Heredity versus practice / by Lilian Lindsay.

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With kind regards
Lilian Lindsay

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HEREDITY
versus
PRACTICE

by

Dr. LILIAN LINDSAY
C.B.E., LL.D., M.D.S., F.D.S., R.C.S. Eng., H.D.D., L.D.S. Edin.

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HEREDITY VERSUS PRACTICE*

By Dr. LILIAN LINDSAY, C.B.E., LL.D., M.D.S., F.D.S., R.C.S. Eng., H.D.D., L.D.S. Edin.

FIRST I MUST EXPRESS my profound appreciation of the high honour you have conferred upon me by asking me to address you at this Northcroft Meeting, and my indebtedness to our first president Mr. Badcock for his valuable advice as to the construction of this paper.

The Council of this Society showed wisdom and foresight when they resolved that one meeting every year should be called the Northcroft Meeting, for this will ensure that our founder will be held in remembrance as long as this society exists.

In his inaugural address Dr. Northcroft said, " let us seek to harmonise divergent opinions." In an endeavour to follow this injuction I have chosen two texts from the Old Testament because they seem to me to express the eternal struggle of practice to endeavour to counteract the influence of heredity ; and also that they comprise the history of orthodontics. The first text is from the preacher, the pessimist, the worldly wiseman who said " That which is crooked cannot be made straight." The other is from the prophet, the optimist, whom Schopenhauer called the other-worldly wiseman who said " The crooked shall be made straight,"

That Dr. Northcroft was a man of wide vision is shown by his choice of a title for this society " the study of odonto prosopic orthopaedics " which, much to his regret, was replaced by the present title the study of orthodontics ; " as if " he said " mal-occlusion were the be-all and end-all of this study."

His Dental Board Lecture might be considered as his confession of faith for in it he dealt with his conviction that the study of the development of the whole body and the consideration of the normal, what it is and why, was the only way to attain to the understanding of the irregularities of the teeth.

This problem of the normal or, as the ancients called it the natural, has occupied the minds of philosophers throughout the ages. Hippocrates agreed that the heads of men were not all like one to another, and he laid it down that the bones should be measured according to the size of the head, not that all bones do arise from the head but because all bones should answer proportionably to those to which they are articulated. Works on anatomy generally started with shapes of the head and the " Fabrica " of Vesalius is no exception. Vesalius describes five different shapes starting with the natural. There were heads which bulged out at the back, others bulged out in front, and one belonging to a beggar in Bononia who had a head four square. Speaking of those heads which come to a point in front which he calls *acuminata* he says Thersites had such a head and mentions the Greek word used to describe it as " phosos " — a flame, (but he prefers the word oxycephalon).

Chapman's translation of that passage in the Iliad excites the same exhilaration as that described by Keats

* *Northcroft Memorial Lecture, read before the British Society for the Study of Orthodontics in October*, 1948.

" The filthiest Greek who came to Troy,
he had a goggle eye,
Stark lame he was in both his feet ?
his shoulders were contract
Into his breast, and crooked withal,
his head was sharp compact."

This is a good description of oxycephaly.

Writing in " Airs and Places " Hippocrates described a race living by the Sea of Azov whom he calls macrocephali because of their long heads which tradition ascribed to moulding at birth, because " they consider those the noblest who have the longest heads." Hippocrates argues, as if he were Darwin trying to convince himself that acquired characters can be fixed and transmitted " Thus at first usage operated and this constitution might be considered the result of force ; but after a time it became natural and usage had nothing to do with it." He proceeds as if he were the Abbé Mendel " for the semen comes from all parts, the sound from the sound parts and the unhealthy from the unhealthy parts and children with blue eyes are produced by parents with blue eyes, and if it be true of some parts why should it not be true of others and children with long heads be produced by parents with long heads ? "

Two thousand years later Emile Littré excavating in the Crimea discovered several tumuli containing skeletons of a race with peculiar heads, noticeable by the onlookers as well as the scientists, these heads were of extraordinary height compared with the base. Littré decided that these skeletons belonged to that race which Hippocrates called macrocephali.

It struck me when listening to Professor Harris last year that the genes carrying the characters of oxycephaly might have originated with these people and have been disseminated throughout the world, as suggested by Camper when discussing similar peculiarities, by the migrations of peoples, by shipwreck, by seafaring, by warfare and by trade.

