The physiology of plastic surgery / by Edward H. Bennett.

THE PHYSIOLOGY

OF

PLASTIC SURGERY.

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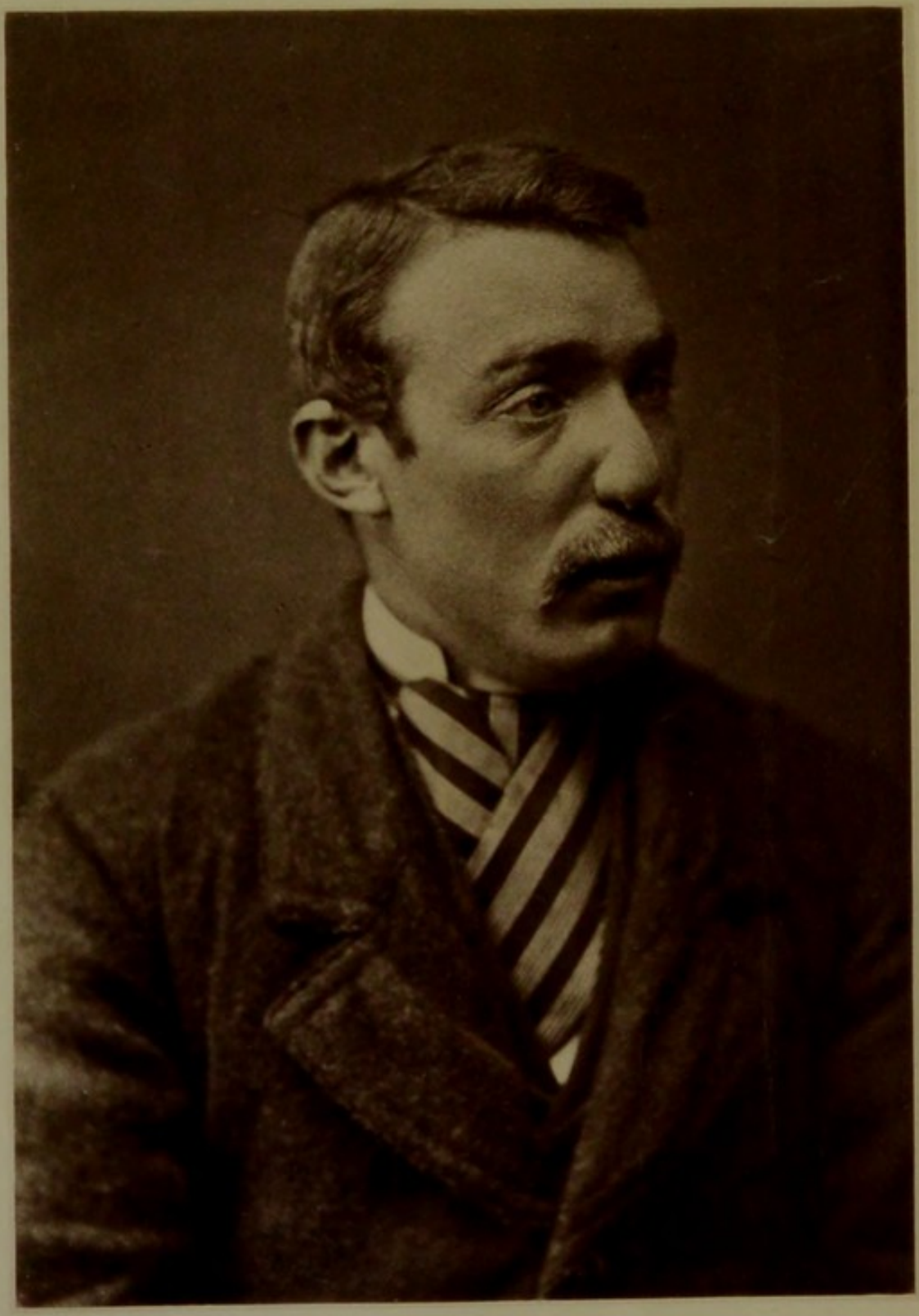

Dr. E. H. Bennett's Case of Restoration of the Nose.

