

displacement, with or without fracture, of its perpendicular portion, and produces, therefore, not only great deformity, sometimes a complete flattening of the end of the nose, but, also, in some instances, complete obstruction of the nostrils.

We conclude, from all that we have seen, that fractures and displacements of the septum narium are generally followed by permanent deformity, and occasionally with still more serious results. We suggest, therefore, a more careful examination in recent injuries, with a view to the ascertainment of its lesions, and it would be well, certainly, if we could devise some reliable mode of treatment.

It is doubtful whether a partition so thin and unsupported can ever be well adjusted and supported by artificial means. We possess, however, some advantages in the treatment of this accident which we do not in the treatment of broken *ossa nasi*, viz., facility of observation and of approach; and if we can do little with plugs and supports in the one case, we may possibly do more in the other. Nothing seems more rational, then, than to plug carefully and equally each nostril with pledgets of lint, while we cover the outside of the nose completely with a nicely moulded gutta-percha splint or case, which ought to be made to press snugly upon the sides, and permitting these to remain for several weeks, or until the cure is completed. The *papier maché* of Dzondi, employed by him in cases of broken *ossa nasi*, would be equally applicable here; but the gutta-percha, as being more plastic, and hardening more quickly, ought to be preferred.

Attempts to remedy the deformities of the nose, at a later period, belong to the department of anaplastic surgery, and the modes of procedure must be varied according to the circumstances of the case.

The following example will serve as an illustration of what may sometimes be accomplished in these cases:

A young man fell from a two-story window, striking upon his face. A surgeon was called, but he did not discover the nature of the injury to the nose.

One year after the accident he called upon me for relief. The cartilaginous portion of the septum was broken just at the ends of the nasal bones, and forced backwards about three lines, producing a striking depression at this point of the ridge of the nose, whilst at the same time the end of the nose was thrown up. The deformity was very unseemly, and annoying both to himself and to his friends, who at first could scarcely recognize him.

I introduced a narrow, sharp-pointed bistoury through the skin of the nose on the right side, and resting its edge upon the ridge at the junction of the cartilage with the *ossa nasi*, I cut the cartilaginous septum directly backwards about three lines, and then making a gradual curve with my knife, I cut downwards about eight lines toward the end of the nose. The intercepted portion of cartilage could now be easily lifted with a probe, and the line of the ridge of the nose completely restored. It was at once apparent, also, that lifting the cartilage would depress the tip of the nose and restore its symmetry.

To retain the cartilage in place, I constructed a gutta-percha splint of the length and shape of the nose, but so formed along its middle as that

it would not press upon the cartilage which I had lifted, resting well upon the *ossa nasi*, but not touching the ridge from the lower ends of these bones to the tip of the nose, at which latter point it again received support. I now passed a needle, armed with a stout ligature, through the upper end of the uplifted cartilage, transfixing, of course, the skin on both sides of the nose, and this I tied firmly over the splint. This accomplished the important object of pressing backwards and downwards the tip of the nose, and thus tilting up the upper part of the ridge and septum, and of more effectually securing the cartilage in place by lifting it directly with the ligature. On the second day the ligature was removed, but the splint was continued two weeks, during most of which time a band was kept drawn across the lower end of the splint, and tied behind the neck.

To prevent the cartilage from falling back when final cicatrization occurred, I pressed the sides of the splint firmly toward each other, just below the incision, so as to force as much as possible the walls of the nares into the fissure of the septum, made by lifting it up. The result is a complete and perfect restoration of the nose to its original form.

Dr. James Bolton, of Richmond, Va., has devised a very ingenious mode of rectifying an old displacement of the septum nasi. He makes a stellate incision of the septum in such a manner as to form of it about eight triangles with their apices converging to a common centre. He then seizes each triangle separately with a pair of forceps, and breaks it at its base without detaching it. Having thus comminuted the septum, he is able to restore it to position and retain it until consolidation is effected.¹

CHAPTER X.

FRACTURES OF THE MALAR BONE.