There was Thersites among the Achaians in the Greek army, and the Achaians migrated into Greece from the North ; there was Pericles the great ruler of Athens whose head was a constant source of ridicule among the comedians ; Quintilian says " Pericles had an acuminated head, words thronging out not peacably as other men's." This gift of words is another feature, for although the words of Pericles were noble ones those of Thersites were " unregarded." There were those oxycephalics recorded by Vesalius and in this country in 1616 Helkiah Crooke mentioned in his ' Microcosmographia ' " Myself have seen a wondrous head in Lincolnshire like to the roof of a house neere to a sharpness all the way through, that boy was a foole and a wondrous great eater." He adds as if they were not uncommon " heads that are acuminated and like a sugar loaf have high roof of the palate." This agrees with the theory propounded by Professor Arthur Thomson in 1923 that when the bones of the vault of the skull are high the palate bones must follow. This is another feature of oxycephaly and is recorded in most of the reported cases.

It is possible that this excessive height of the palate may be the cause of the harsh voice often associated with oxycephaly. Thersites was :—

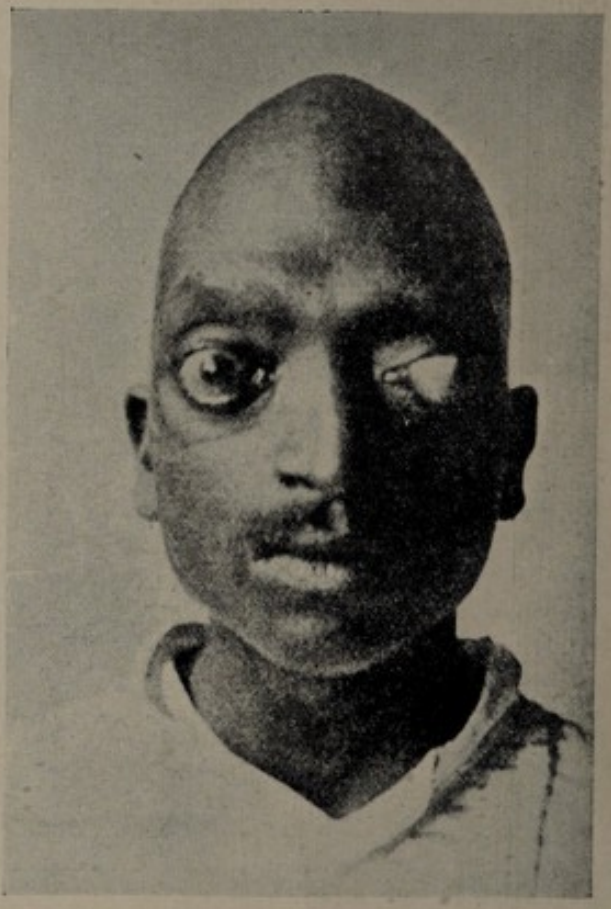


Fig. 1 (by kind permission of the Editor of *The Lancet*).

" A man of tongue whose ravenlike voice
a tuneless jarring kept
Who in his rank mind copy had of
unregarded words."

There were other historical figures who were noted for their " compact heads " for example the last king of France Louis Phillippe and his father Phillippe Égalité and there was Sir Walter Scott.

The first figure shows a Hindu with oxycephaly who was brought into the hospital at Bombay suffering from malaria; his goggle eyes attracted attention and a full report was made of his condition. He was otherwise well formed and intelligent, his palate was very high but the arch in front was good and the teeth were not crowded. There was a history of heredity in his family of this peculiarity. Park and Powers in America have collected records of 100 cases of oxycephaly. In some of their cases there were other peculiarities such as webbed fingers and toes, defects of the clavicle and elbow together with some of the other features of cleido-cranial-dysostosis such as shoulders folded across the chest as in the case of Thersites and supernumerary teeth as in the case reported in the *B.D.J.* by our President. In some of the skulls there was a sloping downwards of the floor of the orbit which the American authors decide is the cause of the protruding eyeballs.

I have emphasised this so-called abnormality which has been regarded as a dominant character, because it illustrates the persistance of the force of heredity and its influence heedless of sex, of race, of environment, or country ; there was a case as far away as Patagonia.

The same force of heredity is seen in other characters more familiar to the orthodontist, the prognathisms.

Parsons measuring Saxon skulls found superior prognathism such a constant feature that he decided that it must be a racial character. One thousand years before the Saxons this character was present in Egypt among the members of the eighteenth dynasty. Ahmose I, a powerful monarch who drove the Hyksos out of Egypt, is described by Ruffer as having a prognathous upper jaw and protruding teeth, a feature common to all the females of his line. The males also showed

Fig. 2

this prognathism as seen in his son, his grandson, his great-grandson and his great-great-grandson, Thutmose IV who shows this in a marked degree.

