents in the nasal and mouth groups N and D, NG and G, will likewise be worked in contrast, employing one or more of the long vowels. It is evident that by forcing the breath into the mouth, and thus gaining a greater pressure of the organs at their point of contact, much influence is being brought to bear upon the muscles of the soft palate, and also those of the tongue and lips.

"This process must be repeated day after day as any other exercise in physical development, and as greater facility is shown in directing the breath through the mouth, the more difficult sounds and combinations must be introduced with discretion.

"If this work proceed regularly, as any gymnastic exercise should do, it will soon be apparent that the muscular power of the organs is increasing and gradually becoming self-acting.

"The time employed in this treatment varies according to the condition of the palate, but it may

be laid down as a general rule that from three to nine months daily work is necessary, after which the mother, governess, or nurse must continue the exercises daily for some months. Where the child is of school age there is, of course, no reason why he should be kept at home after the special treatment has come to an end.

"It is of the utmost value to the success of the work that the person who undertakes the subsequent care of the child should be present at as many of the lessons as possible, so that the various difficulties may be explained *pari passu*."

CHAPTER IX

I. SECONDARY OPERATIONS FOR CLEFT PALATE.

Complete failure : Causes of : Partial failure : Holes : Situation of : Spontaneous closure : Use of obturators : Operative treatment

II. DISPLACEMENT OF TEETH—TREATMENT

I. SECONDARY OPERATIONS FOR CLEFT PALATE

When an operation for cleft palate has resulted, unfortunately, in complete or partial failure, the question of the performance of a secondary operation has to be considered, together with the nature of such an operation and the best time for its performance.

When the failure has been complete, the line of union having broken down throughout its whole length, the cause must be ascertained if possible, and an endeavour made to avoid this in the secondary operation. If the failure is due to the bad health of the child, it is best to wait for a considerable time, until the general health has been brought into as good a condition as possible. If, on the other hand, as is more often the case, there has been some error in technique, or septic inflammation in the wound, then it is better to delay only

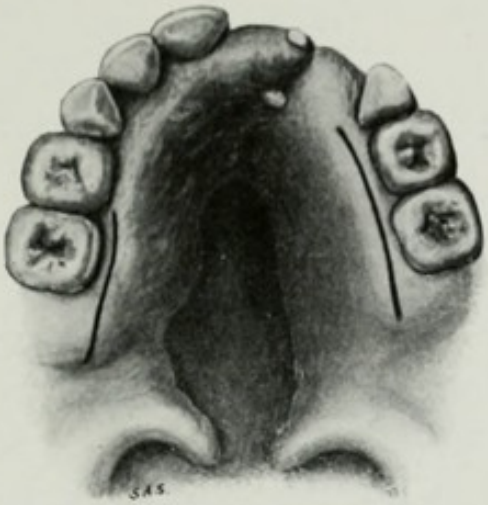


FIG. 198. Complete left cleft palate showing the condition of patient when first seen by us. The previous operation elsewhere had resulted in the closure of only the anterior part of the cleft, the rest of the line of union having broken down. The great irregularity of the edge on the right side of the palate shows where sloughing has taken place : other irregularities mark where the stitches have cut out. There is much scar tissue and the soft parts are firmly bound down to the underlying bone. The black lines indicate the exact position of the incisions that were made in our operation for closure of the cleft.

John E., aged 2½ years. 1909. Appendix, 125.

FIG. 199. Oblique view of the right side of the palate in the preceding illustration, showing how little tissue was available on this side for the closure of the cleft.

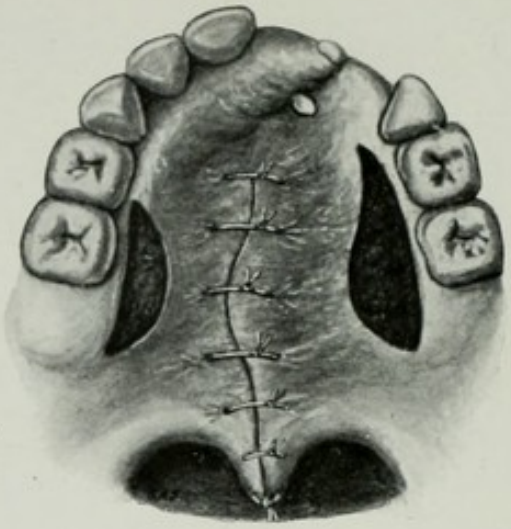


FIG. 200. The same palate immediately after operation, showing complete closure of the cleft, although with a good deal of tension in the middle, and the exact extent of gaping of the lateral wounds. It will be noticed that the right lateral incision is quite short, so as not to endanger unduly the vitality of the tissues on this side.

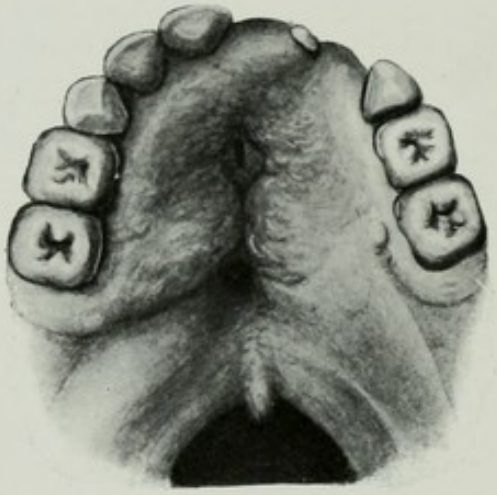


FIG. 201. The same palate, nearly 4 months later. A considerable hole which remained at the junction of the hard and soft palates has contracted to the size shown. The dark area at the anterior portion is not a hole but is the deep red nasal mucous membrane. There is a good deal of antero-posterior shortening of the palate.

until the raw surfaces are granulating healthily, the temperature is normal, and the child has recovered from the effects of the first operation.

As a general rule, under such conditions the secondary operation may be undertaken after an interval of some three or four weeks. At this period it is usually not difficult to separate again the muco-periosteal flaps, which have not yet become too firmly united to the underlying bone. If sepsis has occurred and has been the main cause of failure, probably a certain amount of immunity will have been acquired and will render infection less likely to occur after the second operation. The usual practice of delaying the second operation for many months until the wound has thoroughly healed and much scar tissue has formed is not to be recommended, unless for some special reason. Secondary operations performed long after the primary one are usually rendered much more difficult from the presence of dense scar tissue, which entails the employment of more force and leads to undue bruising and laceration of the delicate tissues of the palate. If the failure of the first operation has been due mainly to the great width of the cleft, to a very low arch or other mechanical difficulties, then the secondary operation is not likely to be followed by any better result than the first. Under these circumstances it may be best not to attempt any secondary operation at all, but to resort to treatment by an obturator. We have in our own practice but very rarely known complete failure of the primary operation to occur. Such a case, however, is the following:

FIG. 202. Cleft of the soft and part of the hard palate, showing the condition of a patient at the age of five, when first seen by us. The irregularity of the edges of the cleft indicates a previous operation, which had been performed elsewhere in early infancy.

Ethel M., aged 5 years. Royal Free Hospital, 1909. Appendix, 127.

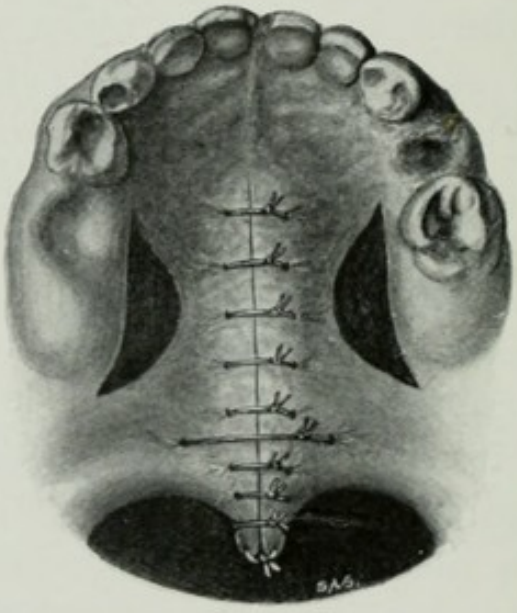


FIG. 203. The same palate immediately after operation, showing the complete closure of the cleft and the exact size of the lateral incisions that were made. Note also the wide tension stitch in the soft palate.

Violet R., aged 2 years and 4 months, was operated upon by one of us for complete single cleft of the hard and soft palates. Probably from the

FIG. 204. The same palate 14 days later. The line of union in the hard palate has broken down, but the soft palate (except the uvula) has firmly united. The lateral wounds have completely closed as usual.

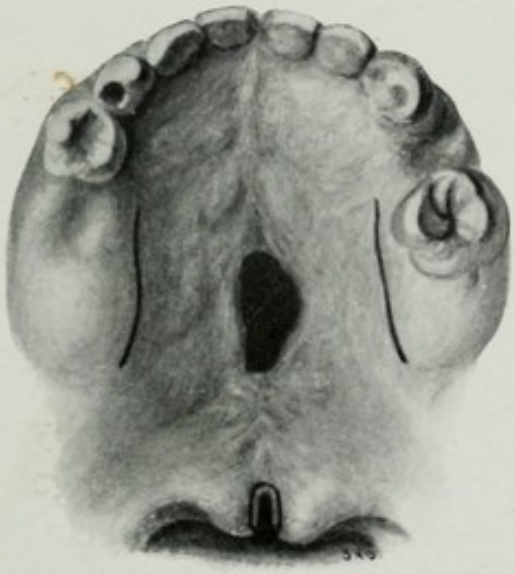


FIG. 205. The same palate 41 days later, showing the extent to which the hole has closed spontaneously. The black lines show the incisions that were then made in our second operation. The result of this operation was that a small hole still remained.

undue length of time occupied by the operation, the whole line of union broke down. A second operation resulted in almost complete closure of the cleft, and after two other small operations a good palate was obtained. The child had an intelligent and careful mother, who devoted herself to its training,

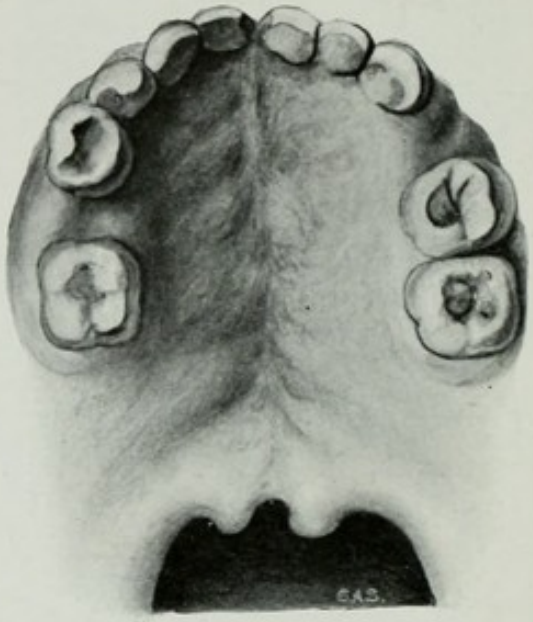


FIG. 206. The same palate twenty months later.

with the result that the child, now aged twelve years, speaks intelligibly and with comparatively little nasal intonation.[1] (Appendix, 29.)

Partial failure is naturally much less serious than complete. The latter practically always leaves the patient worse than before, owing to the destruction of tissue that has necessarily taken place. A partial failure, on the other hand, provided that a

[1] This child was one of the fifteen patients exhibited by one of us at the Royal Society of Medicine in May 1911. *Proc. R. Soc. of Med., Surg. Sect.* June 1911.

fairly broad band of union in the region of the soft palate has been obtained, usually leaves the patient in an improved condition. The muco-periosteal flaps have been displaced towards the middle line, the cleft is probably much narrower and the subsequent operation for the complete closure may be undertaken with good prospect of success, unless, of course, sloughing has taken place.

Union of the posterior part of the cleft is much more important than that of the anterior, since the latter always shows a strong tendency to close spontaneously, or at least to become very much smaller as the development of the jaws proceeds. Even if no secondary operation be undertaken for the closure of the opening in the hard palate, it is always possible to supply an efficient substitute by means of an obturator; if only the union of the soft palate has been well and truly accomplished, the result as regards speech will then be quite satisfactory. After partial failure it is advisable not to do the secondary operation quite so soon as in the case of complete failure, for fear of breaking down the freshly united portion.

Mere holes in the line of union should not be interfered with until a very considerable interval of time has elapsed. Holes even of considerable size situated at the junction of the hard and soft palates (the most common place) will usually heal spontaneously in the course of a few months. Case 56 (Appendix) is an illustration of this point. After

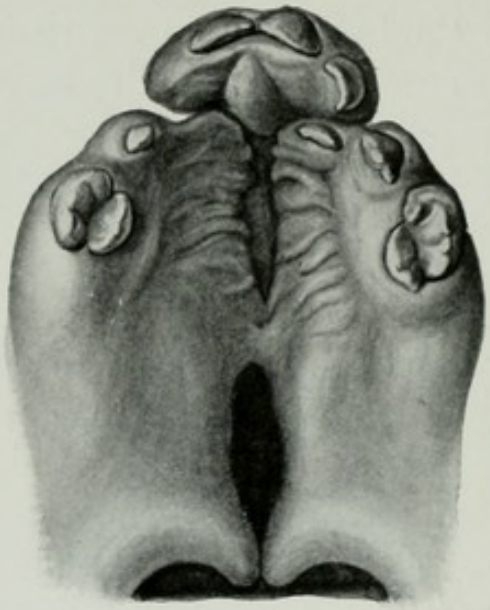


FIG. 207. Complete cleft of the hard and soft palate after the primary operation. The anterior part is firmly closed. The dark part in the centre is the nasal mucous membrane. In the region of the soft palate there is still a considerable gap.

Reginald R., aged 1 year and 7 months. Royal Free Hospital, 1910. Appendix, 137.

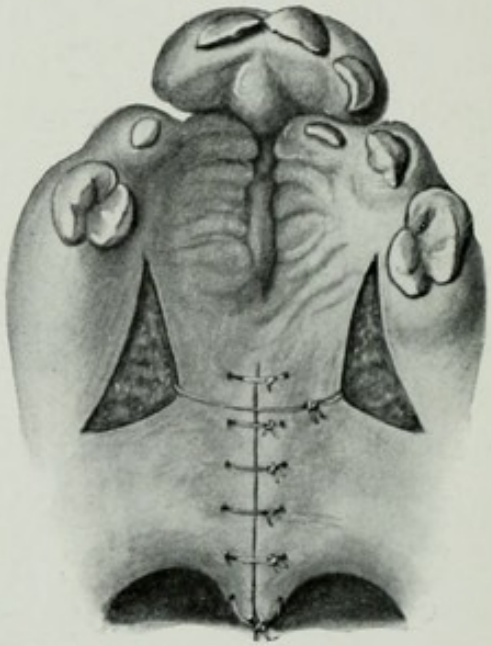


FIG. 208. The preceding immediately after the secondary operation, showing the position of the lateral incisions. Note the tension suture passed through the lateral incisions ; it has been purposely tied not very tightly

the first operation a hole was left in the above-mentioned situation large enough to admit the end of one's thumb. It was thought that a secondary operation would be necessary. Nevertheless, in the course of some months complete spontaneous

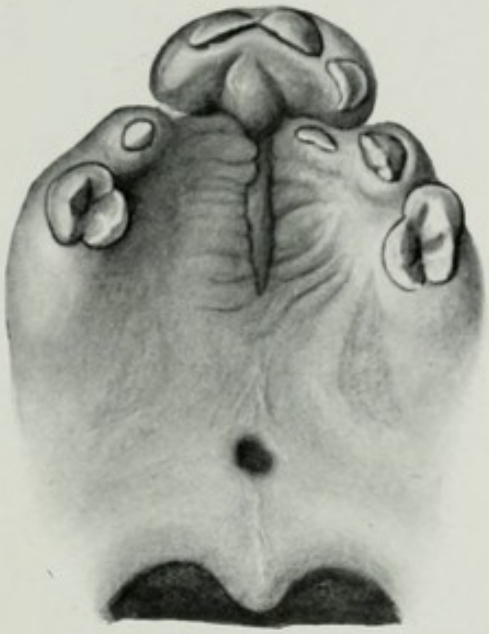


FIG. 209. The same palate 5 weeks later. A small hole in the soft palate still remains. No further operation was necessary, the hole healing spontaneously a few months later.

closure took place. It may be pointed out that a large hole in this situation, if allowed to heal without further operation, may cause the soft palate to be drawn forwards (Fig. 201, p. 238), thus shortening it and perhaps interfering to some extent with speech. In the case above described, however, no such evil result followed.