I HAVE been unable to find any records of a simple fracture of the malar bone, that is to say, of a fracture unconnected with a fracture of other bones of the face. It is probable, however, that it sometimes occurs, but that, not being accompanied with much displacement, it is overlooked. I have myself seen a fracture of the upper margin, or of that portion which constitutes a part of the orbital border, in two or three instances, while I was unable to detect any other fracture among the bones of the face: but it is by no means certain that other fractures did not exist, perhaps in some of the bones which form the socket, or in the superior maxilla, as mere fissures, or as fractures with only slight displacement. The prominence of the malar bone, and especially the sharpness of its orbital margin, would enable the surgeon to detect easily the smallest displacement, or even a fissure, whilst a much more extensive displacement elsewhere would escape detection.

¹ Bolton, Richmond Med. Journ., April, 1868, p. 241.

The two upper maxillary bones form, as they are placed opposite to each other, an irregular arch, one end of which rests upon its fellow, at the intermaxillary suture, and the other end rests upon the nasal and frontal bones; whilst over the centre of the arch is situated the malar bone. The force of a side blow upon the malar bone will expend itself, therefore, chiefly upon the base of the maxillary apophysis, as being in the line of the direction of the force. The force continuing to act, after the apophysis is broken, the portion of the superior maxilla above the floor of the nares will fall inwards toward the septum, while the portion below will tilt outward, and open the intermaxillary suture along the roof of the mouth. This suture will also open more widely in front than behind, owing to the greater depth of the suture in front.

These observations I have verified by several experiments made with a hammer upon a clean skull.

One might suppose that it would be a very easy matter to restore these bones to place upon the naked skull, after such an accident. Certainly it would be very desirable to do so, were this accident to occur to any patient, since the malar bone is slightly depressed, the nostril upon this side is nearly closed, and the line of the teeth is disturbed, and it is possible also that an opening might be established between the nose and mouth immediately back of the incisors. In fact, however, I found the restoration impossible. It could not be accomplished by an instrument within the nose pressing outwards, nor by pressing inwards upon the teeth and alveoli; not, certainly, without very great and unwarrantable force. The difficulty consisted simply in the antagonism of the serrated margins of the intermaxillary suture, which, projecting one or two lines on each side, could not be made to interlock again, but were firmly braced against each other.

I shall not find it necessary to report in detail the results of the experiments, but shall content myself with stating that by the second blow, in the last experiment, the skull was also found broken at its base, through the lesser wings of Ingrassias; the force of the blow having been conveyed, apparently, along the orbital plate of the superior maxilla and os planum.

This is the only example from four experiments in which the fracture extended through the dental arcade, and it was the result of the first blow. The fracture of the base of the skull by the second blow indicates the possibility of producing a fatal lesion of the brain or of its blood-vessels by a blow upon the malar bone.

General Summary of results when the blow was inflicted directly upon the malar bone.—A fracture of the superior maxilla occurred in every instance; and twice when the malar bone was not broken: in each of the last two cases the antrum alone was broken, and the depression of the malar bone was scarcely noticeable. In the second of these cases, the fracture extended also through the dental arcade.

In three cases the nasal apophysis was broken near the base, and in one case at two points. One of the three fractures of the nasal apophysis was accompanied with a diastasis of the superior maxilla through its intermaxillary suture.

The malar bone has been broken twice by the first blow, and always

when the blow has been repeated. The orbital margin and orbital plate have been fissured twice, the outer portion of the orbital plate being pushed a little into the socket. Once this plate has been pushed downwards.

The zygoma has been broken three times, and always transversely a little beyond its centre, or where the bone is the most slender and most convex.

The ethmoid has been broken three times, and always longitudinally through the orbital plate.

The sphenoid has been broken once, at the base of the skull.

In addition to these observations upon the naked skull, I have seen at least four examples, which illustrate the relative infrequency of fractures of the malar bone, as compared with fractures of the superior maxilla and of the other bones of the face, even when the blow is received directly upon the malar bone.

Patrick Maloney, *æt.* 55, fell about twenty feet and struck upon his face. Six weeks after the accident, while an inmate of the Buffalo Hospital of the Sisters of Charity, I found the right malar bone depressed, but I could not trace any line of fracture in the malar bone. I think the antrum of the superior maxilla was broken, and the malar bone forced in upon it.

Thomas Crotty, *æt.* 20, was struck with a hoop, August 15, 1855. He was seen immediately by a surgeon in Canada, but the fracture was not recognized. Five days after, he called at my office. I found the outer portion of the right malar bone lifted slightly, and the lower and anterior angle depressed about three lines, as if this portion had been forced in upon the antrum.