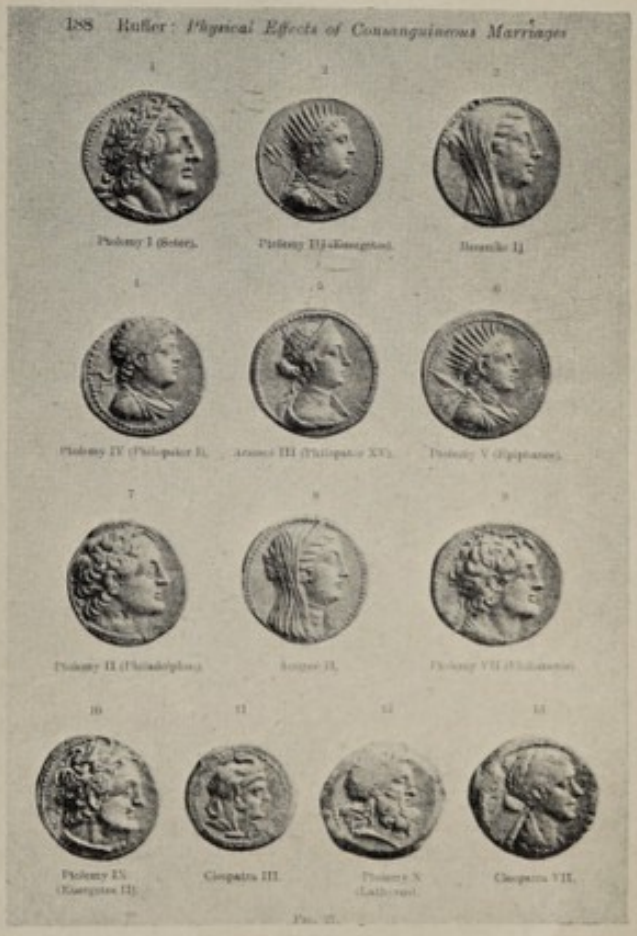


Fig. 3

When Alexander the Great conquered Egypt he left behind his great general Ptolemy Soter who, after the death of Alexander, became Satrap and later King. He was a great administrator as well as a great general, a patron of art, science and commerce and the founder of the famous library at Alexandria. His descendants show the inheritance of his features in characteristic fashion.

It would seem that the powerful lower jaw attended on the great for many of the outstanding figures in history have possessed it.

Fig. 4

William the Conquerer is described by his biographer as having a prognathous lower jaw and thick lower lip. He was strong mentally as well as physically, and may have inherited his jaw from his ancestress the daughter of the king of France who married the founder of the dukedom of Normandy, Rollo the Norseman.

Another strong character was Philippa of Hainault. There is a contemporary portrait of her by Bishop Stapledon who went to Holland. The bishop did not flatter the future queen when he said " the daughter of the Count of Holland is not uncomely ; her nose is smooth and even, save that it is somewhat broad at the tip and also flattened, yet it is no snub nose. Her nostrils are also broad ; her mouth fairly wide. Her lips somewhat full especially the lower lip. Her lower teeth project a little beyond the upper."

Fig. 5 (by kind permission of the Dean and Chapter of Westminster Abbey).

Through the courtesy of the Dean and Chapter of Westminster Abbey I have been able to obtain this photograph. The tablet on the tomb states that it is a portrait taken from life and it is evident that the sculptor has taken pains to show her projecting lower teeth. Phillipa was the daughter of William the Good, Count of Holland and Jeanne of Valois the daughter of the King of France, Phillippe le Hardi.

In 1911 a paper was read which has always remained in my memory, it dealt with mouth breathing and the Habsbourg jaw. This paper was by Mr. William Rushton, and I had the temerity to suggest in a paper in 1931 before this Society, that in their youth, as the Habsbourg's had adenoids, as shown in their portraits at that age, the constant throwing forward of the lower jaw to relieve this respiratory obstruction, caused stimulation at the temporomandibular joint and remoulding at the angle of the jaw, which Carl Breitner produced in Rhesus monkeys by intermaxillary traction.

This is well demonstrated in the contrast between the two lower jaws of Frederic III

and his son Maximillian ; the strong features of the father with the acute angle, with those of the son with the defective growth of the maxilla and the obtuse angle of the mandible. The portraits of the Habsbourgs show this adenoidal look and the open mouth described by Mr. Rushton.