Small holes anywhere along the line of union, which appear within a few weeks of the primary operation (Fig. 210), seldom require a secondary one. They

nearly always close spontaneously. The liability to closure is naturally much greater if they are situated in the comparatively thick soft palate. Small holes in the hard palate, if showing no great tendency to heal, may often be treated with advantage in children

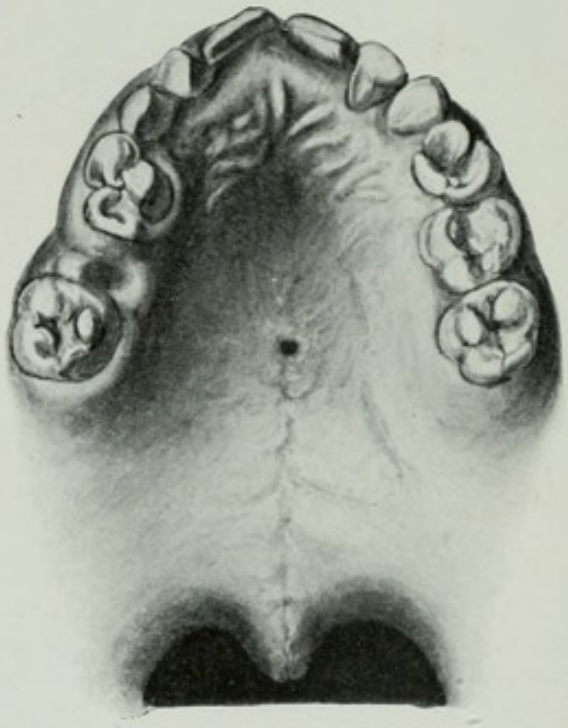


FIG. 210. Cleft of the soft and part of the hard palate. A small hole persists at the posterior part of the hard palate. For condition before operation *see* Fig. 168, p. 187.

Sylvia D., aged 6. Royal Free Hospital, 1911. Appendix, 145.

of five or six or more years of age, by means of a very light vulcanite obturator fitting over the hole and attached on either side to the teeth. Fig. 211 (Appendix, Case 10) shows a boy aged 9 years who wore such an obturator for many months. By its means the troublesome little hole in the hard palate was almost entirely closed. It contracted

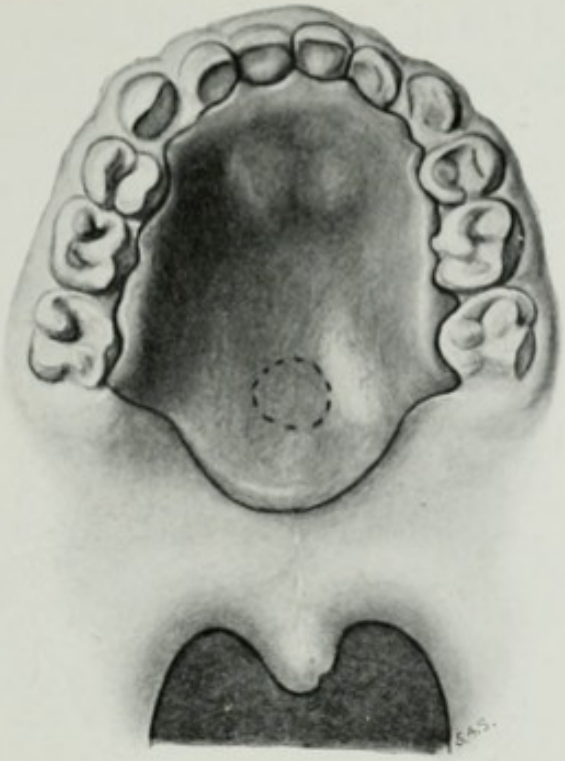


FIG. 211. A palate of a boy, showing a light vulcanite obturator worn for many months over a hole indicated in the figure by a dotted line at the junction of the hard and soft palates.

Roy A., aged 9 years. Appendix, 10.

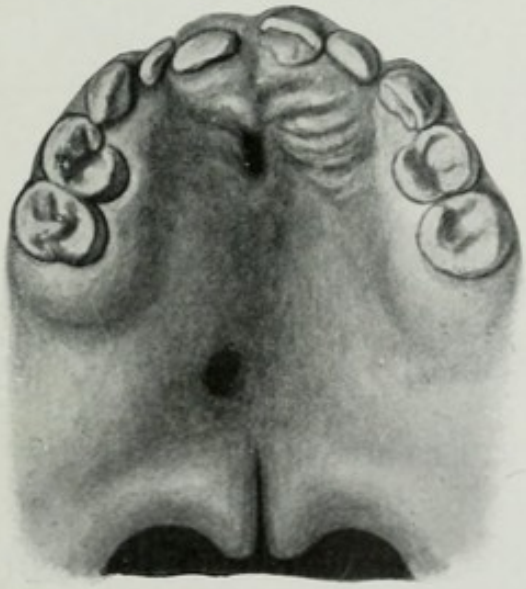


FIG. 212. Complete cleft of the hard and soft palate a few weeks after operation, showing two small holes. No further operation was necessary.

William B., aged 3 years and 4 months. Royal Free Hospital, 1911.

to the diameter of about 2 millimetres and eventually healed completely after the insertion of one stitch.

If it be found desirable to operate for a hole in

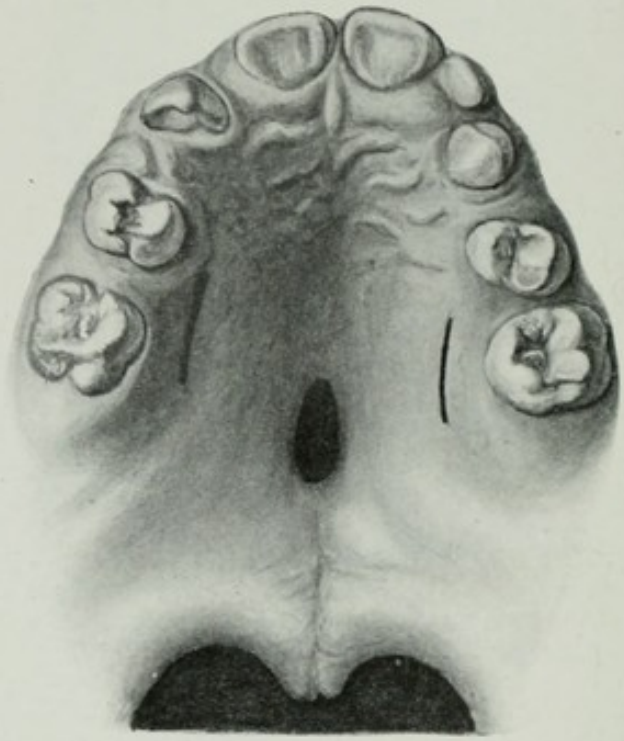


FIG. 213. Showing a hole of considerable size persisting 2½ years after the primary operation for closure of a cleft of the soft and part of the hard palate. The whole of the tissues between the lateral incisions were freely dissected up from the underlying bone to permit of the approximation of the rigid margins of the aperture. The scars of the lateral incisions made in the primary operation are faintly visible behind and inside the molar teeth. The secondary operation would have been performed much sooner had circumstances permitted.

Annie J., aged 8 years. Royal Free Hospital, 1911.
Appendix, 113.

the palate, it will generally be necessary to make incisions of considerable length on one or both sides at some little distance from the opening, and to dissect up a considerable area of surrounding tissue (Figs. 213 and 214). Mere paring and suture with-

out such dissection is quite useless. Indeed, it is only too likely to result in the hole being larger than before.

The lateral incisions that are made for the relief of tension almost invariably heal without any diffi-

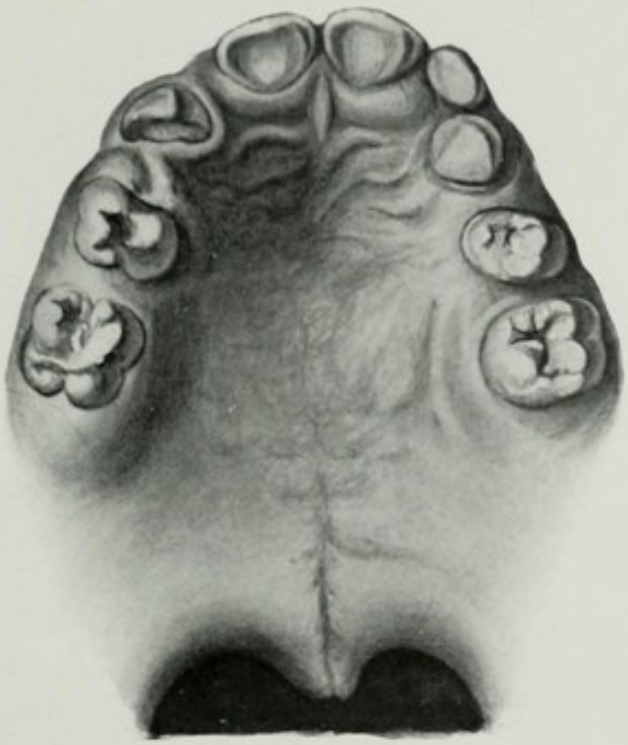


FIG. 214. The preceding, twenty-three days later; the hole is completely closed.

culty and in a very short time. Occasionally an opening may persist for a few months. Once only have we found it necessary to do a secondary operation for the closure of such a hole (Fig. 215). This was the case of a girl aged 10 years at the time of the primary operation. She had a somewhat wide cleft of the soft and most of the hard palate (Fig. 167, p. 186). After median suture wide openings were

left on either side. These soon closed up almost completely, but on the left side a small opening about 2 millimetres in width was still present more than two years afterwards. A small secondary

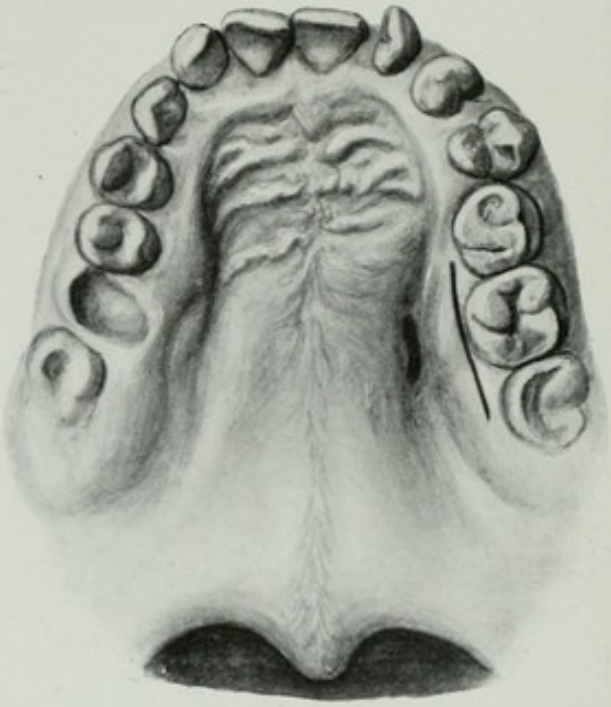


FIG. 215. A palate, 2¼ years after the closure of a rather wide cleft of the soft and most of the hard palate, showing a small hole in the situation of the left lateral incision. It was closed by means of an incision made along the alveolar border, dissecting up the intervening tissues and refreshing the edges of the hole. For condition before the primary operation, see Fig. 167, p. 186.

Gladys L., aged 12 years. Royal Free Hospital, 1910. Appendix, 95.

operation was then performed, the margin being pared and the tissues dissected up from the underlying bone. An incision down to the bone, close to the teeth, permitted the opening to be closed by means of a couple of sutures. Healing took place by granulation in the course of a few weeks.

A hole at the anterior end of the hard palate (such as that in Fig. 216) is sometimes treated with advantage by cutting from one side a flap of muco-periosteal tissue with its base behind, and sliding it laterally so as to cover the hole. Such a flap, however, is not unlikely to slough, and if employed

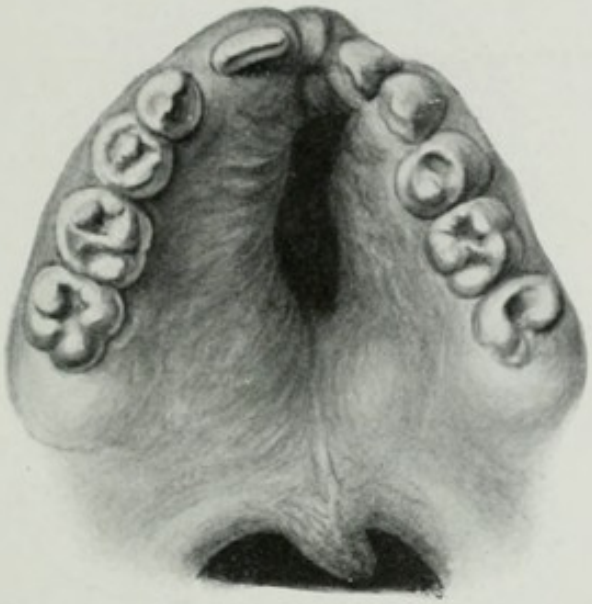


FIG. 216. A hole in the anterior part of the hard palate, suitable for closure by means of a flap taken from the right side of the palate. Such holes are difficult to close on account of the rigidity of the tissues, and the small amount available. Obturator treatment is often to be preferred in these cases.

at all, great care must be taken not to cut off too much of its blood-supply.

Figs. 198 to 206, pp. 237–242, are introduced to show the various stages in the closure of two cleft palates by means of secondary operations. The details are given in the descriptions of the figures.

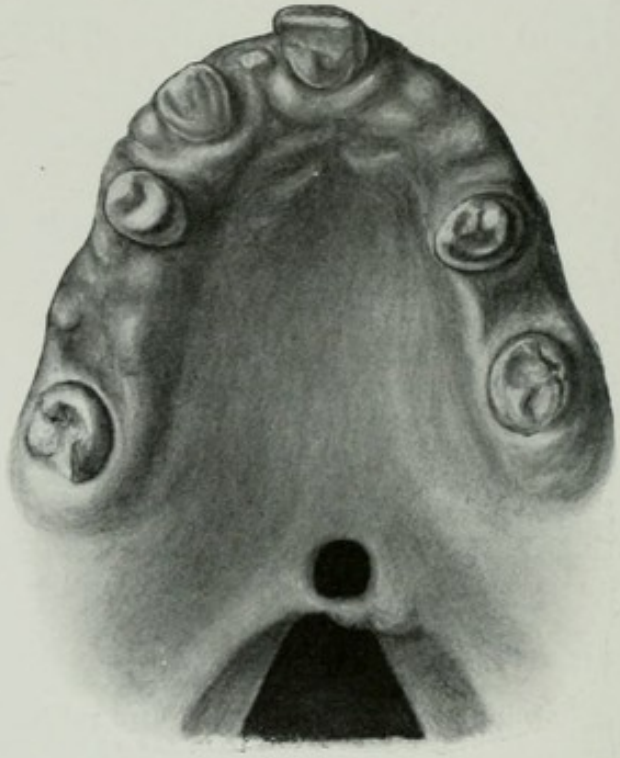


FIG. 217. Palate of a patient aged 21, on whom an unsuccessful operation for a cleft of the soft palate had been performed elsewhere many years previously. It will be seen that the uvula has been completely destroyed and only a very narrow band of tissue unites the thin and scarred edges of the cleft. We did not advise any operation.

FIG. 218. A palate wholly unsuitable for further operation. Two operations had been performed elsewhere several years previously. At the second one, the anterior part of the cleft was said to have been "closed by a flap operation." The mother stated that the holes seen at the front of the palate had come (from atrophy of the flap) since the child left the hospital and that they were still enlarging. A single narrow bridge is all that unites the edges of the cleft, and the tissues on the right side are exceedingly thin. The irregularity of the teeth is noticeable, although there never had been any cleft of the alveolus, or of the lip. (From a coloured drawing.)