The third case will be found reported under fractures of the superior maxilla, and the fourth has been brought under my notice in the practice of Dr. Wadsworth, of New York, the fracture having been occasioned by collision with the head of another man.

Prognosis.—The malar bone may be depressed, as we have seen, to the extent of two or three lines, without being broken. This accident will be more properly considered under fractures of the upper maxilla. A fracture of the malar bone implies, therefore, generally, that great force has been applied, and that other fractures exist as complications. This may not be true, however, when only the orbital margin of the socket is broken. If the orbital plate is broken, and a portion of it is pushed into the socket, it may occasion a slight protrusion of the ball, as in two cases related by Dr. Neill as fractures of the upper maxilla, and as has been noticed in the experiments already referred to. This protrusion of the eyeball will probably continue, in some degree, as long as the bones remain displaced. It is quite probable, however, that in some cases, after severe injuries of the face, a moderate protrusion of the eyeball is due entirely to extravasation of blood in the socket; a circumstance which would be likely to follow a fracture of the bones of the socket, and to increase temporarily the protrusion of the eye.

If the body of the bone is broken entirely through, and coma supervenes upon the accident, there is some reason to fear that the skull is fractured at its base, and the prognosis ought to be grave.

Treatment.—If there is only a fissure of the orbital margin, it will not require attention; but if the fissure extends through the orbital plate, and at the same time the anterior and inferior margin of the bone is depressed, in consequence of which the orbital plate is tilted upwards and made to push forward the eyeball, the propriety of surgical interference may be considered. If this protrusion is considerable, and evidently due to the displaced bone, an attempt should be made to lift the body of the malar bone, and thus to restore to position its orbital plate. The method of accomplishing this I shall describe particularly when speaking of fractures of the superior maxilla with depression of the malar bones.

CHAPTER XI.

FRACTURES OF THE UPPER MAXILLARY BONES.

THESE fractures assume so great a variety in respect to form, situation, and complications, that it would be impossible to speak of them systematically, or to establish anything but very general rules as to treatment and prognosis.

They may be broken, or loosened from each other or from the other bones with which they are articulated, with or without any farther fracture; the nasal processes may be broken, and generally this accident is accompanied with a fracture of the nasal bones also; the malar bones may be forced in, carrying with them a portion of the outer wall of the antrum; the alveoli may be broken and more or less completely detached; and either of these several fractures may be complicated with fractures of the other bones of the face, or of the base of the skull even.

Treatment.—When the harmonies of the upper maxillary bones are only slightly disturbed, nothing but a retentive treatment is necessary.

A man was thrown backward from a loaded cart, one wheel of the cart passing over his face. He was taken up unconscious, but when I saw him on the following morning, his consciousness had returned. The right malar bone was broken, and forced down upon the antrum about three lines. Both superior maxillæ were loosened from their articulations, and could be moved laterally, the motion producing a slight grating sound. The same motion and grating occurred whenever he attempted to swallow. No effort was made to elevate the malar bones, nor did I find any means necessary to retain the maxillary bones in place, the amount of displacement being very inconsiderable, and never sufficient to be observed by the eye. Cool lotions were applied constantly to the face, and the patient was sustained by a liquid diet. On the ninth day all motion of the fragments had ceased, and on the twenty-seventh day the patient was completely recovered, with only the depression of the malar bone remaining.

Sargent, of Boston, reports a similar case, in which a slight separa-

tion of the maxillary bones united promptly and without any retentive apparatus.¹

But in a case in which the superior maxillary bones had been more completely torn from their connections, complicated with other severe injuries, I found it necessary to support the fragments by closing the lower jaw upon the upper, and by suitable bandages. The patient died, however, on the twelfth day.²

Graefe recommends, where the bones are thus extensively separated and displaced, an apparatus made of steel, and suitably covered, which is to be applied against the forehead and buckled under the occiput. From which apparel, in front, descend a couple of steel plates, which, having arrived at the free border of the upper lip, are reflected upon themselves, and are made to support upon their extremities long silver gutters, intended for the reception of not only the displaced teeth and alveoli, but also those teeth which are firm.³

Goffres has employed a similar apparatus, only that he has substituted gutta-percha for the silver gutters of Graefe.⁴ In Goffres's case the apparatus was made to support a pad also, intended to make lateral pressure over the displaced fragments.