Some of the Portuguese family showed signs of superior prognathism as in Catherine of Braganza whom Sir John Evelyn described " her teeth wronging her mouth by sticking a little too far out." John VI of Portugal had the short upper lip which exposed his centrals. There were other members who had the inferior prognathism of the Habsbourgs.

In all this strange eventful history the premaxilla has played many parts. It has had its exits and its entrances. Professor Brash at the end of his Dental Board Lectures said " It is suggestive that many of the true deformities and many of the worst irregularities of the teeth are in the region of the premaxilla which has a special developmental and evolutionary history."

The great impresario who introduced the premaxilla to the stage was Galen the idol of the world of medicine for 400 years. The passage referring to it in his works is so obscure that it has left a bone of contention for anatomists ; Goethe said that it must always remain in doubt as to whether Galen described the intermaxilla of a man or a dog. Vesalius, who was brought up in the Galenic tradition by the anatomist Jaques Dubois, sought to express his homage to the " Master " by illustrating his works. For this purpose he collected as much human material as possible. As he collected doubts arose which, when they became certainties that the premaxilla described by Galen was that of a dog, he published his findings. The medical world headed by Dubois, rose in wrath and words flew from both sides. At last Dubois who was a good anatomist, agreed as to the absence of the premaxilla from the human face, he capitulated and made an honourable retreat by saying that as Galen had described these bones as present in man's face they must have been there in his day but owing to increasing luxury they had been lost. Vesalius had the last word which has echoed down the corridors of time in that illustration in the " Fabrica " of the human skull superposed on that of the dog.

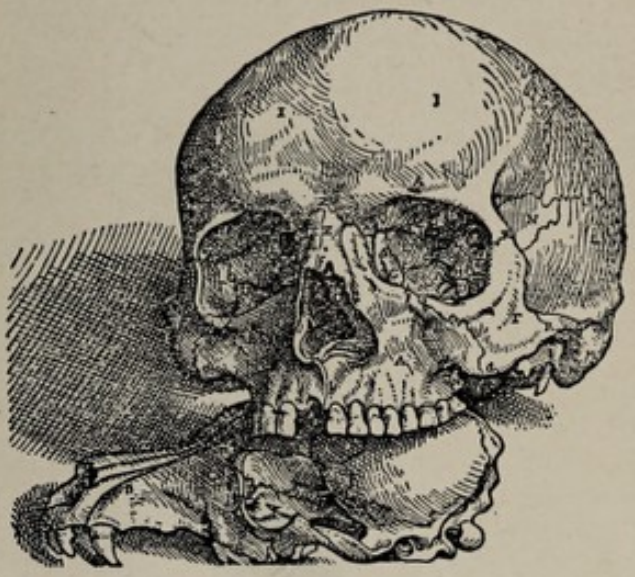


Fig. 6

Exit the inter or premaxilla for the next 200 years. Cheseldon does not mention it neither does so acute an observer as John Hunter. Camper who dissected the heads of infants and very small embryos declared that the premaxilla did not exist in man.

It was left to the great poet Goethe to re-introduce it. He described it in a classic article " there exists an intermaxilla in man as well as in animals." Goethe traces this element from fishes up to man and gives the most detailed description of these bones. He shows its struggle for existence in the faces of the different species and that its presence waxes and wanes according to the function exercised by the teeth in the front of the mouth. In those animals where the greatest force falls upon the incisors, as in rodents, there the premaxilla is best developed. It is mightiest in the mightiest as in the elephant. In the carnivores where the greatest strain falls over the carnassial teeth it is not so well developed ; in the horse it is quite slender for the chief stress falls over the molars and in the ruminants it is weak and furnished with cartilage instead of teeth.

In the extensive work of Leuckhart there are many illustrations especially of embryos in which it can be seen that there

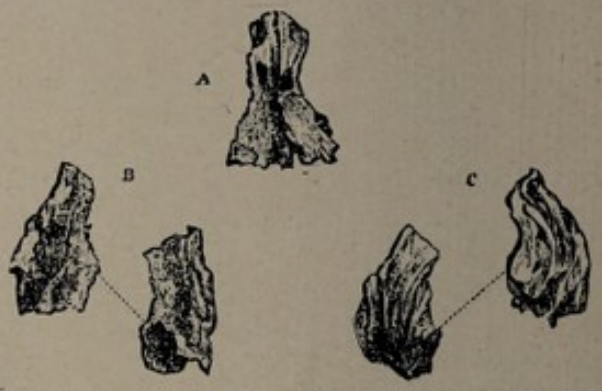
are differences on the two sides of the maxilla in the time of calcification of the premaxilla which may be the reason for some asymmetries. Leuckhart mentions that in fishes with one eye the premaxilla is rotated towards the blind side on which it is absent but when there are two eyes the premaxilla is equal on both sides. In a human skull showing complete eruption of one central and only partial eruption of the other there is, on the defective side, a spur of bone sent out from the premaxilla into the nose.