II. EFFECT OF CLEFT-PALATE OPERATIONS UPON THE TEETH

Figs. 219 to 225 show the effect that cleft palate operations may have upon the alignment

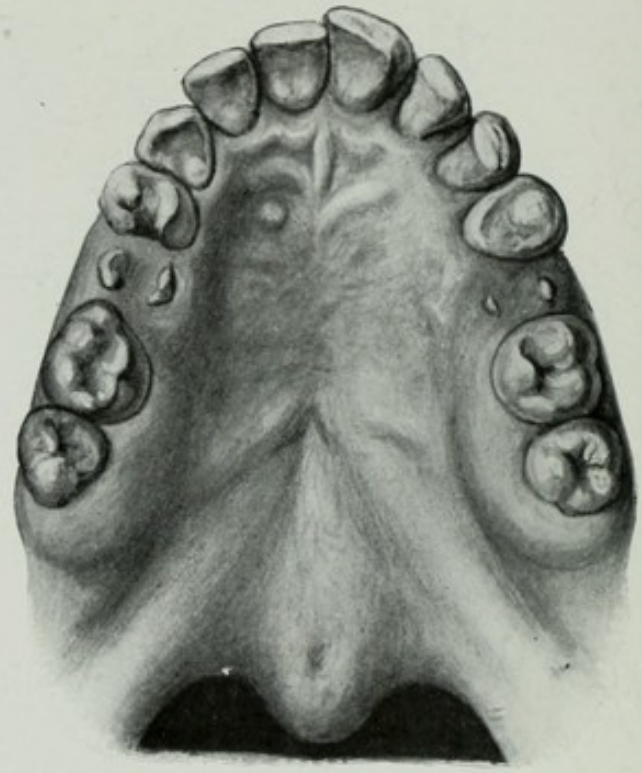


FIG. 219. The palate of a patient 13 years after closure of the cleft, shown in Fig. 53, p. 62. It shows the flattening of the alveolar arch on the right side, due to contraction of the scar tissue.

Janet W., aged 23. Royal Free Hospital, 1898.
Appendix, 7.

of the teeth. Any operation upon the palate is accompanied by a certain amount of scarring; if it has been an extensive one, or if many operations have been performed, and especially when the operation has been followed by a large hole in the palate which is allowed to close spontaneously,

in other words, whenever a considerable amount of scar tissue has formed, contraction is likely to occur. This contracting scar tissue may cause displacement of one or more of the developing teeth.

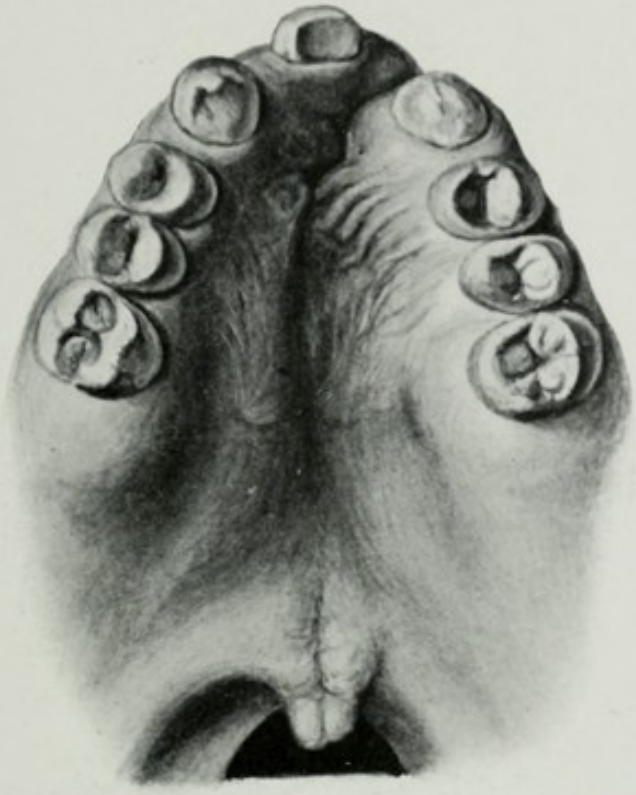


FIG. 220. The palate of a patient, 15 years after the closure of a complete cleft. It shows slight flattening of the alveolar arch on both sides.

Leslie C., aged 17. Royal Free Hospital, 1911.
Appendix, 3.

Unless care be taken to counteract the deformity it may become permanent and may even affect the speech.

Fig. 219 shows the palate of a young woman thirteen years after closure of the wide cleft depicted in Fig. 53, p. 62. It will be noticed that the right alveolus is slightly flatter than that of the opposite

side, all the teeth from the canine to the last molar having been displaced inwards.

Fig. 220, from a boy aged 17, fifteen years after operation for closure of a complete cleft, shows

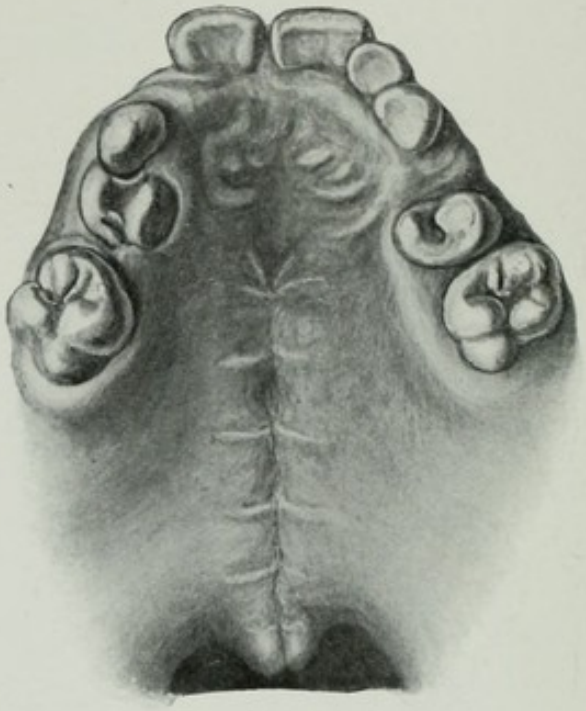


FIG. 221. The palate of a patient some six years after operation on a cleft of the soft and part of the hard palate. It shows slight displacement inwards of the teeth on both sides.
Charles F., aged 10. Appendix, 66.

slight flattening of the alveolar arch on both sides. The loss of most of the incisor teeth is a more serious matter, but in spite of this the patient's speech was almost perfect.

Fig. 221, from a boy aged 10, some six years after operation upon a cleft of the soft and part of the hard palate, shows slight displacement inwards of the teeth on both sides, but his articulation was nevertheless perfect.

Figs. 222 and 223, from twin sisters aged 10, show great displacement of the teeth. The operations

FIG. 222.

FIG. 223.

FIGS. 222 and 223. The palates of twin sisters, aged 10, many years after operation for closure. It is not known exactly what operation was performed, but it is evident there has been considerable contraction and displacement of the teeth of both sides. There was no harelip in either case. *See also* Figs. 23 and 24, p. 36.

which had been performed many years before the children came under our notice, had evidently been followed by a great deal of scarring and contraction.

Fig. 224, from a boy aged 12, about seven years after operation for complete cleft, shows inward

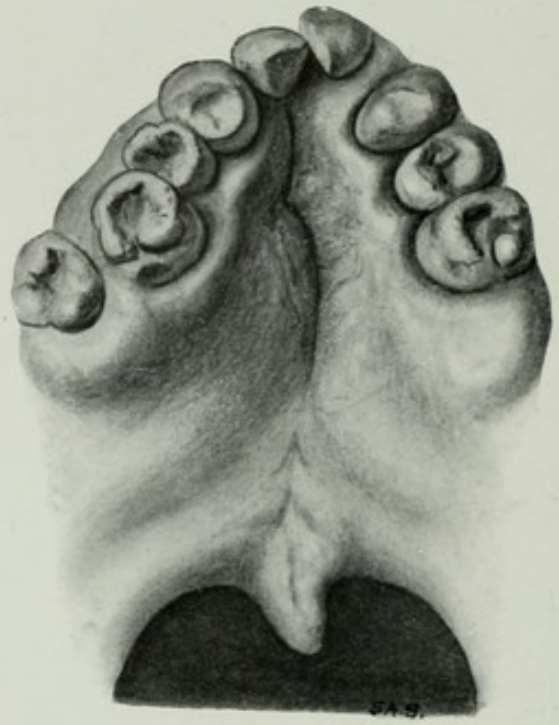


FIG. 224. The palate of a patient about seven years after closure of a complete cleft, showing considerable deformity of the alveolar arch.

Harold W., aged 12. Royal Free Hospital, 1911.
Appendix, 49.

displacement of the teeth of the right side and a narrow pointed condition of the anterior part of the alveolar arch. This latter condition was caused, however, not so much by contraction of scar tissue as by injudicious treatment of the premaxillary process, which appears to have been wholly or partly removed.

A similar but more marked degree of pointed alveolar arch is shown in Fig. 108, p. 130, from a cast in the museum of the Royal College of Surgeons. The history is unknown, but it is evident that the

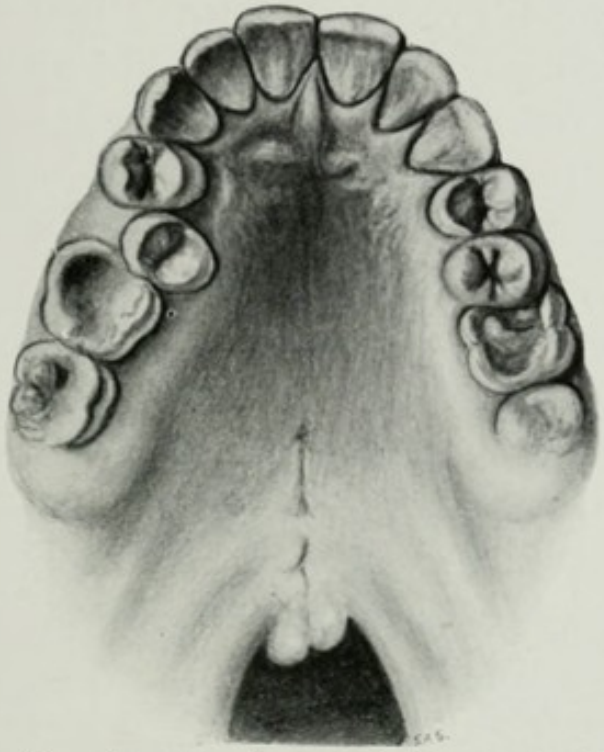


FIG. 225. The palate of a patient nearly 10 years after closure of a cleft of the soft palate. Some displacement inwards of a tooth on the right side is shown.

Ethel C., aged 12½. Royal Free Hospital, 1911. Appendix, 35.

premaxillary process had been removed, probably in infancy.

Sometimes only a single tooth is displaced, as in Fig. 225, from a girl aged $12\frac{1}{2}$ years whose cleft of the soft palate had been closed at the age of $2\frac{3}{4}$ years (Appendix, Case 35). In this case, however, it is doubtful whether the operation was the cause of the dental irregularity. For a similar irregularity may

be noticed in some cases of cleft of the soft palate which have never been operated upon, as shown in Fig. 188, p. 211, from a boy who was aged 13 when he came to us for operation.

Operations for complete cleft nearly always leave some irregularity in the line of the incisor teeth owing to the displacement of the premaxillary process. Rotation of one of the central incisors is very common.

The treatment of the displaced teeth after cleft palate operations is important, since neglect may cause the patient's speech to be worse than it otherwise would have been. Inward displacement of the molar or bicuspid teeth and lateral contraction of the jaws can easily be treated in a developing jaw by means of an obturator, with or without a spring to exert pressure upon the teeth. If any of the incisor teeth are absent or irregular, as they usually are in cleft palate associated with harelip, it is highly desirable that dental treatment should be carried out. A small plate carrying one or more front teeth can easily be fitted. This often greatly improves the articulation, especially of the dental consonants. It is in childhood especially, while the jaws are not fully developed, that dental treatment is particularly necessary. Only too frequently, however, is such treatment neglected or postponed until adult age has been reached.

CHAPTER X

OTHER OPERATIONS FOR CLEFT-PALATE

Treatment by clamps: Brophy's operation: Davies-Colley's and Lane's operations

BESIDES the method that has been described in detail in chapter vii., there are certain other operations which differ in principle and which may now be discussed.

I. Treatment by Clamps or Wires

These methods of dealing with complete cleft palate aim, not at an immediate closure of the cleft by means of soft tissues, but at approximating the sides of the bony cleft, so that the subsequent suture of the soft parts may be facilitated. In complete cleft palate the maxillary bones have failed to coalesce and are separated from each other by the width of the cleft. (Fig. 226, Fig. 57, p. 66, and Fig. 109, p. 132). Theoretically, therefore, the approximation of these bones should bring together the edges of the cleft. Practically, to a certain extent, in single cleft palate at any rate, this is hindered by the premaxillary bones which prevent complete approximation of the palatine

portions of the maxillæ (Fig. 57, p. 66). The more or less firm attachments of the maxillary and

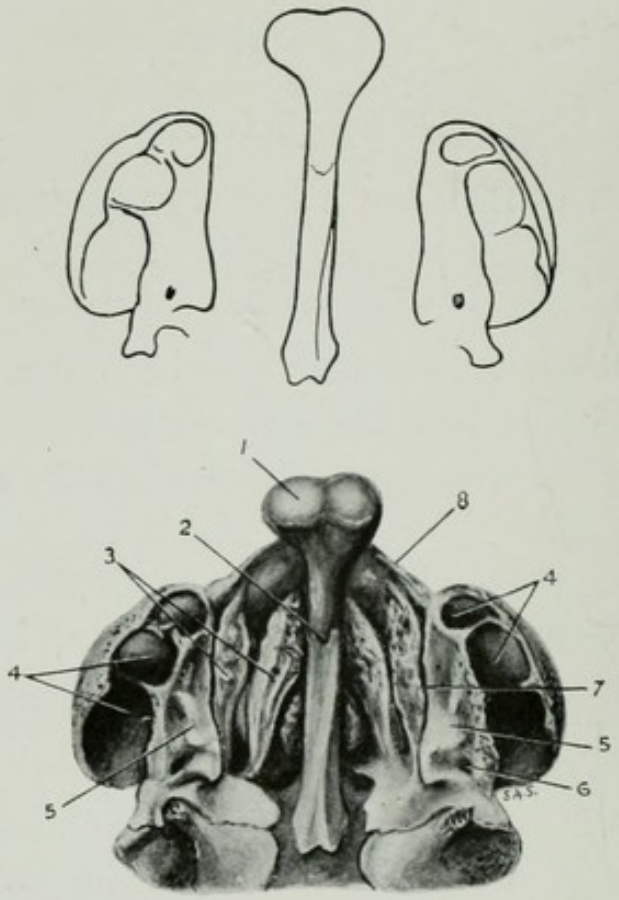


FIG. 226. Drawing of a complete double cleft palate in a newborn infant. The septum has been straightened in the drawing.

(From a specimen (No. 195) in the Museum of the Royal College of Surgeons. Natural size.)

1. Premaxillary process with germs of incisor teeth; 2. Septum nasi—the anterior third is cartilaginous; 3. Middle and inferior turbinated bones; 4. Sockets of teeth; 5. Horizontal plate of palate; 6. Posterior palatine foramen; 7. Edge of the cleft in the palate; 8. Bony margin of nose.

palate bones to those of the cranium (chiefly through the malars and pterygoids) offer resistance to the apposition of these bones. In the young infant soon after birth, when ossification is less

advanced, it is more easy to press the bones together than it is later on. Indeed, forcible approximation after the first few weeks of life becomes increasingly

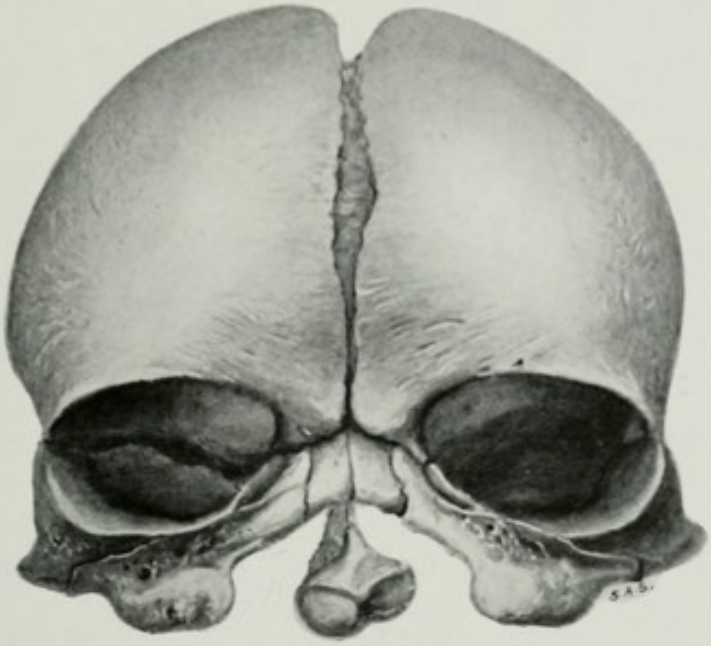


FIG. 227. Front view of the preceding, showing how little bony tissue there is at this age between the floor of the orbit and the alveolus. (Natural size.)