No doubt cases may now and then occur in which this apparatus would serve a useful purpose; but in most cases two interdental splints of gutta-

percha, placed one on either side, leaving an open interval in front for the purpose of conveying food to the stomach, will accomplish every indication, and in a manner much more comfortable to the patient, and more satisfactory to the surgeon, than any form of mechanical apparatus. A pad or compress upon the side of the face, supported by a roller, is better than the pad attached to one side of Goffres's apparatus, as a means of lateral support. The mode of preparing and of applying gutta percha as an interdental splint, will be described in connection with fractures of the lower jaw.

Wiseman, having been summoned to a child with his whole upper jaw forced in by the kick of a horse, "beating the ethmoides quite in from the os cribriforme," and forcing the palate bone against the back of the pharynx, found great difficulty in securing a permanent readjustment. At first he attempted to introduce his finger back of the bone; but, failing in this, he bent an instrument into the form of

FIG. 27.



Goffres's modification of Graefe's apparatus.

¹ Boston Med. and Surg. Journ., vol. lii. p. 378.

² Report on Deformities after Fracture. Trans. Amer. Med. Association, vol. viii. p. 375, Case IV.

³ Traité des Frac., etc., par L. F. Malgaigne, p. 373.

⁴ Goffres, Bulet. de l'Acad. de Med., 1862, t. 27, p. 1157, from Poinset.

a hook, and, passing it between the bone and the pharynx, he easily replaced the fragments. But, on removing the instrument, they were again displaced. Immediately he had constructed an instrument by which the bones could be not only easily reduced, but also retained in place, extension being made by the hands of the child, his mother, and others, alternately. In this way the reunion was finally effected, and "the face restored to a good shape, better than could have been hoped for."¹

Harris, of New York, mentions a case in which a child, two years old, having fallen from a height of fifty feet upon the pavement, was found to have a diastasis of both the superior maxillary and palate bones; the separation being sufficient to admit the little finger, and extending from between the alveoli which supported the central incisors, to the soft palate. It is not said whether any efforts were made to reduce the bones, but six weeks after the injury was received they were still open, and it was proposed to close the space by a plastic operation as soon as the condition of the patient would warrant such a procedure.²

I suspect that in this example, as in my experiments referred to under fracture of the malar bone, it was found impossible to adjust the bones and close the intermaxillary suture, and for the same reasons.

If, in consequence of a blow received upon the ossa nasi, the nasal processes of the superior maxillæ are broken down, they may be lifted and adjusted in the same manner as the ossa nasi.

I have seen several examples of this accident, and I have in my cabinet a specimen, in which the nasal bones being driven in by the kick of a horse, the nasal process upon the left side is broken off just above the root of the cuspid tooth, and its upper end inclined inwards towards the nasal passage and backwards, until it is completely buried. In this situation it has become firmly united to the bony and soft tissues into which it was brought in contact.

The following example will illustrate some of the complications and difficulties connected with a depression of the malar bone, and consequent fracture of the antrum maxillare.

M. P., of Colesville, aged about 34 years, was thrown from a height, striking upon his face, forcing the right malar bone down upon the antrum of the superior maxilla. Dr. L. Potter, of Varysburg, and myself were called.

The deformity produced by the sinking of the malar bone was very striking, and both the patient and myself were very anxious to have it remedied, if possible. We found some of the teeth upon the side of the fracture loose, and we determined to extract them, and press up the bone with an instrument introduced through the empty sockets. The first attempt to extract a molar tooth, however, brought down several teeth, and the whole floor of the antrum. The detachment of this fragment was also now so complete that we believed it necessary to remove it entirely, a labor which was accomplished with infinite difficulty, and with no little hazard to the patient, as dissection had to be extended very far

back into the throat, and in the end it was not effected without bringing out, attached to the fragment of maxillary bone, a considerable portion of the pyramidal process of the os palati.

The time occupied in this operation was at least one hour, during which we were every moment in the most painful apprehensions, lest we should reach and wound the internal carotid, which lay in such close juxtaposition to the knife that we could distinctly feel its pulsation. After its removal the hæmorrhage was for an hour or more quite profuse, and could only be restrained by sponge compresses pressed firmly back into the mouth and antrum.