Professor Wood Jones has made an exhaustive study of these bones and the narial margins in man. He considers the absence of the premaxilla from the human face is an attribute peculiar to man which in the course of evolution has marked him off from the rest of the animal kingdom. The early coalescence of the premaxilla with the maxilla (4th week of intrauterine life) is evidence of its early phylogenetic acquirement. The reduction of the muzzle the elevation of the nasal bones, and the down growth of the maxilla have forced the premaxilla out of the face until it is a thin layer of bone over the sockets of the incisors.

Callender in a communication to the Royal Society mentioned a maxillary clip coming forwards in front of the premaxilla and so shutting it out from the face and at the same time obliterating any suture that there was between maxilla and premaxilla.

That marked feature in man the anterior nasal spine is formed during this process of obliteration, by the maxilla. This spine measures 5.5 mm. in Europeans, in the more prognathous 4.4 mm., in the Mongols 4 mm., in Australian aborigines 3.3 mm., and in Negroes 2.6 mm. The narial margins in the last three races are double and show a gutter and the nasal aperture is wide. Sir Arthur Keith drew attention to a point which he says he has not seen observed previously that at the 5th year the surface beneath the anterior nasal spine starts from the premaxillary element but that in the adult it starts from the anterior palatine canal, which process he likens to the cutting back of the anterior border of the ascending ramus of the mandible.

From time to time at rare intervals there are claims put forward of congenital absence of the premaxilla. Fischel describes a female skull in which the sagittal suture is obliterated and the appearance of the whole is hyperorthognathous. There are only the canines present in the front of the mouth which are separated by 8 mm. by a knife edge of bone there is no anterior nasal spine but the so-called foramen incisivum is present. The canines are sharply rotated so that their labial surfaces are turned to the anterior or mesial surfaces of the premolars ; the arch has lost its keystone. Sir Frank Colyer, to whom I am indebted for the suggestion to study this element and who has helped me greatly, has proved that some of these cases which appear to the casual observer as instances of congenital absence are in fact early cleft palate operations in which the premaxilla has been removed. Sir William Fergusson advocated this operation in cases of double cleft palate to facilitate the union of the two sides of the maxilla. Other cases have been recorded in the Journal of Anatomy but as Sir Frank Colyer pointed out these skulls show evidence of severe infection and in all likelihood the premaxilla has been exfoliated



A, anteria ; B, external ; C, internal view of the intermaxillary bones.

Fig. 7

as in the case recorded by Bryant in the Proceedings of the Pathological Society in 1858 of a child of four years after an attack of measles the whole of the premaxilla was exfoliated Bryant says, " The bones are the most perfect specimens I have ever seen."

Kolliker suggested that deficiency of the premaxilla was one of the causes of open bite.

In this study of the intermaxillary-maxillary suture Sir Frank Colyer will be remembered by the paper he gave to the E.O.S. in 1936 on " The Pathology of the Crowded Mouth," in which he showed as the result of study of the skulls in the R.C.S. museum that when the suture is closed at the age of 4 years there is crowding of the teeth, but that when it is open there is that much desired spacing of the milk teeth and the hope of regular teeth in the successors.

On this subject Professor Brash remarks " the true explanation of that relationship will, I believe, be found in general considerations of the relation of sutures to growth and particularly in the evidence that sutures tend always to close but are always in a constant state of reformation as surface growth takes place, evidence which points to the conclusion that the closure of a suture is not the *cause* but the *result* of a cessation of growth."

This is the case for the preacher. What have the followers of the prophet to say ?

It is to that restlessness, which has marked him out from the beginning that man owes any progress he has made. His dis-satisfaction with deviations from the straight and his desire to rectify them, is shown in stories of the loss of paradise. The flood story, that first experiment in eugenics was a determination to exterminate the unfit and to begin afresh by breeding only from the perfect in mind, body and estate.