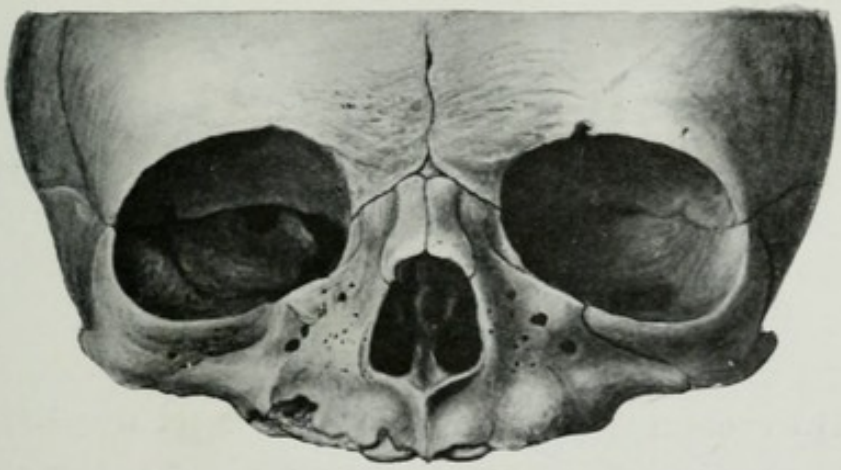


FIG. 228. Front view of the skull of a young infant, for comparison with the preceding. The malar bones and maxillæ are firmly attached to one another.

From a skull in the possession of the authors. (Natural size.)

difficult, and is likely, if much force be used, to be followed by serious fracture of the base

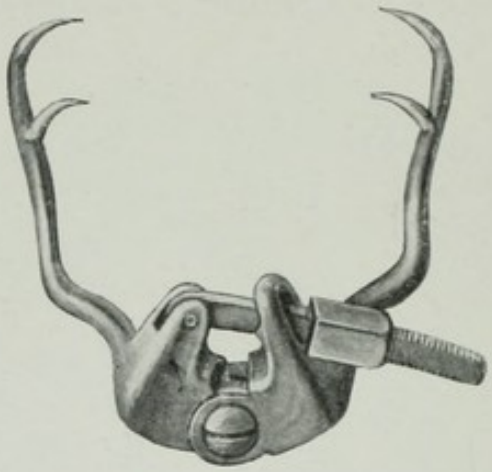


FIG. 229. Ulrich's clamp for approximation of the two sides of the palate. (Natural size.)

of the skull, a point that should not be lost sight of.

There are two principal methods by which this forcible approximation may be attempted:

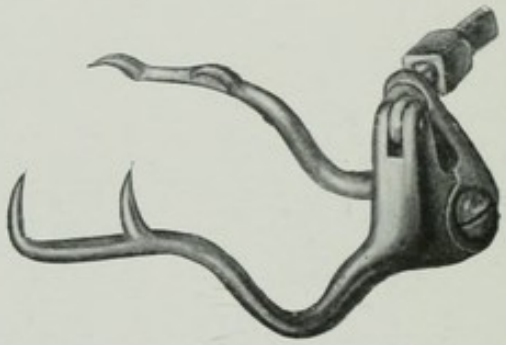


FIG. 230. Side view of the same.

(A) by clamps applied outside the gums; (B) by wires passed through the upper jaws (Brophy's method).

(A) **Clamp method.**—A metal clamp is intro-

duced into the mouth, the jaws of the instrument being laid on the outer sides of the upper gums, on to which they are made to bite. The clamp is left *in situ* for several weeks. By tightening it up every few days, the maxillæ can be gradually pressed together. Several forms of clamp have been invented, of which we figure that of Dr. Ulrich of Copenhagen.

An obvious objection to clamps is the pain and irritation which they cause and the necessarily septic condition of the wounded gums into which the teeth of the instrument have to bite. Another objection seems to be the tendency for the clamp to cause rotation of the maxillæ rather than direct lateral approximation. We have no personal experience of the method and do not recommend it. Indeed Dr. Ulrich tells us that after a fair trial he has himself abandoned it.

(B) **Wiring method** (Brophy's operation).—In this method the sides of the cleft, after approximation, are held together by means of silver wires passed through the jaws. It is associated with the name of Dr. T. W. Brophy of Chicago, who introduced it many years ago, and, after large experience, remains a warm advocate of it. Soon after his first description of the operation was published, it was taken up by many surgeons. The results obtained by them were, as far as we have been able to learn, by no means satisfactory,

and the operation, in this country at least, of late years has fallen into disfavour. As originally performed it was undoubtedly a very severe procedure. Many cases of death are known to have occurred, from fracture of the bones, sepsis and other causes. It is possible, however, that the undoubtedly bad results obtained were due more to the manner in which the operation was usually performed than to the operation itself.

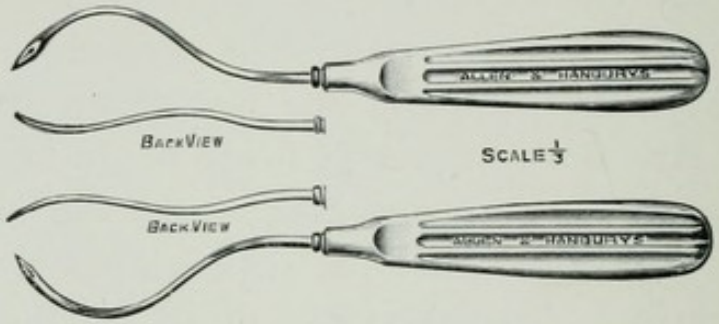


FIG. 231. Brophy's needles for insertion of silk threads through the upper jaws.

Dr. Brophy has gradually perfected his technique and now uses comparatively little force in the manipulations by which the bones are brought together.

We have recently (August 1911) had the advantage of a personal demonstration of his latest procedure from Dr. Brophy himself, who now operates in the following manner:

The child being anæsthetised, one of his special needles (Fig. 231), threaded with a stout silk suture of the same size as the silver wire which is to be used, is carefully passed through the upper jaw just above

the bony palate, till the eye appears in the cleft. Reference to Figs. 227 and 232 will show how little room there is between the teeth and the floor

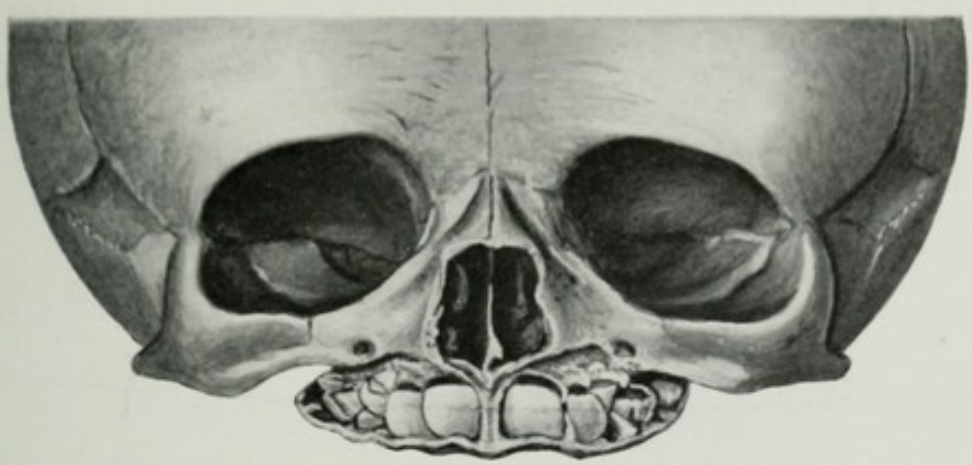


FIG. 232. Skull of a new-born child, showing the germs of the temporary teeth and their close proximity to the orbit. The front wall of the upper jaws has been removed to show the teeth.

From specimen A. 172 in the Odontological Collection of the Royal College of Surgeons. (Natural size.)

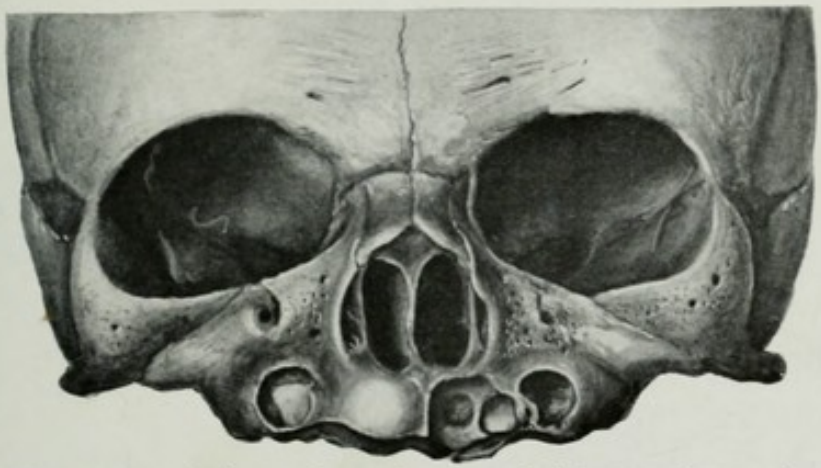


FIG. 233. A similar specimen from a male infant aged 2 months.

A. 13, Odontological Collection, Royal College of Surgeons. (Natural size.)

of the orbit in a young infant. In passing the needle the point must be kept below the orbit, and if any of the teeth are encountered, the end

of the needle should be carefully wormed past it. It must be constantly borne in mind where the point of the needle is, and care must be taken to keep it close above the horizontal plates of the maxillæ and palate bones. When the eye of the

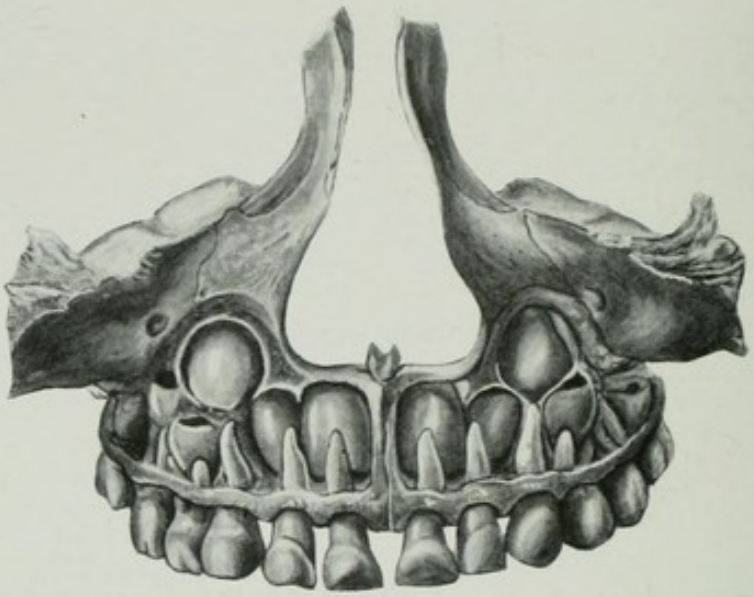


FIG. 234. Upper jaws of a child aged 4 years, showing the germs of the permanent teeth, after removal of the bone in front of them. Odontological Collection, Royal College of Surgeons. (Natural size.)

needle appears in the cleft, the silk loop is pulled out, and the needle withdrawn, leaving the silk along its track, with the loop in the cleft. By using a "reverse" needle, a loop of silk is passed above the palate on the opposite side of the cleft. Two such loops are inserted on each side, one as far back as possible, and the other a short distance in front of this. A third loop of silk is then passed through the longer side of the alveolus, so that it appears in the anterior part of the cleft. There

will be, therefore, in the cleft, three loops of silk on one side, and two on the other (Fig. 235). The

FIGS. 235 to 242 illustrate the various stages of Brophy's latest method of operation for closure of a complete cleft palate by means of silver wires and lead plates. The drawings have been made from an actual specimen of the deformity and immediately after a personal demonstration by Dr. Brophy.

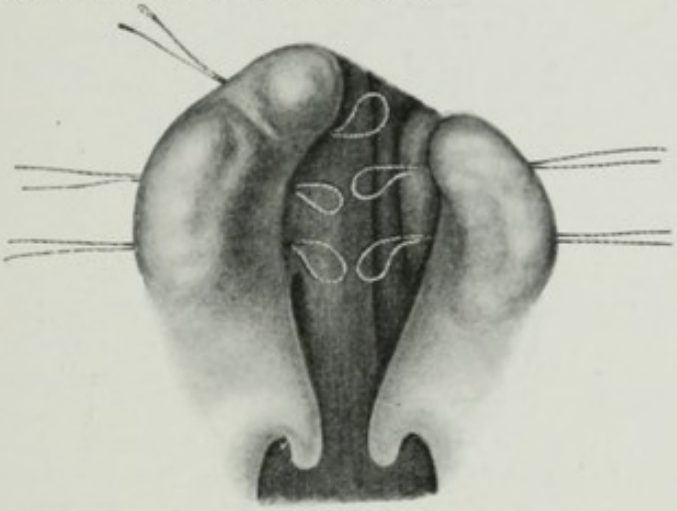


FIG. 235 (Stage 1). Five stout silk sutures have been inserted; the loops project into the cleft.

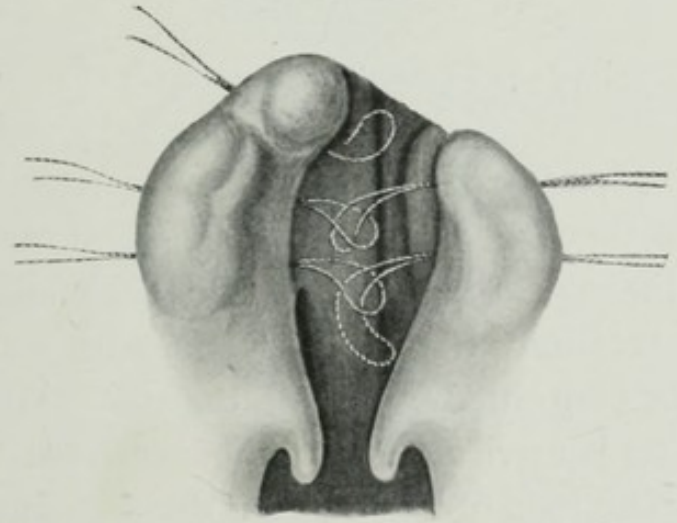


FIG. 236 (Stage 2). By using two of the loops of the right side as tractors, the silk loops of the left side are drawn across both the maxillæ.

two hinder loops are threaded separately into one another and by withdrawing one loop the other will

follow it (Fig. 236). There will then be passing across the cleft two double silk threads, and each pair of threads will have a loop on the outer aspect of one alveolus, the free ends being on the outer aspect of the other alveolus (Fig. 237).

The most anterior loop up to this time has been left lying in the anterior part of the cleft (Fig. 237).

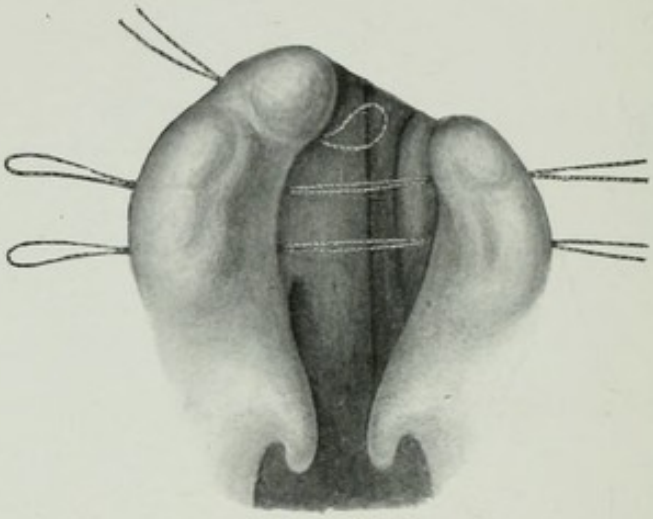


FIG. 237 (Stage 3). Two of the loops of silk now extend right across both maxillæ and cleft.