When the hæmorrhage was sufficiently controlled, we proceeded to examine the antrum, the floor of which being removed entire, permitted the finger to enter freely. The restoration of the malar bone was now accomplished without much difficulty, and with only moderate force.

Two years after the accident the face presented, externally, no traces of the original injury. The malar bone seemed to be as prominent as upon the opposite side, and there was no perceptible falling in where the teeth and alveoli were removed. During several months after the removal of the bone, the antrum continued to discharge pus, but at length a semi-cartilaginous structure closed in the cavity below, entirely reconstructing its floor, and the discharge ceased. Since then he has experienced no further inconvenience.

I wish to propose two or three expedients for lifting the malar bone when it has been thrust down, which may in certain cases be substituted for the mode which has been heretofore generally adopted.

In many instances no difficulty will be experienced in resorting to the usual method. The recent loss of one or more teeth opposite the floor of the broken antrum, or the complete displacement of a tooth by the accident itself, will give an opportunity for the perforation of the antrum through the open socket, and for the introduction of a suitable instrument for lifting the depressed bone. Unless, however, the opening is quite large, the instrument employed must be so small, such as a straight steel sound or a female catheter, as to expose the parts against which its end is made to press, to some risk of being broken and penetrated. It is even possible in this way to penetrate the socket of the eye, and thus inflict serious injury upon the eye itself. Yet, with some care, such accidents may be avoided, and it is probable that in the cases supposed, where the sockets of the teeth opposite the base of the antrum are open, this method will continue to have the preference.

But if the teeth remain firm in their places, or if they have been some time removed, and the sockets are filled up, and we wish to enter the antrum at its base, we must either drill through its anterior wall above the roots of the teeth, or we must proceed to extract a tooth. The first method gives an inconvenient opening, and one through which it will be necessary to use a curved instrument; but yet it is a method far less objectionable than the extraction of a tooth which is firm, or which is even tolerably firm, in its socket, and which may require the forceps for its removal. The objections to this latter procedure were suggested by the tedious and painful operation already detailed. The first attempt to extract a tooth brought down the whole floor of the antrum, with all its

¹ *Chirurgical Treatises*, by Richard Wiseman, 1734, p. 443.

² *New York Journ. Med.*, vol. xiii., 2d ser., p. 214.

corresponding teeth, and the pyramidal process of the palate bone. The tooth was already loose, and we thought it might easily be taken out, but it had not occurred to us that it was loosened by the comminuted condition of the walls of the antrum, and of the dental arcade. The experiments made upon the dead subject would seem to show that this fracture and comminution of the alveoli is not a very frequent result of a fracture of the antrum produced by a blow upon the malar bone; yet it may happen, and whenever it does, the attempt to extract a tooth must always expose the patient to the same hazards. Certainly it is no trifling matter to pull away all of a man's upper teeth upon one side, and to open freely into a broad cavity which might never close again, and which, in this event, must always serve as a place of lodgement for particles of food, and for foul secretions, to say nothing of the external deformity which it is likely to produce, and of the severity and even danger of the operation.

I wish, then, to suggest certain procedures, the value of which I have been able to determine by experiment upon the living subject in two or three cases, and which I have carefully and frequently tested upon the cadaver.

First, we ought to attempt to lift the bone by putting the thumb under its zygomatic process and body within the mouth. If the bone is thrown directly downwards, or downwards and backwards, this method can scarcely fail; and even when it is thrown downwards and forwards, so as to press into the antrum, it is likely to succeed. If, however, for any reason, the thumb cannot be brought to bear upon its under surface, we may make a small incision upon the cheek over the anterior margin of the masseter muscle, where its insertion into the malar bone terminates, and pushing a strong blunt hook under the bone, we may lift it with ease.

Where the depression of the malar bone is in the direction of the anterior and superior angle, these means may not be found available, and we may then employ a screw elevator, an instrument which I find already constructed in a case of trephining instruments made for me by Luer, of Paris, and which I have often used, and constantly recommended to my pupils, in certain cases of fractures of the skull. The instrument ought to be made of the best steel, and with a broad, sharp-cutting thread. A slight incision being made through the skin, and down to the centre of the malar bone, the elevator is then screwed firmly into its structure, and now its elevation and adjustment may be accomplished with the greatest ease.