The years flowed on into the centuries and deviations from the perfect appeared once more stimulating man's ingenuity to devise means for their rectification. Sophocles observed this when he wrote :—

All fertile in resource, resourceless never
Greets he the morrow ; only death he wants the skill to shun
But many a fell disease the healer's art hath foiled
So soaring far past hope the wise inventiveness of man
Finds diverse issues ; good or ill.

Towards the end of the 17th century a stalwart supporter of the prophet appeared in the person of the great Pierre Fauchard who announced that " the crooked *shall* be made straight." and proceeded to show his faith by his works. He met with the same excuses against repeated visits to the orthodontist as are offered today, that is, lessons and masters. These excuses did not deter Fauchard, he collected a few spectators and armed with his pelican he dragged the errant tooth into position to the amazement of all who beheld it. The other method was to tie the tooth or teeth to a strip of metal, gold or silver, and to renew the ties, tightening them every day. It is an error to call that piece of metal an expansion arch, for expansion never entered Fauchard's head. When the space was not large enough for the irregular tooth he made it large enough by filing the adjacent teeth. There was a prevailing opinion that filed teeth did not decay and lasted longer than those which are not so treated.

That habits and posture are responsible for irregulatriies is no new idea, for Camper relates that it was held that Dutchmen had long heads " because they lie upon their temples or their sides, and that Germans have round heads flat at the back because they lie upon their backs." " A particular manner of sitting or lying, of standing or walking, various corporeal defects and other circumstances of the like nature give a particular cast to the whole body. This is so obviously the case that the countenance of a deformed person will become deformed, that is it sinks gradually by the pressure of the brain which has now lost its equipoise. Thus the socket of one eye sinks lower than the other."

These defects were treated then as now by physical exercises in academies and colleges equipped with suitable appliances.

It was natural that irregularities of the teeth should attract the attention of John Hunter who was the first anatomist to devote an entire treatise to the natural history and diseases of the teeth. His experiments on the growth of bone led him to state that after the eruption of the full temporary dentition growth ceased in that part of the jaws and that if it had not been sufficient to accommodate the permanent successors there would be irregularity in that part especially the upper. To counteract this lack of room he suggested the extraction sometimes of the bicuspids sometimes of the first permanent molars " before the temporary grinders are shed."

He did not however ignore that room could be made by mechanical means and made the profound observation " the very principle upon which teeth are made to grow irregularly is capable, if properly directed, of bringing them even again. This principle is the power which many parts (especially bones) have of moving out of the way of mechanical pressure."

In this work there is the first suggestion as to expansion which may not have been original since it is certain that Hunter worked with James Spence, Hunter says " if a cross bar was to be stretched from side to side across the roof of the mouth between cuspis and cuspis it would widen the circle." He goes on to say that the teeth may be ligatured to this but that it is troublesome.

All this time inventions multiplied but it is evident that only fixed appliances were used.

We read of the little Empress of Brazil shedding tears as Cartwright tightens the braces on her teeth and she is told that royalty must learn to suffer and be strong. Mothers exhorted their weeping daughters " il faut souffrir pour etre belle." The force applied seemed to increase with the passage of time.

Kneisel in 1836 published a book devoted entirely to irregular teeth. He made an attempt at rough classification of these irregularities. He was meritorious in that he took impressions of the mouth and cast models from these. For some inscrutable reason he poured them first in sulphur before plaster and afterwards in fusible metal, with counter die.

All this in order to strike up a cap to which to attach a spur to bring an in-standing tooth into line. Six years later Schange in 1842 published another work on irregularities. He deplored the early extraction of the temporary molars and like his modern successors attributed many of the irregularities of the permanent teeth to this operation. He devised cribs with occlusal rests to prevent the cribs from slipping into the gum. To these cribs he soldered hooks for elastics sometimes on both sides buccally for the retraction of outstanding incisors.