A long piece of silver wire (American gauge, 18–20) is then bent into a V-shape, and one end is passed through the hindmost loop of silk. By making traction on the latter, the wire is carried across the cleft in the path of the silk. A similar proceeding is carried out with the intermediate loop of silk. The loop of each wire is divided, and there are now four wires passing from side to side. The most anterior wire is withdrawn by pulling one end out until the other appears in the cleft, when it is seized by a pair of forceps. This end (*i.e.* the end

in the cleft) is then bent round to form a loop, which is threaded into the third silk loop (Fig. 239). By

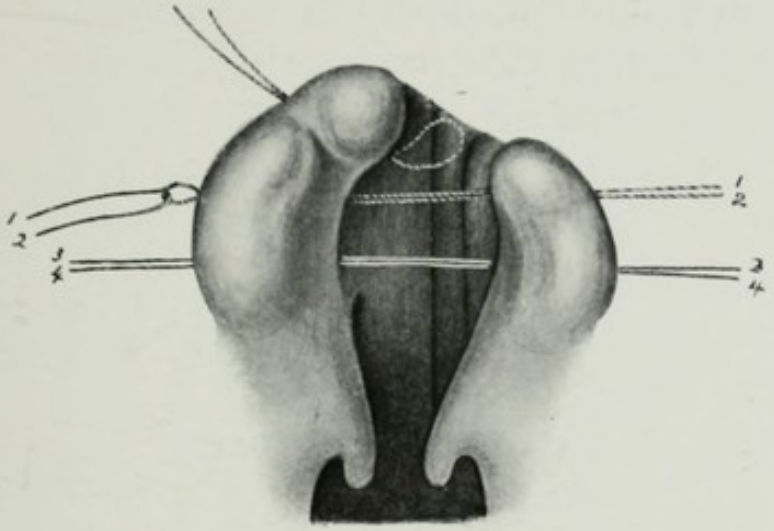


FIG. 238 (Stage 4). A long piece of stout silver wire has been threaded through the middle loop of silk, by which it is about to be drawn through the jaws. Behind this the double wire is shown already in place. The anterior loop is still of silk.

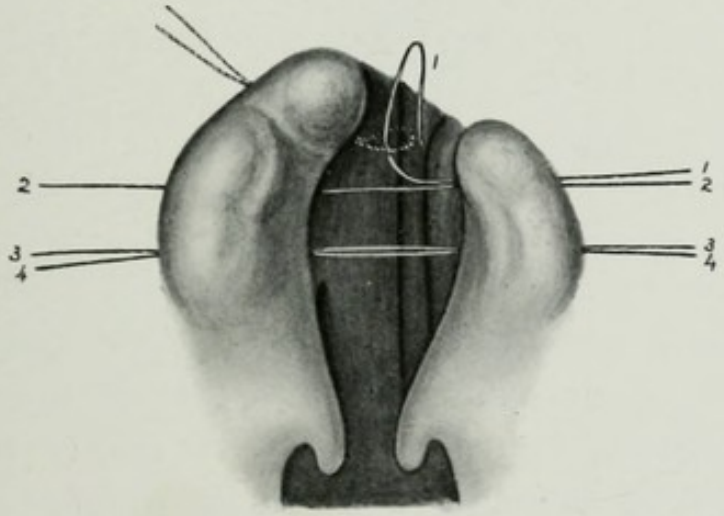


FIG. 239 (Stage 5). One of the anterior pair of wires has been withdrawn from the right maxilla and has been threaded through the front loop of silk, which is about to draw it through the pre-maxillary process.

making traction the latter is withdrawn, and the wire comes to occupy its place. There will now be

four wires on each side; on the longer side there will be three apertures, and on the shorter side two apertures, through which the wires penetrate the bones (Fig. 240). Two leaden plates, one with three holes and the other with two, are then cut of a sufficient size to take the wires and to fit the outer aspect of the alveoli. These plates must be made

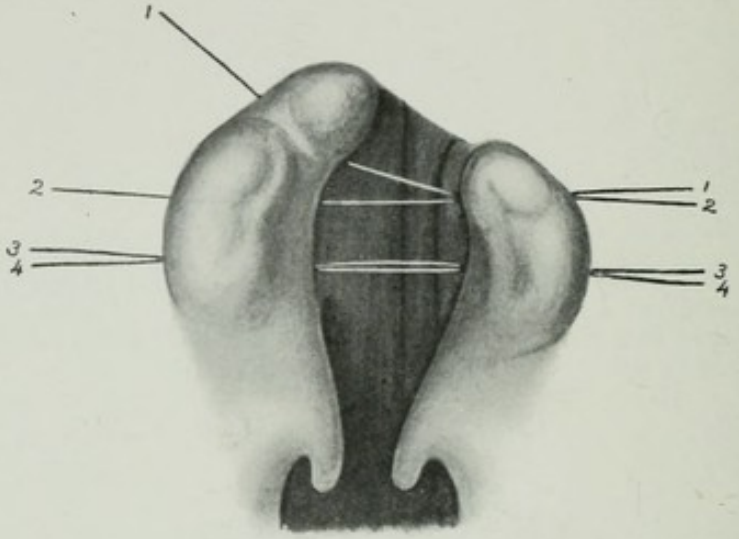


FIG. 240 (Stage 6). Showing the front wire passing through the premaxillary process.

for each case, and the holes punched where the wires will pass through them; their thickness must be of the same gauge as that of the wires. The edges of the plates must be gently turned outwards so as not to press on the mucous membrane of the alveolar processes. The wires having been passed through the holes in the plates the jaws are gently yet firmly pressed together; as this is done, the "slack" in the wire is reduced by twisting the ends round each other. No attempt

must be made to force the jaws together by twisting the wires up tightly. If this is done the wires will break and the bones will not be approximated.

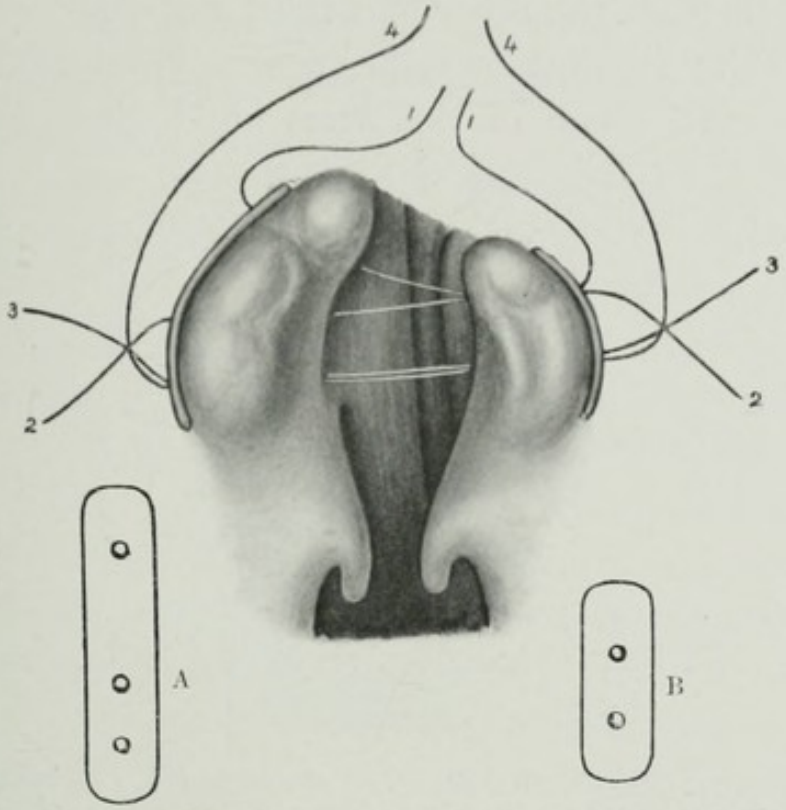


FIG. 241 (Stage 7). All the wires having been placed in their correct positions, perforated lead plates are threaded upon them. As the jaws are slowly approximated by gentle digital compression, the ends of wires 2 and 3 are twisted together, the first and last wires (1 and 4) are brought forwards, and their respective ends twisted together in front of the premaxillary process. A and B show the perforated lead plates.

Moreover, it is essential to see that the proper wires are twisted round one another, and that each is dealt with in turn. Thus in Figs. 241 and 242 the wires 2 and 3 are interlocked on each side, 4 and 4 are brought round the anterior end of the cleft and twisted together in front. The bones may be approximated by the thumb and fingers pressing

on the lead plates, or by means of a periosteal elevator with a broad end used in the same way. The pressure must be exercised first on one side and then on the other and must not be violently applied. It must be rather a steady, intermittent pressure. None of the wires are to be used to

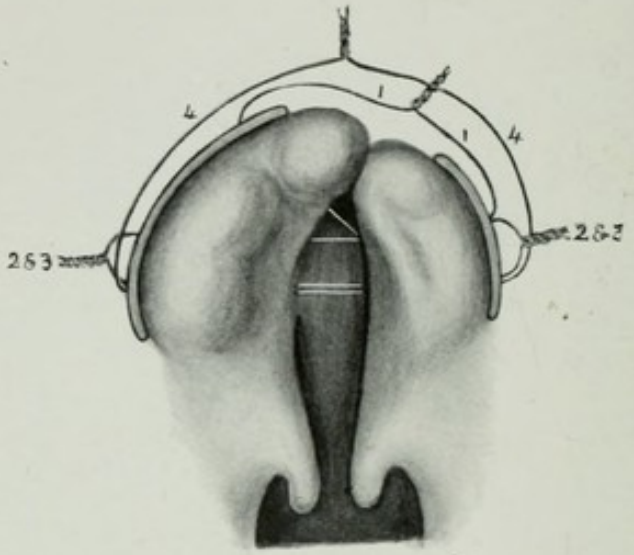


FIG. 242 (Stage 8, Final Stage). The maxillæ are being brought into contact and the front part of the cleft has been closed. For the sake of clearness the wires and their twisted ends are shown at a little distance from the jaws. In reality they would of course lie close to the lead plates and the gums.

make traction on the bones; they are to hold them in position, and are to be twisted up first on one side and then on the other as the bones come together. The premaxillary process is gently pressed back as far as possible to its normal position. As this is being done the anterior wires (1 and 1) are twisted round each other. When the margins of the cleft have been brought nearly into apposition, they are gently scarified or scraped, so

as to produce a raw surface, and while this is being effected care must be taken not to break the wires in the cleft. The bones are then brought into contact, the wires are finally tightened, their ends cut short, and gently hammered down on the plates.

During the scarification of the edges of the cleft there is very little bleeding. When the pre-maxillary process is very prominent its re-position is rendered more easy by obliquely dividing the septum of the nose just behind and above its attachment. As the wires are twisted, the process will slide or glide upwards on the lateral surface of the septum, and come to lie in its normal position.

The wires and lead plates are left in position for six weeks, and are then removed. After a few days the wires become slacker than at the time of the operation. Extensive ulceration or sloughing of the gum ought not to be produced. Sometimes a superficial excoriation does occur. It is important to keep the mouth clean, and to remove any debris of food from the alveoli near the plates. This can easily be done by means of swabs after the child has been fed. No special antiseptic treatment is required; possibly chlorate of potash both locally and internally may be useful. At the end of six weeks the bones will have firmly united, and no fear of their separating need be entertained after the removal of the wires.

The operation considerably diminishes the size

of the harelip, if one is present, and corrects the lateral displacement of the nose in such cases. In his earlier operations, when the cleft was wide, Brophy used to divide the attachment of the malar to the maxilla on each side. He very rarely does this now, as he operates earlier, and the method of employing the wires as described above is sufficient, in the majority of cases, to obtain more or less closure of the cleft. Brophy claims that the best results are obtained by operating when the child is ten days to three weeks old. The bones at this period and up to four or five months are very pliable, being composed chiefly of organic matter. After five months the bones are firmer, as they contain more osseous material, and hence do not so readily allow of their being brought into apposition without the risk of fracture taking place. It is also claimed for the operation that the alveolar processes develop normally, and the teeth in the premaxillary process grow in the correct or almost correct direction, and therefore that the whole of the teeth in the upper jaw occlude with those of the lower. It is urged that the deformity is much less, that the nasal accent does not occur, and that speech is normal when the time comes for its development, as faulty habits will not have been acquired. The hare-lip is operated on about two months or more after the cleft in the hard palate has been closed. The cleft in the soft palate is closed at a later date, generally about the sixteenth month.

To do this operation efficiently it is essential to have proper instruments, the chief of which are the needles for passing the silk threads, proper-sized wires and lead plates. The holes in the latter must be made specially at each operation. A punch is therefore necessary and an awl to enlarge the holes as required, and a proper wire-twister. In Brophy's hands this method of operating seems to have been very successful, and he tells us that his mortality is only about 3 per cent. But in this country the operation has not been done with any great frequency or success. Many surgeons have experienced great difficulty in getting the bones together, and we have heard of cases in which extensive necrosis of the bone has occurred. Moreover, the mortality has been considerable. It is possible that this want of success may be due to the operation not having been properly performed, to its not having been done sufficiently early in life, or with proper instruments. Some surgeons have also said that the palatine processes, instead of remaining horizontal, have become more or less vertical, owing to rotation taking place as the bones came together. If the wires are placed in the correct positions this should not occur. An interesting question is the effect of the operation on the development of the teeth. We fail to see how the wires can avoid damaging the germs of the teeth. Reference to Figs. 227, 228, and 232 will show that the wires, if they are to be below the orbit, cannot be

passed except through the region of the developing teeth. Brophy admits "that the germs of the teeth are sometimes disturbed and occasionally that certain teeth are imperfectly developed when erupted." Anatomically it would seem that this should occur very frequently. It is probably hardly necessary to point out that this method cannot be used when the cleft is an incomplete one.

Theoretically Brophy's operation is very tempting. The sides of the cleft are brought more closely together, and the subsequent operation for its complete closure is facilitated. Nevertheless, if clumsily or imperfectly executed, the danger to life is very great. We have shown how, after closure of the harelip, the cleft in the palate naturally undergoes in most cases a remarkable degree of spontaneous closure. It is questionable whether it is desirable to do an operation which undoubtedly involves considerable risk, when the same result may be obtained without risk by waiting for a year or two. No detailed statistics have yet been brought forward by Brophy or, so far as we know, by any one else, to show what is the actual mortality of the operation, immediate or remote, nor in what proportion of cases the object aimed at, namely, complete approximation of the edges of the cleft, is really obtained. Finally, it should be remembered that the complete clefts of the palate, the only ones suitable for Brophy's operation, are usually just those that can be closed

without much difficulty by the ordinary operation. The cleft which is by far the most difficult to close satisfactorily by ordinary means (a wide cleft of the soft palate and most of the hard without cleft of the alveolus, Fig. 63, p. 73) is one for which Brophy's wiring operation is quite useless.

II. Turn-over flap methods

A. Davies-Colley's operation was devised for cases in which the cleft was supposed to be too wide to be closed by Langenbeck's method. Two flaps were made, one of which was turned over like the leaf of a book and the other was superimposed on it across the cleft. The cleft could only be partially closed by this proceeding, and to a large extent the method was subsequently discarded by its author in favour of the older operation. A full description of the operation will be found in the "Transactions of the Royal Medico-Chirurgical Society," 1894, vol. 77, p. 237.

B. Arbuthnot Lane's operation is an extension of Davies-Colley's. It has been very widely adopted by some surgeons in this country and much discussion has taken place as to its merits and supposed advantages. A flap consisting of the whole thickness of the muco-periosteum is raised from one side of the hard palate. This flap of

muco-periosteum, which is left attached at the margin of the cleft, is turned across so that its raw surface looks downwards to the mouth. On the opposite side, the muco-periosteum is raised from the underlying bone for a short distance, thus leaving a space adjacent to the cleft. The free edge of the flap from the other side of the cleft is placed in this space, and the two are then sutured together. From the soft palate a flap of mucous membrane and subjacent tissues is raised and turned across the defect in a similar manner. Of course when there is a cleft of both the hard and soft palates the mucous membrane of the latter and the muco-periosteum of the former are raised in one layer. If the cleft is wide it may be necessary to include in the flap the muco-periosteum from over the alveolus. The incisions marking out the flap will be made so as to make it of appropriate size and shape.