With the author's kind regards

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THE PHYSIOLOGY OF PLASTIC SURGERY.[a]

THE title of this communication would allow me to discuss a very wide range of subjects. I purpose, however, to confine myself to the study of a very few points of interest alike to the practical surgeon and the physiologist, taking as an illustration the special operation known as the Indian operation for the restoration of a lost nose.

The accidental presence in Sir P. Dun's Hospital at this time of a patient on whom I performed this operation four years ago enables me to demonstrate the special points I desire to refer to with advantage.[b] The length of time that has elapsed since the operation is sufficient to ensure that all changes of nutrition, of cicatricial contraction, and of innervation are completed and permanent. In this patient the entire of the cartilages of the nose with their coverings had been lost by lupus. His present condition is sufficient, I think, to remove a certain opprobrium which attaches to this operation in consequence of the imperfect results too frequently observed to follow its performance. The charge that it results only in replacing the lost organ by "a tumour planted in the middle of the face" is at least in this instance not sustainable.[c]

On the other hand, I do not assume that such good results are always or invariably to be obtained, for the circumstances of each case are different, and in many are most unfavourable, particularly the size of the flap obtainable and the extent of cicatrix upon the cheeks, &c., but these are the points which must guide the surgeon in the selection of cases for operation.

[a] An Address delivered at the opening of the present Session of the University Biological Association.

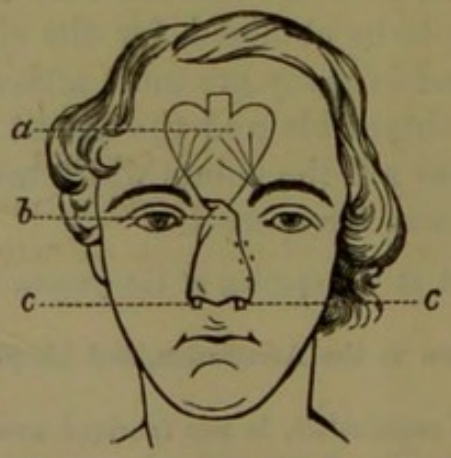
[b] The patient was shown to the Association, and his photograph exhibits his condition accurately.

[c] Il faut avant tout le reconnaître, le nez fabriqué avec un lambeau ne présente jamais une forme bien naturelle ; il ressemble plus ou moins à une tumeur implantée au centre de la face. Manuel de Médecine Opératoire. Par Malgaigne. 8th Edition. Par Le Fort. 1877.

While impressed in favour of the operation in suitable cases, I dare not, however, expect to attain to the success of Sédillot or of Skey, who both assert that in their hands deformity was so completely removed that even the companions of the individuals never suspected that they had been the subject of operation. It is sufficient to know that with care and judicious selection excellent results can be obtained. We must not suppose that this operation presents only difficulties in the way of selection and execution. Death of the patient has, we are told, occurred in two out of eight cases treated by Dieffenbach, and Sédillot states that he saw four patients die of the operation in Paris. Death of the flap has happened also, and no one can undertake the operation without this contingency suggesting itself to his mind.

I have not, I am happy to say, seen either of these results in my own practice or in the hands of other Irish surgeons; but that they have occurred even with masters in the art of plastic surgery is enough to prove that the operation may not be lightly undertaken or regarded as a mere surgical toy. But my present object is not the study of the risks to life or flap, nor any of the details of the operation except the more strictly physiological changes occurring in cases in which both the patient and the transplanted flap live. I deal only with the structural alterations in the flap and the changes observable in its sensibility. The entire success of the operation æsthetically depends on the correct appreciation of the former, while to the latter belong facts of the highest physiological interest, which, as far as I know, have been hitherto left almost unexamined.

For exactness sake I will briefly sketch the essential features of the operation.