Malgaigne remarks: "In all complicated fractures of the upper jaw, there is one principle which surgeons cannot too much study, namely, that all fragments, however slightly adherent they may be, ought to be most carefully preserved, and they will be found to unite with wonderful ease. This remark had already been made by Saviard, Larrey insists strongly upon it, and we have seen that M. Baudens, so great an advocate for the removal of loose fragments, has declared for these fragments a special exemption."¹

Malgaigne has here especial reference to fractures of the dental arcade,

¹ Op. cit., vol. i. p. 376, Paris ed.

and to fractures implicating the alveoli, and extending more or less into the body of the bone.

It would be an error, however, to suppose that a reunion will in these cases uniformly take place. Exceptions have occurred in my own practice, the fragments becoming loosened and completely detached after the lapse of several weeks. In the case related by Miller, the whole floor of the antrum having been broken off, in an unskilful attempt to extract the second right upper molar, it was found impossible to make it unite, and it was subsequently removed.¹ Such unfortunate results certainly may sometimes be reasonably anticipated. Yet they occur so seldom as to justify the opinions and practice advocated by Malgaigne.

In some instances, where fragments are displaced, carrying with them several teeth, while others in the same row remain firm, it will be sufficient to close the mouth and apply a bandage as for fracture of the inferior maxilla; in others, the teeth and their alveoli ought to be fastened with silk, or gold or silver thread; gold, silver, gutta-percha, or vulcanite clasps may be applied to the teeth and jaw.

In a case of fracture of the right superior maxilla, reported by Baker, of Norwich, N. Y., complicated with a fracture of the inferior maxilla, the alveoli were retained in place very perfectly by a mould of gutta-percha.² Neill, of Philadelphia, has also reported three cases of fracture of the bones of the face, involving the superior maxilla, in two of which the eyes were made to protrude more or less from their sockets. The loosened alveoli were made fast by wire. The subsequent deformity was inconsiderable, yet in no instance was the restoration complete.³ The same method was adopted successfully by a surgeon in Virginia, in the case of a negro fifty years old, where most of the teeth of the left upper jaw were forced into the mouth, carrying with them their corresponding alveolar processes. The teeth remained firm in their sockets, but the separation of the bone was complete, the fragment being held in place only by the mucous membrane of the mouth. On the eighth day the surgeon found that the negro had removed the wire, and also the cork from between his teeth, and the maxillary bandage; but the soft parts had already united, and the bones showed no tendency to displacement. His recovery was speedy, and it was accomplished without any further treatment.⁴

Our experience during the war of the rebellion in this country confirms most of the observations heretofore made in relation to these fractures. Owing to the extreme vascularity of the bones composing the upper jaw, the fragments have been found to unite, after the most severe gunshot injuries, with surprising rapidity; the amount of necrosis and caries being usually inconsiderable, compared with the amount of comminution. The same anatomical circumstance, namely, the vascularity, has rendered these accidents peculiarly liable to troublesome hæmorrhages, both primary and secondary.

¹ Miller, News Letter, April, 1854. Also, Bost. Med. and Surg. Journ., vol. li. p. 264.

² Baker, New York Journ. of Med., vol. i., 3d ser., p. 362.

³ Neill, Phil. Med. Exam., vol. x., new ser., pp. 455-8.

⁴ Amer. Med. Gazette, vol. viii., new ser., p. 106.

The Surgeon-General reports that of 4167 wounds of the face, transcribed from the reports from the beginning of the war to October, 1864, there were 1579 fractures of the facial bones, and of these 891 recovered, 107 died—the terminations are still to be ascertained in 581 cases. He further remarks that secondary hæmorrhage has been the principal source of fatality in these cases, and that frequent recourse has been had to ligation of the carotid, with the result of postponing for a time the fatal event.¹

CHAPTER XII.

FRACTURES OF THE ZYGOMATIC ARCH.

THE zygoma, strictly speaking, is formed in a great measure by the body of the malar bone, and it is broken whenever the malar bone is completely separated through any portion of its body; but I propose to confine my remarks to that portion only which is composed of the two processes, called respectively the zygomatic processes of the malar and temporal bone.