Mr. Lane performs this operation on infants a few days or weeks old. The vitality of the flap is said to be sufficient to prevent sloughing occurring to any extent, and if non-union occurs at any part, a secondary operation to close the hole is performed later. When there is a harelip as well as a cleft palate, the operation for the repair of the lip is performed either at the same time as or after that on the palate.

It is very difficult to obtain reliable information as to the ultimate results of this operation. The

immediate mortality is admittedly high.* That the defect can often be closed at the time of operation by this proceeding is quite certain, but what is required is to know the subsequent fate of the flap and how the patient speaks. We have seen several cases in which the flap has undoubtedly atrophied and large holes have been left (Fig. 281, p. 253); in others it has been evident that the whole flap has sloughed and the palate been left in such a condition that further operation was quite impossible. The soft palate is frequently very deformed owing to the contraction of the scar tissue: moreover it is often stiff and rigid instead of being freely mobile. Most important of all, however, is the question of speech in a person who has been operated on by this method. At the demonstration of cases before the Surgical Section of the Royal Society of Medicine (May 1911), very few patients were shown who had been operated on by this method and who were old enough to talk or to answer questions intelligbly; and therefore we are still left without reliable information on this important point.†

* *See* "Proceedings of Royal Society of Medicine," vol. iv., No. 8, June 1911, where, on page 172, the mortality is said not to exceed 5·9 per cent., but on page 195 the mortality is given as 12·5 per cent. during the past two years.

† For a fuller discussion of the advisability or otherwise of performing Mr. Lane's operation, see *Lancet*, May 27, June 4, and June 11, 1910, May 27 and June 10, 1911; *Brit. Med. Journal*, October 28, 1911; and especially an excellent summary of the whole controversy by Mr. F. W. Goyder in the *Practitioner* for September 1911.

CHAPTER XI

ON OBTURATORS AND ARTIFICIAL VELA

Formerly, when operations for the closure of a cleft palate were not attempted, or when they were less successful than at the present time, mechanical means alone were employed to remedy the defects of a cleft palate. Much ingenuity and many elaborate pieces of apparatus were designed : some were found to be useful, and others to be quite useless. As the apparatus became more simple the utility of them increased. After Fergusson, Smith, and others demonstrated that the cleft could be successfully closed by operation, the use of obturators has been gradually discontinued, so that nowadays it is only in exceptional cases that they are employed.

Mechanical aids in the treatment of cleft palate are either obturators, which consist of a metal or vulcanite plate, and cover the defect in the hard palate, or artificial vela, which are elastic movable valves or flaps, which close the defect of the soft palate. A combination of the obturator and the artificial velum is required when there is a cleft involving both the hard and soft palates. An obturator differs from a " plug " in that the former

does not fit into the hole in the palate. A "plug" should never be used, as it constantly tends to increase the size of the defect in the hard palate by its constant pressure. Patients sometimes display great ingenuity in making "plugs" for themselves, but they are never to be ordered or used by surgeons.

Two main arguments were adduced for the employment of obturators—(1) the want of success following operative procedures, (2) that improvement of speech does not always follow an operation. As regards the first point, we know now that in the majority of cases operations are successful, and that if the first operation is not a complete success secondary operations usually completely close the defect. As to the second point, speech is not necessarily improved by the use of an obturator unless the patient is taught to phonate properly. If a palate be closed by an operation, the patient has also to be taught to speak properly, and it should be remembered that the closure of a cleft palate is the means to this end. Whether mechanical aids are employed or the cleft is closed by an operation, months or years of careful training may be necessary to enable the patient to speak correctly.

The objections to the use of obturators and artificial vela are (1) the difficulty in applying them; (2) the necessity for frequent renewal, especially in children; (3) the local effects produced in the mouth by their presence.

The difficulty in applying them.—This occurs especially in connection with the soft palate, and therefore just where good effect is most desirable. It is not easy to apply an artificial velum to the margins of the cleft so that it fits accurately and yet does not exercise pressure or cause irritation. At the same time it must be capable of being freely moved by the palate muscles. An obturator is easily fitted to a cleft of the hard palate.

Frequent renewal is necessary on account of the growth of the parts, and because the material of which the appliances are made is perishable. Theoretically, treatment by mechanical aids should be begun before defects in speech are fully established. But as children begin to talk in the second or third year. it is almost impossible to do this, because a child would scarcely tolerate the constant presence of an obturator and artificial velum. A young child does not appreciate the value of speaking correctly, and will probably rebel against the wearing of the appliance. Moreover, the growth of the jaws would necessitate frequent renewal of the apparatus, a new one being required every few months. The expense of this becomes a serious objection. As a rule mechanical treatment cannot be begun before the sixth year at earliest, and by this time defects in speech would be pronounced.

The local effects produced by their presence.—Irritation of the sides of the cleft, leading to

inflammation and ulceration, may follow, so that pain and tenderness are constantly present. Food and the secretions of the nose are apt to accumulate on the upper surface of the apparatus, leading to fœtor of the breath. Hence constant care in the cleansing of the mouth and apparatus is required. It therefore has to be removed from time to time, or even dispensed with altogether for a period. And there is the further difficulty in replacing the appliance in its proper position.

The possibility of the obturator becoming displaced and falling into the pharynx and upper part of the larynx is, in children, a danger that should not be forgotten.

There are, however, certain conditions under which mechanical aids are advisable, and, indeed, must be employed. When it has been necessary to remove the intermaxillary bone in congenital cleft palate, and a large aperture remains which it is not possible to close by operation, the use of an obturator carrying the teeth is essential. Similarly, if a large hole resulting from partial sloughing of the flap cannot be closed by a plastic operation, an obturator must be employed to shut off the communication between the mouth and the nose. In the very rare cases of extremely wide cleft, it is possible there may not be enough tissue to close it, or when the soft palate is very defective, or when, from the failure of former operations, so much scarring has led to such

shrinking of the tissues that any further operation is impracticable, an obturator and an artificial velum is the only method of treatment. It is sometimes said that mechanical aids should be used for patients who have reached adult life without an operation having been performed. This is by no means an inflexible rule, and provided there is enough tissue to close the defect an operation should be done before supplying the apparatus, especially if it appears possible to close the cleft in the soft palate. One of us has recently operated on a patient aged twenty-seven with very marked success as regards speech, and the cleft was completely closed.

Obturators consist essentially of a vulcanite or gold plate which is fixed to the teeth. To its posterior margin the artificial velum is attached by a hinge. It is made of rubber, and is of such a size that its margins fit into and are embraced by the edges of the cleft, or the size is such that it rests on the nasal surface of the soft palate, and thus serves to fill up and shut off the post-nasal space from the mouth. To increase the mobility of this valve one end of a light gold spiral spring or a swivel is often fixed to the upper surface of the velum, the other end being attached to the upper surface of the obturator. It is very difficult to make an artificial velum which will fulfil the requirements—viz., to keep its position and be freely movable with the soft palate. A soft,

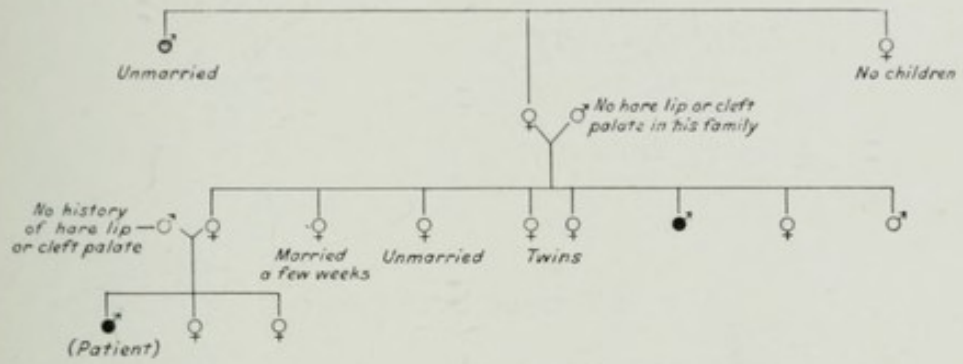
flexible velum is generally better than one made of unyielding material. But soft rubber soon deteriorates. Hard rubber or vulcanite lasts longer, but is not so easily adaptable. Perhaps a thin sheet of velum rubber, which can be sewn on to the obturator and renewed as often as necessary, is the best and it is certainly the simplest form. Another form of artificial velum is made of hard rubber, and is triangular in shape, and is set at an angle to the obturator, so as to lie above the soft palate and fill up the pharyngeal space, the posterior wall of the pharynx nearly coming in contact with it on deglutition or phonation. When the artificial velum is first put in, it causes a good deal of pharyngeal irritation and retching. It should be worn only for a short time each day, and it should not touch the posterior wall of the pharynx.

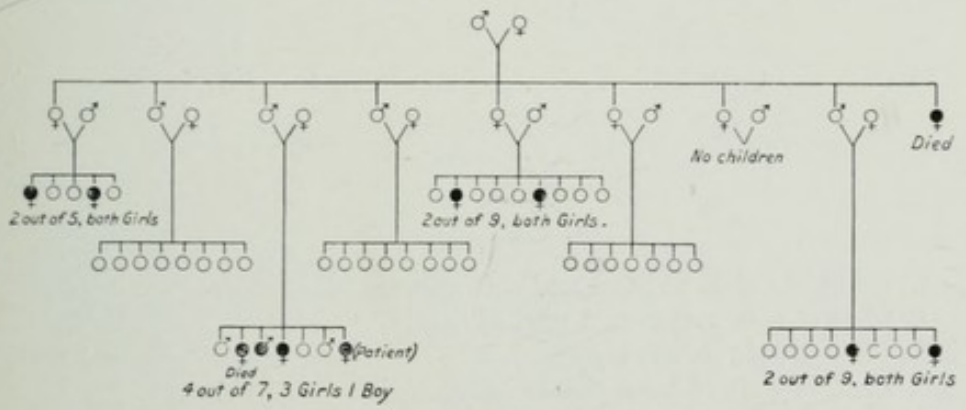
It is perhaps needless to add that whenever a case of cleft palate is to be treated by artificial means, the aid of a dentist will have to be invoked.

In most cases of complete cleft palate, after treatment by operation, the absence of one or more of the incisor teeth renders the wearing of an artificial denture advisable, at any rate for adults. When in a growing jaw there is much contraction or irregularity of the front part of the alveolar arch, the use of a denture with or without a spring is highly desirable. It should be worn until the deformity is completely corrected.

APPENDIX I

TWO PEDIGREES OF CLEFT PALATE PATIENTS





● Cleft Palates ○ Normal Palates

APPENDIX II

ONE HUNDRED AND FIFTY-FOUR CONSECUTIVE CASES OF CLEFT PALATE OPERATED UPON BY MR. BERRY FROM 1894 UNTIL THE END OF 1911

Male patients	74
Female patients	80
Total	154

AGE AT TIME OF OPERATION:

Under 2	20 cases
Between 2 and 4	50 „
„ 4 „ 8	30 „
„ 8 „ 12	35 „
„ 12 „ 16	12 „
Over 16	7 „
Total	154

EXTENT OF CLEFT

I. Complete cleft of hard and soft palate	60
II. Cleft of soft palate and part of hard	59
III. Cleft of soft palate only	31
IV. Central cleft of hard palate only	1
V. Hole left after operation done elsewhere	3
Total	154

The following list, with the necessary corrections and additions required to bring it up to date, has been compiled from statistics already published in the *British Medical Journal* for October 7, 1905, and October 28, 1911.

No.	Name.	Age at time of Operation on Palate.*	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
1	FLORENCE R.	12	Complete cleft, hard and soft palate. About 18 mm. wide.	1894 Mar. 29	Soft palate only united.	1905. Case cannot now be traced; date of last report, 1894.
2	LAURA McV.	18	Soft and ½ hard. 17 mm. wide.	1896 Feb. 29	Complete closure, good movable soft palate.	1911. Speech good.
3	LESLIE C.	$2\frac{1}{2}$	Complete cleft, hard and soft.	June 27	Complete closure, good movable soft palate.	1911. Speech good. Has been carefully trained at home and at school.
4	CYRIL F.	$4\frac{5}{12}$	Complete cleft, hard and soft.	1898 April 17	Complete closure, good movable soft palate.	1911. "Said to speak as plainly as the majority of people." (Letterfrom patient now in Canada.)
5	EVAN G.	10	Complete cleft, hard and soft.	June	Complete closure, good movable soft palate.	1903. Speech still somewhat nasal; otherwise good.
6	SIDNEY R.	10	Cleft of soft palate; notch in posterior edge of hard palate.	Sept. 14	Complete closure, good movable soft palate.	1905. Speech fair. K, Sh, Ch, not good. Has had no training in articulation.
7	JANET W.	10	Soft and ¾ of hard. 15 mm. wide.	Sept. 17	Complete closure, good movable soft palate.	1911. Speech good; a little difficulty with Sh. Has had no special training.
8	JOAN B.	3	Cleft of soft palate, post. part of hard, thin and membranous.	1899 Jan. 22	Complete closure, good movable soft palate.	1911. Speech good. First operation wound healed by granulation. Second operation for suture of uvula.
9	WILLIAM T.	$2\frac{1}{2}$	Soft and notch in hard. 15 mm. wide.	Feb. 11	Hard palate, minute hole just admitting probe; good movable soft palate, but rather short.	1905. Speech fair. Difficulty with S, G, Z Had undergone unsuccessful operation in infancy by another surgeon. Operation difficult on account of previous destruction of tissue.

* If more than one operation was performed, the age is that at the time of our first operation,

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
10	ROY A.	9	Soft and $\frac{1}{4}$ of hard.	1899 Mar. 5	Complete closure, good movable soft palate.	1911. Speech good. At school in Switzerland.
11	MARY T.	10	Soft and $\frac{1}{3}$ of hard. 12 mm. wide.	Mar. 27	Complete closure, good movable soft palate.	1905. Speech fair, K not good, reading poor.
12	MAUD J.	14	Soft and notch in hard. 18 mm. wide.	May 27	Immediately after operation a small hole. Patient not seen again.	1905. Patient cannot now be traced; date of last report, 1899.
13	ROSINA J.	9	Soft and $\frac{1}{3}$ of hard. 18 mm. wide.	May 27	Immediately after operation two minute holes and uvula ununited. Patient not seen again.	1905. Patient cannot now be traced; date of last report, 1899.
14	MINNIE N.	8	Cleft of soft palate, uvula destroyed by previous operation. 15 mm. wide.	May 1	Complete closure; soft palate, short and drawn up (result of previous operation) so that nasal cavity cannot be shut off.	1911. Three previous operations at three different London hospitals; all had failed. Speech bad. Works as a laundry maid.
15	ALICE M.	9	Soft and part of hard.	June 17	Complete closure, good movable, but rather short, soft palate.	Speech indifferent, but improving when last seen, in 1903. Previous operation at another hospital at age of two; complete failure. Has had rheumatic fever twice. In 1904 died of valvular disease of heart.
16	GLADYS M.	8	Soft palate. 10 mm. wide.	July 13	Complete closure, good movable soft palate.	1905. Speech fair. Can pronounce all consonants. A very backward child; defective eyesight; cannot read. Has had no training.
17	ARTHUR P.	14	Soft and part of hard. 8 mm. wide.	July 22	Immediately after operation small hole in front of uvula. Patient not seen since.	1905. Speech said to be much improved. Mentally defective.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
18	MINNIE M.	3	Soft and ¼ of hard. 8 mm. wide.	1899 Oct. 7	Complete closure, good movable soft palate.	1911. Speech good. Slight difficulty with S.
19	ELIZABETH D.	3	Soft and ¼ of hard. 7 mm. wide.	Oct. 21	Complete closure, except for minute hole; good movable soft palate.	1905. Speech fair, can pronounce nearly all consonants. Has had no training.
20	PATRICK D.	8	Soft and part of hard. 20 mm. wide.	Nov. 2	Complete closure, good movable soft palate.	1905. Speech fair; some difficulty with L. Mentally defective. Beginning to learn to read.
21	MARY A.	13	Complete, hard and soft. 15 mm. wide.	1900 Mar. 24	Complete closure, except for a hole barely admitting a probe.	1905. Speech good; greatly improved since operation. In 1908 she died in the country after an operation for acute appendicitis. (Letter from mother.)
22	MAY F.	11	Soft and ½ hard. 15 mm. wide.	June 14	Complete closure.	1905. Speech good but slight nasal twang remains.
23	MAY P.	6	Soft and ¾ hard. 16 mm. wide.	Sept. 22	Complete closure, good movable soft palate.	1911. Speech fair; much difficulty with G. Mentally defective.
24	GLADYS H.	4	Soft only. About 12 mm. wide.	Oct.	Complete closure; palate perfect as regards shape and mobility: soft palate rather tense.	1905. Speech fair; could be much improved by training.
25	AIM. E I.	4	Complete, hard and soft. About 13 mm. wide.	Nov. 1	Complete closure.	1905. Speech good. "Speaks very well when she takes pains." (Letter from mother.)
26	ELIZABETH R.	18	Soft and ¼ hard. 18 mm. wide.	Nov. 24	Wound broke down completely.	1905. Cannot now be traced. Was advised to come again for second operation, but did not do so.