A flap, shaped as in the diagram (*a*), is cut out on the forehead by incisions extending in depth to the areolar tissue immediately

covering the pericranium, of a size, determined by previous measurement, sufficient to supply not only a covering for the parts exposed by the loss of the nose, but, as far as the operator can estimate, enough to represent the shape and projection of the lost member. This flap dissected to the narrow neck, resembling the stalk of a leaf attached in the interval between the brows, is twisted round and placed on a surface already pared and defined by clean cut margins, and there united by sutures in order that union by first intention may be induced. To imitate the shape of the nose some supports (*c c*), either pledgets of lint or metallic supports, or some such structure, are placed beneath the unsupported central parts of the flap and in the position of the intended nostrils to raise the former into a suitable tip of the nose, to maintain the latter pervious. For this support I prefer a little shield of thin silver fashioned to imitate the form of the lost cartilages, and cut to fit the margins of the openings of the nostrils in such manner as to avoid any danger of its edges slipping beneath the margins of the flap, and so preventing their union with the incisions on the face.

These are the essential points of Carpue's operation as practised by him in 1816, only that he made no effort to support the central part of the flap. He describes and figures its appearance lying flaccid after the completion of the operation, and his disappointment at this state of affairs; but he says—"Nature worked with me and raised the nose by her own means." None of us are content in the present day to trust this matter to nature alone, and each according to his taste supplies some artificial support. More depends, I am certain, on the changes which take place in the deep surface of the flap as it cicatrises than on any form of support introduced beneath it. To meet this cicatrisation of the internal surface of the flap, while supports judiciously used may regulate it, the one thing essential is to provide a flap of ample width and length, enough not only to make allowance for the contraction of the flap when it is cut out (all writers speak of this allowance), but enough to provide a nose in all dimensions much too large for the face when first adjusted. In this lies the first and greatest obstacle to the success of the operation, for unless the forehead be high and wide a proper flap may be an impossibility.

The attempts to induce the growth of bone in the flap by transplanting with it the periosteum of the forehead into the position of the desired bridge of the nose, or the actual displacement of

bone from the nasal processes of the superior maxillæ, or again the sacrifice of a digital phalanx for the same purpose, are modifications of the operation which I am not at present concerned with. They are all of much interest as laudable efforts to supply the want expressed by the passage I have quoted from Carpue, and by the various contrivances invented to support and model the new nose, but they all increase the gravity of the operation, and as yet have been productive of but little positive success. I am satisfied that if the conditions as to the size of the flap can be fulfilled they are unnecessary.

A curious theory bearing on this part of my subject has been published by the late Mr. Hamilton, whose skill in this branch of surgery was so well known in this city. He attributes to the vessels of the part the strange function of a nose-making power—"offering in this respect another confirmation of the curious physiological fact of the nose-supporting vessels having deposited in the new nose a material approaching that of the natural organ, and thus turned a soft loose flap as it came from the skin of the forehead into a fleshy, firm structure, not far removed from the consistence of the real nose." We have here a theory evidently constructed on the physiological lines of the Bridgewater Treatises, but good as it seemed to the author, a more rational and more practical explanation arose in his mind after its enunciation, for in the next sentence he says—"Another reason may be the contraction and necessary consolidation of the part." To obtain a flap of the size sufficient to allow of this contraction and consolidation of the part is not only difficult in many cases, but when possible it requires so wide an isolation of tissue from its vascular supply that in one's earlier operations the prominent fear is for the life of the flap. I have already said that I have never seen this fail. Directly related to this question of modelling of the new nose is the practice I have adopted in dealing with the formation of the nostrils. The notches seen in the upper margin of the flap as it is traced on the forehead are intended to form the margins of these openings in the new nose, while the columella is to be formed of the intervening lobe.

It has happened in my cases that, even with the fullest sized flap I could get, I found it impossible, without an undue depression of that part of it intended for the tip, to unite the columella in place; or rather, I should say, my early attempts at uniting it failing, I have in the example I exhibit, and in one which preceded it imme-

diately, given up the attempt at the primary operation, leaving it for a later time, and at last abandoning it entirely.