Duverney relates a case in which a young child, having in his mouth the end of a lace-spindle, fell forwards and thrust the spindle through the mouth from within outwards, breaking the zygoma in the same direction, and leaving the fragments salient outwards.² To which case of outward displacement Packard, in a note to Malgaigne's work on fractures, etc., has added a second.³

I know of no other examples in which the fragments have been thrust outwards. A reference to my experiments upon the naked skull will, however, show that the zygoma may be broken and displaced in the same direction, by any force which shall fracture the superior maxilla, and depress the anterior margin of the malar bone. In my experiments this has happened three times, and always at the same point, viz., a little beyond the middle of the zygoma, near where the suture which joins the two processes terminates below. The fractures were always transverse, and not in the line of the suture. They were therefore fractures of that portion of the zygoma which belongs to the temporal bone.

I suspect, also, that to this class of cases belongs the example related by Dupuytren, in which the patient having died on the fifth day, from the effects of the cerebral concussion, the autopsy disclosed "a fracture through the zygomatic arch; and that part of the superior maxillary bone which constitutes the antrum was driven in."⁴

In another case mentioned by Dupuytren, produced by a direct blow,

¹ Circular No. 6, Washington, Nov. 1, 1865, p. 20.

² Duverney, Bulletin de la Société Anatomique, p. 138, 1810.

³ Malgaigne, Amer. ed., p. 289, vol. i.

⁴ Injuries and Diseases of Bones, by Baron Dupuytren. Syd. ed., London, 1847, p. 336.

the fracture was compound and comminuted, and although the fragments were raised easily by an elevator, suppuration ensued beneath, and the matter was discharged within the mouth.¹

Tavignot reports a case of fracture of this arch which was not discovered until after death, the fragments not being at all displaced.²

Dr. John Boardman, one of the surgeons to the Buffalo Hospital of the Sisters of Charity, informs me that he has met with a fracture of the zygoma in a man about thirty years of age, occasioned by a blow from a cricket-ball. Dr. Boardman saw him on the fourth day, and ascertained that immediately on the receipt of the injury he felt slightly stunned, and that he soon recovered from this, but was unable to open his mouth except by pulling it open with his hand; neither could he close it except in the same manner. This immobility of the jaw continued several days with only very slight improvement; at the end of five weeks, however, when last seen, the mobility was nearly, but not quite restored. The depression, a little in front of the centre of the zygoma, was discovered by the patient himself immediately after the receipt of the injury, and he says he tried at once to ascertain whether he could not push the fragments back by moving the jaw. He was unable to make any impression upon them by this manœuvre. The depression still remains, but it is not so distinct as it was when first seen.

Barney Quinn presented himself at the Bellevue Dispensary, April 17, 1871, stating that he had been hit by a stone, in blasting, three weeks before. There was a fracture, with depression, at or near the junction of the malar and temporal processes. The malar bone was elevated a little. From the time of the accident he had been unable to open his mouth more than half an inch.

January 2, 1874, Anna McQuirk fell upon the side of her face. Seven days after the accident she consulted me. There was a fracture with depression at the junction of the malar bone with the zygoma. At first, and for a day or two, she could open and close her mouth easily, but when I saw her, the act of opening the mouth was painful and difficult. Having introduced my fingers into the mouth, I attempted to press the fragment out, but was unable to make any impression upon it.

It is plain that in this latter case the inability to open the mouth was due to the inflammation resulting from the injury, and not to the displacement of the bone, and that as the inflammation subsided the disability would disappear.

John Crandall, an adult, fell upon a stone February 21, 1875, striking upon the side of his face and head. He was stunned by the accident. On the following morning he could not open his mouth. Five weeks later I found the zygoma much depressed near its junction with the malar bone, the corresponding edge of the malar bone being a little lifted. There had been a gradual improvement in his ability to open his mouth, and he could now separate the teeth about half an inch. I advised him that he might expect a slow but complete restoration of the use of his jaw; and if this did not occur within a few months, to call upon me

¹ Op. cit., p. 335.

² Tavignot, Bulletin de la Soc. Anat., 1810, p. 138

again, and I would lift the fragments; but, as he has not returned, I infer that he recovered the use of his jaw.

Symptoms.—An irregular projection or depression of the fragments is the only sign which can be relied upon to indicate the existence of this accident; and this must often be concealed by the swelling which follows so rapidly wherever the integuments are severely bruised over a superficial bone. This displacement can scarcely occur in but two directions, either outwards or inwards; since the attachments of the temporal aponeurosis above, and of the masseter muscle below, must effectually prevent its descent or ascent.