No.	Name.	Age.	Nature and extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
27	EDGAR R.	6	Complete, hard and soft.	1901 Feb. 9	Post. half of cleft still ununited, forming narrow slit 4 mm. wide.	1901. Does not talk at all. Imbecile, deaf mute and very intractable. Operation done in hope that he might then learn to speak. Mental condition improved lately. Operation to be done again later.
28	WILLIAM M.	5	Soft and $\frac{1}{2}$ hard. 10 mm. wide.	July 1	Complete closure, good movable soft palate.	1907. Speech good.
29	VIOLET R.	$2\frac{4}{12}$	Complete, hard and soft. 12 mm. wide.	July 8	Complete closure; good movable soft palate.	1911. Speech good. First operation failed completely; second operation left only small hole. Has been carefully trained by mother.
30	MAUD B.	10	Complete, hard and soft. 15 mm. wide.	July 22	Complete closure; good movable soft palate, but a little drawn up.	1903. Speech good, except K and S.
31	ETHEL W.	16	Complete, hard and soft. 23 mm. wide.	Sept. 23	Complete closure; soft palate good and movable, but a little short.	1911. Speech good.
32	WILLIAM M.	2	Complete, hard and soft.	Sept. 30	Complete closure, good movable soft palate.	1911. Speech good.
33	GEORGE C.	8	Hole 15 × 10 mm., middle of palate left after operation elsewhere. Uvula destroyed by previous operation.	Oct. 14	Hole completely closed; good movable soft palate.	1905. Speech fair. Can pronounce all consonants. Operation a year previously at another hospital.
34	ROBERT N.	$11\frac{11}{12}$	Soft and $\frac{1}{4}$ hard. 15 mm. wide.	Oct. 14	Complete closure.	1905. Speech said to to be "much improved."
35	ETHEL C.	$2\frac{9}{12}$	Soft only. 10 mm. wide.	Dec. 16	Good movable soft palate; uvula rather short.	1911. Speech good.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
36	CAROLINE A.	14	Hole 9 × 4 mm., uvula and post. part of soft palate destroyed by previous operation elsewhere.	1902 April 21	A hole remained after operation. Not seen again.	1905. Cannot be traced. Two previous operations elsewhere; first a complete, second a partial, failure.
37	BENJAMIN B.	2¼	Soft and ¾ hard. 13 mm. wide.	June 2	Complete closure, uvula rather short.	1903. Speech good.
38	ALBERT S.	2½	Complete, hard and soft.	July 1	Complete closure. "Palate looks very well." (Letter.)	1905. Speech good. (Letter from father.) Speech still somewhat nasal (Dr. Armstrong, Blackgang, I. of W.)
39	AMY T.	11	Soft and ½ hard. 13 mm. wide.	July 21	Complete closure.	1911. Good; slight trouble with K and S.
40	FRANK G.	8	Soft and ½ hard. 16 mm. wide.	1903 Jan. 30	Complete closure, good movable soft palate; teeth very defective.	1905. Speech fair. Previous operation elsewhere had failed completely. Would improve greatly if properly trained and fitted with teeth. At work as an errand boy.
41	GEORGE F.	1 9/12	Complete, hard and soft. 13 mm. wide.	Mar. 3	Complete closure; good movable soft palate.	1911. Speech good.
42	LEONARD S.	4½	Complete, hard and soft. 14 mm. wide.	June 2	Complete closure, good movable soft palate.	1905. Speech fair, but still somewhat nasal. Can pronounce all consonants except K. Improving. Teeth very defective.
43	OLIVE P.	8	Soft and ½ hard. 15 mm. wide.	June 8	Complete closure, good movable soft palate.	1905. Speech good even with gutturals.
44	EMILY B.	5	Soft and ½ hard. 15 mm. wide.	June 22	Cleft still unclosed.	1905. Speech bad. Child mentally defective and very intractable. It was not thought desirable to attempt operation a second time.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
				1903		
45	RITA C.	8	Soft and ¼ hard. 13 mm. wide.	Oct. 12	Immediately after operation hole at junction of hard and soft palates.	1905. Cannot be traced.
46	EDITH B.	8	Complete, hard and soft. About 12 mm. wide.	Dec. 7	Complete closure, soft palate rather short.	1905. Speech bad as regards nearly all consonants, but much better than before operation. Teeth very defective. Could be much improved by training and by some artificial teeth.
				1904		
47	HERBERT B.	7	Soft only.	Feb. 1	Complete closure, good movable soft palate.	1911. Speech fair; K still bad. Stammers.
48	BEATRICE B.	3	Soft only. 10 mm. wide.	Mar. 17	Complete closure, good movable palate.	1905. Speech good (according to mother). 1906. Died from an accident (fall on the head).
49	HAROLD W.	5	Complete, hard and soft.	April 7	Complete closure.	1911. Had been a very delicate infant, the subject of hydrocephalus. Speech cannot be tested, as he is a deaf mute and talks only with his fingers.
50	FRANCES P.	10	Soft and ½ hard. 14 mm. wide.	June 20	Complete closure, good movable soft palate.	1905. Speech fair; much better than before operation; K and S bad. Mentally defective; cannot read.
51	GWENDOLINE H.	2½	Soft and notch in hard. 6 mm. wide.	July 22	Complete closure, good movable soft palate.	1911. Speech fair. Father says speech continues to improve. Still difficulty with K and S.
52	JOHN H.	8	Complete, hard and soft. 10 mm. wide.	Aug. 2	Complete closure except a hole 6 × 2 mm. at junction of hard and soft palate; good movable soft palate.	1905. Speech bad. Has had no training at all. Advised to have hole closed, but father thinks it "unnecessary."