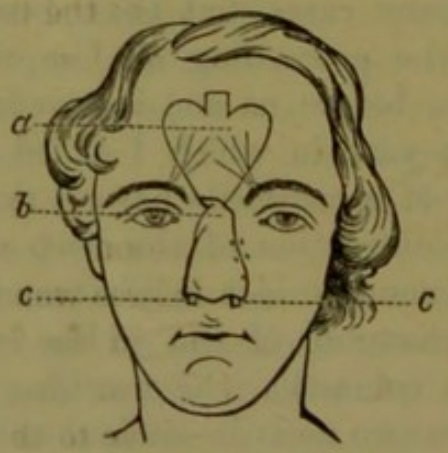
The results in these cases have taught me that this is a better practice than to attempt to form a perfect columella. Further, my experience of two of Mr. Hamilton's cases confirms me in this view. He used (I assisted him in many of his operations) to complete the union by suture according to the usual rule, and succeeded, but always with the immediate result of depressing the tip of the new nose too much. Since his death I have seen and had to treat two of his patients in whom the nostrils were completely occluded, the contraction of the openings left at each side of the columella going on quietly and slowly until complete occlusion or only a pinhole opening existed in the place of each nostril. These could be reopened by puncture, but the moment one gave up the introduction of tubes or some such dilators the nostrils reclosed.

I cannot quote many cases, but these two I have seen as the ultimate result of the proceeding of Carpue carried out completely. In the case before us and its predecessor which I have seen within the last year, in which I failed or omitted to make anything in the way of a columella beyond the middle lobe of the flap, I find that the contraction of the deep surface of the flap is such that only just enough orifice is left to admit air to the nasal fossæ, while the overhanging of the middle lobe of the flap quite hides the want of a columella, the notching still leading one to believe that there are two nostrils—indeed only a close search will prove the contrary. It will be seen, then, that the physiological action may in this case exceed the nose-forming function of Hamilton, and entirely close the organ if its powers be too much called on in our effort to make a complete nose with its two nostrils; that a more moderate demand, satisfied with a single opening for ingress and egress of air, will furnish a fairly presentable and more workable organ.

I pass now to the phenomena I have observed relating to the sensibility of the flap transplanted in this operation—phenomena which, though perhaps of little practical importance in regard to the operation itself, are most interesting physiologically. I have been particularly surprised that, with a very few observations which I shall presently quote, these phenomena have been hitherto allowed to go unobserved, or at least unrecorded.

I must briefly revert to the diagram representing the plan of

the operation. A moment's reflection will suffice to satisfy any one familiar with the nerve supply of the forehead (which I have roughly traced on the diagram) that in the forming of a flap such as we are discussing all the nerves must be divided by the incisions except some few filaments supplying the narrow neck only of the flap. Hitherto I have not spoken of the completion of the operation, which is made at a period about the commencement of the third week, or at some time a little later after the life and union of the flap seated in its new place is secured—namely, the division of the twisted bridge (*b*) of skin and a smooth insetting of its parts into the surrounding structures. Whatever nerve filaments escaped the primary operation are cut across in this operation. Here, then, is a transplanted piece of skin of large dimensions under conditions which ensure that either at its first detachment from the forehead or, should any filaments escape at this time, in the subsequent division of its neck all its nerve fibres have been cut across.



What are the events which follow the section of nerve trunks elsewhere in the body? Very commonly the functions of the nerves, so far as their parts beyond the section is concerned, is for ever lost; they transmit no sensation to the brain, nor provoke the action of any muscle in their district; or, again, a union in favourable and rare instances occurs, and after a long interval—fourteen months at least, mostly a longer period—an imperfect and perhaps slowly-improving power of transmission of external impressions to the centre and of the orders of the will outwards to the muscles is observed; or lastly and most rarely (indeed, there are perhaps but four cases of its occurrence in man recorded on reliable evidence), a rapid union and restoration of function occurs, resulting in a restoration more or less complete in a time varying from ten days to a fortnight after the section. The slower and more frequently observed restoration is preceded by the Wallerian degeneration of

the nerves on the distal side of the section, and repair becomes possible only after it has completed its action and the nerves have been regenerated.

In the literature of this plastic operation I have searched in vain for complete accounts of the behaviour of the sensation in the transplanted flap. Indeed, I can find only a few very incomplete statements with reference to it in the entire range. I think this absence of observations is due to the fact that the minds of operators have been chiefly occupied with fears for the life of the flap, with the details of its union with the face, and in maintaining its form.