Neither motion nor crepitus will often be present. In some cases the difficulty in opening or shutting the mouth, occasioned by the projection of the fragments toward or into the tendon of the temporal muscle, or by the inflammatory effusions, may assist in the diagnosis.

Prognosis.—If the fracture has been produced indirectly by a depression of the malar bone, the prognosis must depend upon the amount of injury done to the other bones of the face; in itself, the fracture of the zygoma cannot be a matter of any moment. The same remark might apply also to any fracture of the zygoma in which the angles were salient outwards. If, on the contrary, the angle is salient inwards, the fracture having been produced by a blow inflicted directly upon the zygomatic arch from without, or by a blow upon the outer portion of the malar bone, it may occasion some embarrassment to the action of the temporal muscles.

If the force which produces the fracture has acted more upon the temporal portion of the arch, near where the process arises from the temporal bone, it may be accompanied with a fracture of the skull, and with serious cerebral lesions, as in one of the cases already alluded to as having been noticed by Dupuytren.

The abscess which followed in the case of the compound, comminuted fracture, quoted from the same author, indicates the danger of this complication; but it must be noticed that its evacuation resulted in a rapid cure, and that no deformity or difficulty in moving the jaw remained.

Treatment.—A fracture, accompanied with an outward displacement, and occasioned by a depression of the malar bone, will be adjusted by a restoration of the malar bone in the manner already described, when speaking of fractures of the superior maxilla, etc. If the fragments are displaced outwards, in consequence of a direct blow from within, then they may be replaced by pressing upon the projecting angle. In this way Duverney easily reduced the bones in the case which I have cited.

When the fragments, in consequence of a direct blow from without, have been driven inwards, and, as a consequence, serious embarrassment to the motions of the temporal muscle ensues, an attempt ought to be made at once to replace them; if, however, no impediment to the action of the muscle exists, it is scarcely necessary to say that no surgical interference will be required. It is quite probable, indeed, that a slight amount of embarrassment may be the result of the direct injury to the muscle inflicted by the blow, without reference to the displacement of the bone, and that a few days will suffice to remedy this evil entirely; and, moreover, experience teaches that in the case of a fracture in other

bones, where the fragments actually penetrate the muscles and remain thus displaced, the points are gradually absorbed, and rounded, so that after a time they constitute no impediment to the action of the muscles. It is proper to infer that the same thing will occur here. The surgeon may be reminded, also, that it is not the muscle, but its tendon, which is liable to be penetrated; and that this is usually protected somewhat by a plate of soft adipose tissue lying between the tendon and the arch.

If to these considerations we add the difficulties which we shall be likely to encounter in the reduction, we shall expect to find but few cases in which a resort to surgical interference will be necessary.

Duverney says that he restored a fracture of this arch, accompanied with depression, by pressing against the zygoma from within the mouth; but an examination of the interior of the buccal cavity will convince us that this is impossible when the fracture is at any point near the middle of the zygoma; and that it can be only when the fracture is at or near the junction of the zygoma with the body of the malar bone, that any effective pressure can be made from this direction. In such a case we may, perhaps, lift the portion of the zygoma remaining attached to the malar bone, by the same means which have already been suggested for lifting the bone itself.

If the bone is driven toward the tendon of the temporal muscle at or near its centre, and if its restoration becomes necessary, it can be accomplished only by approaching the bone from without.

Dupuytren found an external wound through which, by the aid of a levator, he easily restored the fragments to place.

M. Ferrier, however, of the Hospital of Arles, in a case brought before him, made an incision through the integuments down to the bone, and then attempted to slide underneath the small extremity of a spatula; but the aponeurosis would not yield, and he was obliged to cut it also. He was now able to lift the fragments easily. The wound healed rapidly, and the patient was dismissed without any deformity.¹

CHAPTER XIII.

FRACTURES OF THE LOWER JAW.

Division.—Of 55 examples of fracture of this bone which have been recorded by me, not including gunshot fractures, 52 were broken through some portion of the body.

Having made an analysis of 45 of the above examples, I find that 16 were broken completely asunder at two or more points, constituting double and triple fractures; and of the remainder, 5 were accompanied with detachment of portions of the alveoli, and one with detachment of a considerable fragment from the body.

¹ Ferrier, Bulletin des Sciences Méd., tom. x. p. 160.