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
				1904		
53	EDITH S.	$3\frac{0}{12}$	Complete, hard and soft. 8 mm. wide.	Aug. 4	Complete closure, good movable soft palate.	1907. Speech fair; improving.
54	MARGARET S.	$3\frac{5}{12}$	Soft and notch in hard. 8 mm. wide.	Aug. 5	Complete closure, good movable soft palate.	1907. Speech fair; improving.
55	JOAN S. W.	8	Soft and $\frac{1}{2}$ hard. 18 mm. wide.	Oct. 20	Complete closure, good movable soft palate.	1911. Speech good.
56	ELLEN P.	14	Soft and $\frac{3}{4}$ hard. 15 mm. wide.	Dec. 12	Complete closure, good movable palate.	1911. Speech good.
				1905		
57	EDWIN B.	$2\frac{11}{12}$	Soft and notch in hard. 10 mm. wide.	Feb. 6	Complete closure, good movable palate.	1911. Speech good.
58	ALEC R.	$2\frac{7}{12}$	Complete, hard and soft. 10 mm. wide.	Mar. 6	Complete closure, good movable soft palate.	1911. Speech on the whole good, but he still has difficulty with D and initial T, K and G. Much dental irregularity.
59	AMELIA D.	12	Soft and $\frac{1}{4}$ hard. 11 mm. wide.	Mar. 13	Complete closure, except one small hole at junction of hard and soft palate; good movable soft palate.	1906. Speech not yet improved. Mentally defective; vision poor.
60	MERVYN H.	$2\frac{1}{2}$	Complete, hard and soft. 13 mm. wide.	Mar. 20	Hole anterior part of hard palate; good movable soft palate.	1911. "Speaks fairly well." (Letter from mother.)
61	CORNELIA B.	$3\frac{1}{2}$	Soft and $\frac{1}{4}$ hard. 10 mm. wide.	April 17	Complete closure, good movable soft palate.	1912. Speech fair. Has had no training. Advised to have lessons in articulation.
62	ANNIE H.	$2\frac{9}{12}$	Soft and $\frac{3}{4}$ hard. 12 mm. wide.	May 8	Immediately after operation hole 9 × 5 mm. at junction of hard and soft palate.	1911. Not seen since leaving hospital.
63	GEORGE F.	$3\frac{1}{2}$	Soft, with post part of hard very thin, but not actually cleft. 12 mm. wide.	May 19	Complete closure, good movable soft palate.	1911. Speech good.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
64	WILLIAM R.	9	Soft and ½ hard. 6 mm. wide.	1905 May 29	Complete closure, good movable soft palate.	1908. Speech good.
65	SHEILA L.	3	Soft and notch in hard. 10 mm. wide.	June 29	Complete closure, good movable soft palate.	1911. No recent report of speech.
66	CHARLES F.	$3\frac{10}{12}$	Soft and ¼ hard. 11 mm. wide.	July 3	Complete closure, good movable soft palate.	1911. Speech good.
67	DORIS C.	$2\frac{7}{12}$	Soft and notch in hard. 9 mm. wide.	July 3	Immediately after operation small hole at junction of hard and soft palate.	1911. No recent report of palate or speech.
68	HERBERT B.	4	Complete, hard and soft palate. 10 mm. wide.	Oct. 9	First operation, closure of soft palate. Second operation, closure of hard palate.	March 1911. A very small hole still remains at anterior end of the hard palate. Not a very satisfactory case; teeth defective, home surroundings very poor. Speech fair, but not as good as it might be. Has improved much in last year or two.
69	WILLIAM T.	12	Complete, hard and soft palate, but alveolar portion closed spontaneously. 13 mm. wide.	Oct. 16	Complete closure; good movable soft palate.	Feb. 1911. Speech good; slight trouble with S, SK, ST, and initial T. At work as a van boy.
70	EMILY A.	$3\frac{2}{12}$	Hard and soft, but not alveolar border. Rounded anterior end. 18 mm. wide.	Oct. 23	Complete closure; soft palate closed after first operation. Hard palate closed after second operation. Soft palate rather short, moves fairly well.	A very wide cleft at first operation; no attempt made to close anterior part of the cleft. Child mentally deficient, dirty in habits, dull and apathetic. 1911. Speech poor. Mental condition improved; cannot read, but knows some letters.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
71	ESTHER S.	$3\frac{6}{12}$	Soft and posterior ¼ of hard. Uvula destroyed by previous operation elsewhere. 13 mm. wide.	1905 Nov. 13	Complete closure, good movable soft palate, but rather short (from previous destruction of tissue).	Previous operation on palate elsewhere in infancy, followed by non-union and good deal of destruction of tissues. April 1911. Speech fair. Cannot say initial S, T, Z, K, Sh, or St. Cannot recite. Had no special training.
72	MAY W.	7	Soft and ½ hard.	Dec. 4	Complete closure, good movable soft palate.	June 1911. Speech "fairly good." Still has trouble with CH, B, J, D, S, F, Has had no lessons in articulation. Mother says "speech has improved enormously since operation." (Mr. H. Blakeway.)
73	ARTHUR K.	3	Complete, hard and soft palate; spontaneous closure of alveolus. 15 mm. wide.	1906 Jan. 22	Complete closure, good deal of contraction and stiffness of soft palate, result of destruction from previous operations.	Previous operations at 4 months and 8 months by other surgeons; both complete failures. April 1911. Speech fair. Can pronounce all consonants, but still has slight nasal intonation. No training, but has careful mother. Jan. 1912. Speech improved still more.
74	HANNAH W.	16	Central oval (7 mm. × 5 mm.) at posterior part of hard palate; bifid uvula.	Jan. 30	1910. Hole much smaller but not completely closed.	1911. Not seen lately. Speech said to be much improved. Published *Trans. Clin. Soc.*, 1906.
75	JANE J.	9	Soft and ¼ hard. 13 mm. wide.	Feb. 12	Complete closure, good movable soft palate.	On the fourteenth day smart secondary hæmorrhage, occurred once only; good recovery. Feb. 1911. Speech good; S is practically the only consonant with which she has difficulty.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
76	MONTAGUE H.	$2\frac{1}{2}$	Complete, hard and soft palate. 12 mm. wide.	1906 Mar. 13	Complete closure, good movable soft palate.	1911. Speech good; has been carefully trained by mother.
77	RICHARD G.	6	Complete, hard and soft palate. 11 mm. wide.	Mar. 20	Complete closure except for tiny hole at front of hard palate.	March 1911. Not seen by me since 1908, but Dr. Selby of Teynham writes: "Result has been superlatively good." May 1911. Father writes: "Result of operation a decided success."
78	GLADYS M.	3	Complete, hard and soft palate. 15 mm. wide.	June 1	Complete closure, good movable soft palate; much irregularity of alveolus and teeth.	? Operation on palate elsewhere in infancy. 1911. Speech poor, no training; poor home.
79	IVY L.	2	Soft palate. 6 mm. wide.	June 25	Complete closure, good movable soft palate.	June 1911. Speech good; no training; poor home.
80	FREDERICK B.	6	Soft and post $\frac{1}{4}$ hard palate. 12 mm. wide.	July 2	Complete closure	June 1911. Speech fair; had only a few lessons in articulation. Can pronounce all consonants. Mother says he speaks "much better than before operation."
81	HARRIET F.	21	Complete, hard and soft palate, except for a narrow bridge, result of previous operation. 10 mm. wide.	July 2	Complete closure.	Previous operations elsewhere at 8, 11, and 13 years. 1911. Cannot be traced. Believed to be in service somewhere.
82	EMRYS P.	$3\frac{1}{2}$	Soft palate. 12 mm. wide.	July 16	Complete closure.	April 1911. Not seen since leaving hospital, but Dr. W. J. Lewis reports: "Palate appears anatomically good, but the greater part of the voice comes out through the nose." Speech apparently bad; patient seems to have had no training at all.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
				1906		
83	ALBERT B.	7	Soft palate. 12 mm. wide.	July 23	Complete closure, good movable soft palate.	May 1911. Speech good.
84	GLADYS H.	16	Soft and $\frac{3}{4}$ hard palate. 18 mm. wide.	Oct. 15	Soft palate united, large hole in hard palate.	Infection of wound; empyema developed four weeks after operation; good recovery. June 1911. Heard of recently, but not seen since discharge. Parents unwilling to allow completion of operation.
85	AUGUSTUS A.	6	Soft and post. $\frac{1}{4}$ hard palate. 5mm. wide.	Nov. 21	Complete closure, good movable soft palate.	May 1911. Speech good; some difficulty with G and final ST.
86	EMILY T.	$12\frac{5}{12}$	Soft palate and post. $\frac{1}{4}$ hard palate. 15 mm. wide.	Dec. 3	Complete closure, good movable palate.	Two previous operations elsewhere, at 9 months and $4\frac{4}{12}$ years. Both failed completely. May 1911. Speech good.
87	ALFRED W.	11	Complete, hard and soft; spontaneous closure of alveolus. 15 mm. wide.	Dec. 17	Complete closure, good movable soft palate.	May 1911. Speech good.
88	WM. RICH. B.	$2\frac{3}{12}$	Complete, hard and soft palate. 9 mm. wide.	Dec. 31	Complete closure except for small hole at anterior end of hard palate when last seen.	1911. Not seen recently, cannot now be traced.
				1907		
89	MATHILDE A.	9	Complete, hard and soft palate; spontaneous closure of alveolus. 15 mm. wide.	Mar. 11	Complete closure except small hole junction hard and soft palate soon after operation.	1910. Has returned to France. 1911. Speech much improved since operation (letter).
90	MAUD H.	$1\frac{5}{12}$	Soft palate. 10 mm. wide.	May 7	Complete closure, good movable soft palate.	1910. Speech good.
91	DORIS C. V. D.	$6\frac{1}{12}$	Complete, hard and soft palate. 12 mm. wide.	June 7	Closure.	1911. Not seen since operation; cannot now be traced.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
				1907		
92	JOHN I.	$2\frac{1}{12}$	Complete, hard and soft; spontaneous closure of alveolus. 10 mm. wide.	June 15	Complete closure except for minute hole; good movable soft palate.	1911. Slightly mentally defective. Speech poor.
93	HETTY M.	$2\frac{3}{12}$	Soft palate and post. $\frac{1}{4}$ hard. 11 mm. wide.	Sept. 6	Complete closure, good movable soft palate.	1911. Speech good.
94	CECIL REGINALD B.	$\frac{4}{12}$	Soft palate.	Oct. 7	Complete closure, good movable soft palate.	1911. Speech poor (Mr. H. Blakeway). In this case no lateral incisions were made.
95	GLADYS L.	10	Soft and post. $\frac{3}{4}$ hard. 20 mm. wide.	Oct. 14	Complete closure	Two surgeons, consulted previously, refused to operate. 1911. Gone to Canada; speech good when last heard.
96	CHARLES F.	$2\frac{6}{12}$	Complete, hard and soft palate; spontaneous closure of alveolus.	Nov. 4	Complete closure except for small hole in post. part of soft palate.	1910. Speech fair; improving.
				1908		
97	FRANK P.	2	Complete double, hard and soft 11 mm. wide.	Jan. 13	Complete closure except for small hole in hard palate.	1911. Speech good.
98	VICTORIA M.	$2\frac{5}{12}$	Soft palate and posterior $\frac{1}{2}$ of hard. 10 mm. wide.	Feb. 17	Complete closure, good movable soft palate.	April 1911. Speech good. Since gone to Australia.
99	IVY B.	9	Soft palate. 6 mm. wide.	Mar. 16	Complete closure.	1911. Cannot be traced.
100	JOHN W.	10	Complete, hard and soft.	Mar. 16	Complete closure, good movable soft palate.	1911. Speech good. Speech before operation almost unintelligible.
101	RUTH M.	$2\frac{1}{12}$	Complete, hard and soft palate.	Mar. 23	Immediate result: Hole at junction of hard and soft palate, otherwise complete closure.	1911. Cannot be traced.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
102	GEORGE W.	5	Soft palate. 15 mm. wide.	1908 Mar. 30	Complete closure, good movable soft palate.	1911. Imbecile. Speech necessarily defective. Mother says, "Talks ever so much better than before operation."
103	KATHLEEN T.	$1\frac{10}{12}$	Soft and $\frac{3}{4}$ hard; wide, rounded anterior end	Mar. 30	Complete closure, good movable soft palate.	1911. Speech fair; difficulty with B, D, and T.
104	ROBERT J.	$2\frac{6}{12}$	Complete, hard and soft.	April 15	Complete closure.	1911. Not seen recently; speech said to be good.
105	MARGARET G.	$\frac{2}{12}$	Soft palate.	May 18	Complete closure, good movable soft palate.	April 1911. Speech good.
106	CYRIL D.	$1\frac{6}{12}$	Complete, hard and soft.	June 1	Complete closure, good movable soft palate.	May 1911. Speech good.
107	DOROTHY W.	$3\frac{1}{12}$	Complete, hard and soft; spontaneous closure of alveolus. 14 mm. wide.	June 15	Complete closure, good movable soft palate.	May 1911. Speech good.
108	JOSEPH F.	$1\frac{6}{12}$	Soft palate.	July 20	Complete closure, good movable soft palate.	March 1911. Too shy to talk much. Speech appears to be good.
109	BASIL L.	$3\frac{1}{2}$	Soft palate. 13 mm. wide.	Oct. 12	Complete closure except for small hole.	April 1911. Speech improving. Still has difficulty with final S and Z. (Letter from father.)
110	DOROTHY S.	$6\frac{1}{2}$	Complete, hard and soft. 9 mm. wide.	Oct. 12	Complete closure, good movable soft palate.	April 1911. Can pronounce all consonants, but difficulty with G and SK. Dull mentally. No training. Mother says, "Speech has improved wonderfully."
111	GEORGE S.	12	Complete, hard and soft.	Oct. 12	Complete closure except for small hole behind incisors; good movable soft palate.	April 1911. Speech fair. Dull mentally. Further operation declined.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
				1908		
112	ALFRED S. W.	$1\frac{7}{12}$	Soft and $\frac{1}{4}$ hard. 10 mm. wide.	Oct. 24	Complete closure, good movable soft palate.	1911. Palate perfect; does not speak as well as he ought to. (Letter from Dr. Gray of Newmarket.)
113	ANNIE J.	6	Soft and post. $\frac{1}{2}$ hard. 15 mm. wide.	Nov. 2	Complete closure, good movable soft palate.	1911. No report of speech.
114	CONSTANCE G.	26	Complete, hard and soft.	Nov. 9	Complete closure, good movable soft palate.	May 1911. Speech good.
115	BERTIE B.	8	Complete, hard and soft; very wide at birth, but alveolar part closed spontaneously.	Nov. 11	Complete closure, good movable soft palate.	Mentally deficient; blind in one eye; has a very poor home, cannot read, and is much neglected. No special training; speech bad, but could certainly be greatly improved by careful training.
				1909		
116	ALBERT R.	3	Soft palate. 7 mm. wide.	Jan. 11	Complete closure.	1911. Cannot be traced.
117	HILDA ROSE B.	$1\frac{9}{12}$	Soft and $\frac{1}{4}$ hard.	Jan. 18	Complete closure, good movable soft palate.	1910. Mentally deficient; too young to test speech.
118	SILAS S.	$2\frac{3}{12}$	Complete, hard and soft. 15 mm. wide.	April 26	Complete closure.	March 1911. Not seen, but mother writes: "Boy speaks quite plain now; only a slight detriment in some words."
119	NELSON S. D.	$2\frac{7}{12}$	Complete, hard and solt palate.	May 17	Complete closure.	1911. Speaks fairly well; some difficulty with B, TH, M, and G. (Letter from Dr. George Tayler, of Trowbridge.)
120	CHARLES W. A.	10	Soft. 10 mm. wide.	June 6	Complete closure.	1911. Not seen recently.
121	LILIAN C.	6	Complete, hard and soft.	June 6	Still a small hole at junction of hard and soft palate.	July 1911. Speech much improved, but not yet good.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
122	CATHERINE S.	16	Soft and post. half of hard.	1909 June 14	Complete closure, soft palate rather short and not moving well.	1911. Speech good, difficulty with SK.
123	ALICE H.	$5\frac{7}{12}$	Soft palate. 12 mm. wide.	July 19	Complete closure, good movable soft palate. Minute hole front of soft palate.	Child mentally deficient. 1911. Speech fair. Difficulty with L, final S, and TL.
124	HAROLD A.	8	Complete, hard and soft palate, spontaneous closure of alveolus.	Oct. 4	Complete closure.	Previous operation elsewhere in early infancy. 1911. Speech fairly good; easily understood. Most difficulty with J. Still has nasal intonation. (Dr. J. P. Roughton of Kettering.)
125	JOHN E.	$2\frac{6}{12}$	Complete, hard and soft palate. 14 mm. wide.	Nov. 12	Complete closure except for one small hole at front of hard palate. Soft palate rather short.	Previous operation elsewhere. 1911. Speech fair—improving; should ultimately be quite good. Still has difficulty with D, T, G and B. Has a careful mother. Operation difficult on account of destruction of tissue at previous operation.
126	HENRY A.	$5\frac{6}{12}$	Soft palate. About 10 mm. wide	Dec. 13	Complete closure.	Two previous operations elsewhere, both unsuccessful. 1911. Not traced.
127	ETHEL M.	5	Soft palate and $\frac{1}{2}$ hard. 11 mm. wide.	Dec. 18	Complete closure except for a minute hole at back of hard palate.	Previous operation elsewhere 3 years ago. Nov. 1911. Speech fair. Operation very difficult on account of destruction of tissues at previous operation.
128	DOROTHY D.	$1\frac{11}{12}$	Complete, hard and soft palate.	1910 Jan. 19	Complete closure except for a small hole which will probably close spontaneously.	Poorly nourished child; kept in hospital two months before operation. Not seen since leaving hospital.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
129	EDITH P.	13	Soft and post. ½ hard. 20 mm. wide.	1910 Mar. 7	Complete closure, soft palate still rather stiff from scarring.	1911. Speech fair; K and SH bad.
130	WINIFRED B.	$2\frac{5}{12}$	Complete, hard and soft palate. 9 mm. wide.	Mar. 21	Good movable soft palate. Still a narrow slit at anterior end of hard palate.	Feb. 1911. Patient beginning to talk, but speech could not be tested.
131	ERNEST C.	$1\frac{9}{12}$	Complete, hard and soft palate.	April 13	Complete closure except for minute hole left after second operation; probably soon closed.	1911. Not traced.
132	LOUIS W.	6	Complete, hard and soft palate. 10 mm. wide.	April 19	Complete closure, good movable soft palate.	Previous operation elsewhere in infancy. April 1911. "Palate perfect; speech good." (Dr. H. Kerswill, of Sandwich.)
133	VIOLET F.	2	Soft palate. 6 mm. wide.	May 2	Complete closure.	1911. Not seen recently.
134	ALBERT E.	6	Soft palate.	May 9	Complete closure.	1911. Not seen recently; speech reported "good." (Dr. T. N. Kelynack.)
135	ALFRED B.	$1\frac{6}{12}$	Soft palate. 4 mm. wide.	May 23	Failed to unite; cause unknown.	1911. Mother refuses further operation.
136	ERIC B.	$4\frac{5}{12}$	Soft palate. 10 mm.	May 30	Complete closure except for minute hole ant. part of soft palate; good movable soft palate.	1911. Speech much improved, but not yet good; mentally deficient.
137	REGINALD R.	$\frac{7}{12}1\frac{3}{12}$	Complete, hard and soft palate. 9 mm. wide.	July 24	Soft palate broke down after first operation; union after second operation 1911. Still a small hole behind incisors.	Jan. 1912. Beginning to speak well.
138	LILIAN M.	6	Soft palate and post. ½ in. of hard. 18 mm. wide.	Nov. 7	Still a small hole at junction of hard and soft palate.	1911. Speech fair.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
139	JOHN M.	$1\frac{1}{12}$	Complete, hard and soft palate. 9 mm. wide.	1911 Feb. 27	Complete closure. Good movable soft palate.	1912. "Result most satisfactory: does not yet talk." (Dr. Salt of Wingham.)
140	WILLIAM C. B.	13	Soft palate.	Mar. 3	Complete closure, good movable soft palate.	July 1911. Mother says: "Speech already much improved."
141	EDWD. HUGH G.	$1\frac{6}{12}$	Complete, hard and soft palate. 14 mm. wide.	Mar. 13	Complete closure.	1912. Too young to speak.
142	GWENDOLINE C.	1	Soft and $\frac{3}{4}$ hard, round anterior end. 10 mm. wide.	Mar. 20	Complete closure except for small hole anterior part of hard palate; good movable soft palate.	Jan. 1912. Not begun to speak yet.
143	GEORGE W.	$1\frac{3}{12}$	Complete, hard and soft palate.	April 3	Complete closure.	1912. Too young to speak.
144	CLARA W.	10	Complete, hard and soft; spontaneous closure of alveolar margin.	June 14	Complete closure, good movable soft palate.	1912. No report since operation.
145	SYLVIA D.	6	Soft palate and post. third hard. 10 mm. wide.	June 19	Complete closure except for minute hole anterior part not yet quite healed.	Dec. 1911. Still has "a very small hole in the palate, the size of a pin's head. Can talk quite nicely." (Letter.)
146	ROLAND H.	$1\frac{3}{12}$	Soft and $\frac{3}{4}$ hard.	July 10	Complete closure.	1911. Too young to speak.
147	PHYLLIS MCK.	$2\frac{6}{12}$	Soft palate. 6 mm. wide.	July 12	Complete closure, good movable soft palate.	Jan. 1912. Beginning to talk.
148	JOHN K.	$2\frac{5}{12}$	Soft palate. 6 mm. wide.	July 17	Nov. 1911. Complete closure, good movable soft palate.	Nov. 1911. Too young to test speech.
149	DOROTHY L.	2	Soft palate 10 mm. wide.	July 31	Complete closure.	Jan. 1912. Too young to speak.
150	BERNARD W.	$2\frac{1}{2}$	Complete, hard and soft.	Oct. 16	Complete closure except for small hole in hard palate, which will probably soon heal spontaneously.	Jan. 1912. Too young to speak.

No.	Name.	Age.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate Result of Operation.	Remarks.
151	FREDERICK N.	8	Soft palate.	1911 Nov. 6	Complete closure, good movable soft palate.	First two operations (without lateral incisions) failed, the third (with one lateral incision) was completely successful. Recent case.
152	LILY M.	11	Soft and $\frac{1}{2}$ hard.	Nov. 13	Complete closure, good movable soft palate.	Too recent to test speech.
153	JULIO S. M.	$1\frac{1}{12}$	Complete, hard and soft.	Nov. 27	Complete closure, good movable soft palate.	1912. Too young to speak.
154	JOHN K.	$2\frac{7}{12}$	$\frac{3}{4}$ soft and hole in hard palate.	Dec. 28	Complete closure (letter).	Operation elsewhere about one and a half years ago resulted in partial closure and considerable narrowing of the cleft.

APPENDIX III

TWELVE CASES OF CLEFT PALATE OPERATED UPON BY MR. LEGG FROM 1905 TO 1910

No.	Name.	Age at time of Operation on Palate.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
				1905		
I.	Eva B.	13	Soft and nearly whole of hard palate. Greatest width, 24 mm.; low arch.	Nov. 23	Complete failure.	The amount of tissue on each side of the cleft was very small.
				1906		
II.	Edith D.	13	Soft and posterior part of hard. Greatest width, 12 mm.	Feb. 3	Union throughout except part of uvula.	Cannot be traced.
III.	George B.	3	Soft and most of hard palate. Greatest width, 18 mm.	Mar. 21	Small hole in soft palate.	1911. Cannot be traced.
IV.	Alfred B.	14	Soft and $\frac{3}{4}$ of hard. Greatest width, 10 mm.; high arch.	Sept. 5	Complete closure, good movable soft palate.	1912. Speech good.
V.	Lily P.	9	Soft and post-part of hard palate. At three years of age had been operated on.	Dec. 10	Complete closure; good movable soft palate.	Jan. 1912. Speech good.
				1908		
VI.	Martha L.	4	Soft palate. Had been operated on at two years. Cleft of hard palate closed.	Aug. 18	Complete closure.	1912. Cannot be traced.
VII.	James R.	3	Complete, hard and soft palate.	Sept. 3	Small hole at anterior end of uvula.	1912. Speech bad; has not been trained.
VIII.	Harry S.	10	Soft palate only. Greatest width 10 mm.	Nov. 16	Complete closure.	Feb. 1912. "Does not speak plainly."

No.	Name.	Age at time of Operation on Palate.	Nature and Extent of Cleft Palate.	Date of Operation on Palate.	Ultimate result of Operation.	Remarks.
IX.	LILIAN M. W.	$10\frac{3}{12}$	Soft and greater part of hard. Greatest width, 17 mm.	1908 Nov. 23	Small hole at junction of hard and soft palate.	Secondary hæmorrhage on 9th day; stopped by pressure. No report of speech.
X.	WM. B.	2	Complete, soft and hard palate.	1910 (1) Mar. 6; (2) June 22; (3) Mar. 18, 1911.	After 1st operation anterior part healed; the remainder gave way. After 2nd operation line of union again opened up. Two small holes were left after 3rd operation.	Nov. 1911. Speech good; is being carefuly trained.
XI.	LILY W.	18	Median, soft and greater part of the hard palate. Maximum width, 18 mm.	Aug. 22	Soft palate closed.	Soft palate only operated on. Further operation not been performed on account of nasal discharge, &c.
XII.	LILIAN W.	7	Complete, hard and soft palate.	Aug. 23	Hole at anterior part of hard palate.	Further operation has been impossible as the child has been lost sight of.

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