The earliest observation made with regard to the sensation of the flap is that made by Delpech just when the operation was in its infancy in Europe (1820). It refers, too, only to a single part—the feeling present in the neck of the flap on the fifteenth day after its transplantation. He says—"At the instant of its complete separation (*i.e.*, of the bridge) the flap became pale in a marked manner; nevertheless it did not lose either its heat or its natural sensibility, and the patient gave signs of this last every time the needles were plunged into it, for the stitches which involved it." It is clear from this passage that the sensibility of the bridge was due to the transmission of impressions by some route other than through the nerve fibres which may have escaped division in the cutting out of the flap in the first operation, for, if any such were present, the section of the bridge must have involved them, yet the part was sensitive to the needle punctures.

The next exact statement I can find is that of Mr. Erichsen, who says—"The dressings must not be disturbed for three days; by this time, if all go well, the flap will be found somewhat tumid, warm, and sensitive, but pale in colour." I have never seen the flap sensitive at so early a date, nor indeed can I conceive its being so except in a very limited district near the twisted pedicle, for, as I have already noticed, the lines of the incisions must divide the greater number of the twigs of the sensitive nerves which enter into its structure.

Mr. Erichsen describes the effects of the section of the bridge as being quite different from those recorded by Delpech as follows:—"The sensibility of the new nose is entirely destroyed for a time after the division of the bridge, but it slowly returns from all sides, appearing first in the neighbourhood of the adhesions between it and the cheeks, then near the columna, next in the bridge, and

thus the organ at last has its sensation restored; for this, however, several months will usually be required, and the part in which it returns last of all is its central portion."

I have myself verified the truth of Delpech's account of the results of the section of the bridge, and certainly my observations do not agree with those of Mr. Erichsen either as to the existence of sensibility in the flap on the third day, or as to the change in its condition following on the division of the bridge.

I must now state the facts I have myself observed. I only regret that they are not more numerous, for I feel some diffidence in expressing opinions quite opposite to those of so high an authority as Mr. Erichsen, based on so limited a number of cases as I have accurately investigated.

My early experience of the operation was acquired in assisting as a student, and subsequently the late Mr. Hamilton. I have several times operated myself, I confess, without noting the conditions of sensation. My attention was arrested by the early return of sensation in a case treated some six years ago, and I have since made fairly complete observations in two cases, one of which is before us now four years after operation; the second I saw not long since after an interval of at least five years from the time of operation. Unfortunately of all my cases these are the only instances I have been able to follow up for a sufficient time to enable me to speak positively of the ultimate results. I should note that partial operations on one side of the nose, and operations for restoration of the eyelids, although they follow the same rule, as far as I can determine, are yet too uncertain from the form of the flaps and their relation to nerve-supply to justify my mixing their consideration with cases of the complete operation of Carpue.

I find that after the flap has been raised and secured in its place and duly supported, it is devoid of sensation for over a week; as far as one dare test it long after its heat is restored and its colour is assurance of its life, it is not sensitive. Up to the tenth day at least this condition exists, but after the tenth and before the fourteenth day sensation returns suddenly and imperfectly, and so it remains ever afterwards, uninfluenced by the section of the bridge or by the progress of time in any material degree. In the case before us as an illustration the sensation is good, but greatly below that of the other parts of the face, requiring a more firm contact to enable the patient when blindfolded to place his finger on the spot touched than would be necessary on any other part of

the face. His condition is now (four years after operation), as nearly as I can determine with regard to sensation, the same as it was fourteen days after operation. The facts of the other case are precisely similar both as to existence and defect of sensation. The mode of return is like that of the most rapid form of restoration of nerve function observed in the primary union of nerve trunks I have referred to; but no one will for a moment suggest that the surgeon can here effect any exact adaptation of nerve fibres in the adjustment of the lines of incision for primary union around his flap.

Only one other passage I may quote as bearing on this subject. Billroth says—"When you have excised portions of skin, and brought together and united parts lying at a distance, new nerves grow through the cicatrix, and perfect power of conduction comes after a time, as may be often observed in plastic operations. These facts are remarkable, and physiologically are still entirely inexplicable." My object in submitting these observations—which, I admit, are too few in number to justify us in asserting that they establish the rule for all cases—is to offer by them some help, no matter how little, towards the removal of the condemnation of our powers of clinical and physiological investigation contained in the words of Billroth, "still entirely inexplicable."