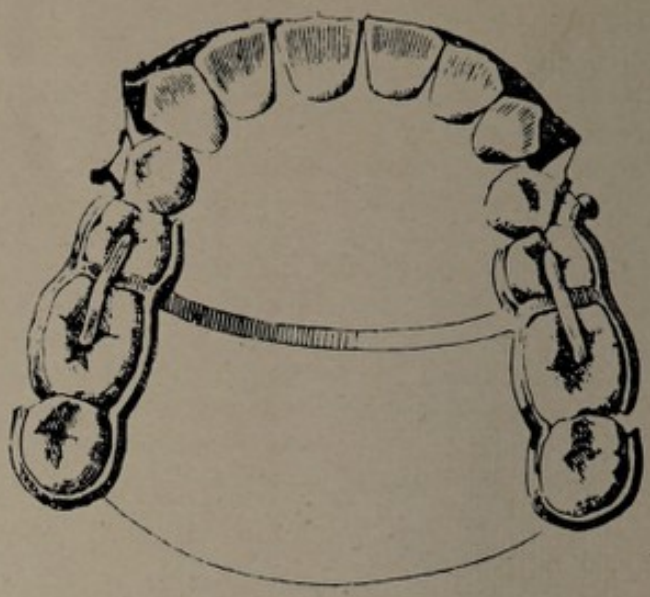


Fig. 8

Materials have had a notable effect upon the treatment of irregular teeth ; carved bone plates were suggested by their use for artificial teeth, indeed the whole practice has been copied from the mechanical training of the dentist in prosthetics. John Tomes mentions bone plates tied in but fitted with hickory pegs for pressing upon instanding teeth and it was not until the introduction of vulcanite that removable appliances came into use. It was about that time that Coffin introduced his expansion plate a split plate with a powerful piano wire spring in the centre, and piano wire became a favourite for springs.

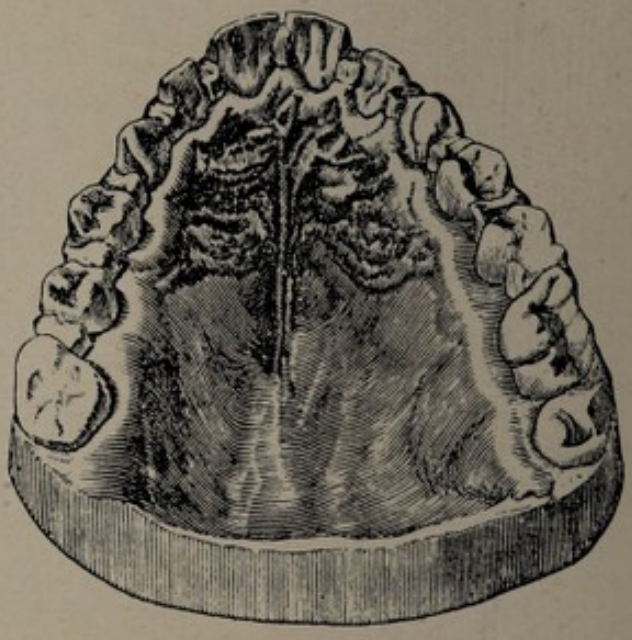


Fig. 9

Sometimes another method was employed for expansion by wedges, Norman Kingsley says " Wedges are also an important source of power." " By the proper adjustment of wedges they can be made to do more in the length of time than all screws, pulleys, levers or inclined planes." The rapidity with which this method worked is illustrated by the fact that in twenty days upper teeth in lingual occlusion could be forced into normal occlusion. Wedges were inserted between all the teeth. That this sometimes led later to disastrous loss of all the teeth with other more unfortunate

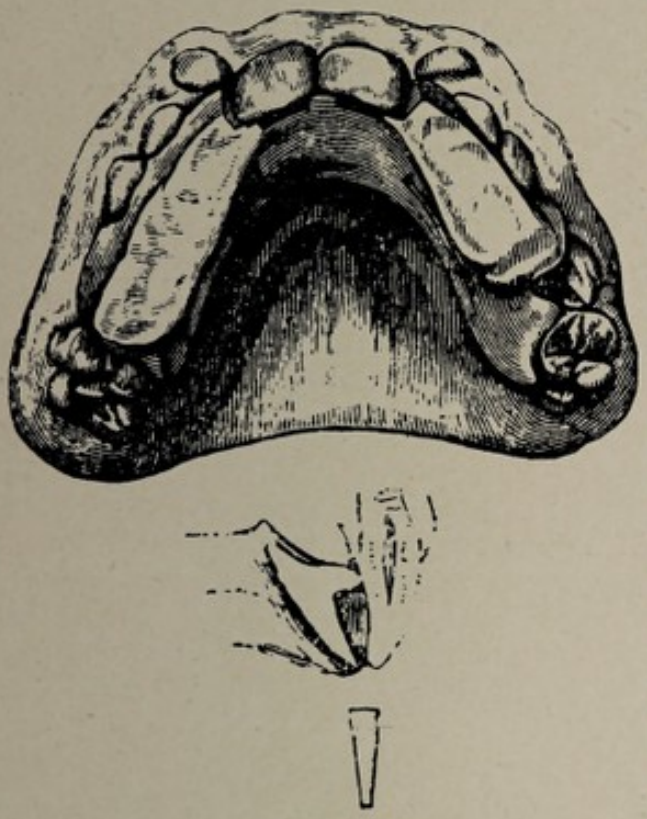


Fig. 10

results, has been recorded. Kingsley claimed " The individual features being naturally well formed and symmetrical the change in their relations produced a face of more than usual beauty." As the practice of this drastic measure seems to have died out it is evident that its dire effects were recognised.

Carabelli seems to have been the first, to classify occlusion, this was into eight classes mordex normalis, mordex rectus, mordex apertus, mordex prorsus, mordex retrorsus, mordex tortuosus, mordex senilis, os senile. To these we may now add a ninth from Professor Friel's classic work on occlusion, mordex infantile.

The mention of occlusion naturally brings to mind the name of Edward Angle who reduced these classes to three with divisions. His powerful personality in the world of orthodontics occupied the same position as did that of Galen in the world of medicine.

Perhaps his greatest claim to fame was as the first to establish a school for training orthodontists, not a mere post graduate course, but a full specialist education for the practice of orthodontics. Students resorted to this school from all parts of the world and in this way his teaching became almost universal, and he was a bold man who would gainsay that teaching. Such a man was William Rushton who showed (contrary to Angle) that beauty of face could exist associated with malocclusion, and that the retention of the full complement of thirty teeth so far from enhancing may mar that beauty.

The great psychologist and physiognomist Dickens emphasised this with wearisome reiteration in the character of Carker in Dombey and Son " An unbroken row of gleaming teeth whose whiteness and regularity were quite distressing . . . his smile had something in it of the snarl of a cat."

Nevertheless the followers of Angle held extraction of a tooth a violation of the laws according to Angle. So great was that influence it engendered a kind of bigotry among his followers and when Mr. J. H. Badcock went to the Orthodontic Congress in 1926 to read a paper on the value of extraction in the treatment of irregularities he was regarded as bearding the lion in his den.

Mr. Rushton held that mouth breathing was responsible for much irregularity and Warwick James, Northcroft and Dickin designed mouth screens for wearing at night.

Robin with his monobloc and Andresen with his Norwegian system are of the same category.

Outstanding among those who base their treatment upon the laws of the physiology of the tissues is Sim Wallace,

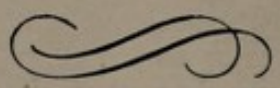
who gave fresh impetus to treatment by prevention by insisting on natural feeding from birth onwards. Breast feeding is the great stimulant to growth at the maxillary intermaxillary-suture keeping the suture open by a stimulus to surface deposition. In this Dr. Wallace is supported by the observations of Sir Frank Colyer that the wise encouragement of mothers to give their infants bones to gnaw and tough things to chew as soon as the teeth have erupted, and the abolition of slops from the diet of the young, may encourage the crooked to become or to grow straight.

In spite of all this milder teaching, drastic measures held the field until there came a warning voice as to the effects of so much force upon the supporting tissues, when Albin Oppenheim published the results of his researches. Then came the war 1914-18 when orthodontics went into abeyance. Once more materials brought in a revolution in appliances, the introduction of stainless steel made possible the adoption of the milder methods advocated by Oppenheim and gave orthodontists with the ingenuity of Professor Friel the chance to exercise it in devising delicate springs which would act gently but continuously and avoid the dangers enumerated by Oppenheim.

For many years Mr. Chapman has urged the study of the normal and those seeming divergencies from it which are merely phases in normal development; in so doing he was bringing into remembrance the maxims of Fauchard that it requires great experience to know when to operate but much greater experience to know when not to operate.

Taking a survey of the whole field of orthodontics, and particularly that part of it which concerns aetiology, it is a matter of pride to reflect that the most important contributions in that sphere have come from our own anatomists John Hunter, Sir Arthur Keith, Professor Wood Jones and particularly Professor Brash in his Dental Board Lectures and when he summed up in favour of heredity, a distinguished orthodontist exclaimed " Yes but hang it all we have to treat these conditions."

It is in that treatment that reconciliation may be found between the followers of the preacher and those of the prophet, by natural feeding, by judicious extraction, by those saner methods of treatment evolved after long research, by surgery in those grosser forms of malocclusion, surgery both operative and plastic with the aid of prosthetics, (even oxcephaly has been successfully relieved by surgery) or it may be by those methods shadowed forth in the inaugural address of our President, that the last part of the prophet's sentence may be fulfilled " and a highway shall be there."



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