

settled by the exigencies of the case at hand. Certainly this patient was not harmed.

7. Another curious thing about this case was the fact that the scales did not show that he lost any weight during the entire starvation period. There are great variations in these daily weights. I have no means of proof as to their accuracy, as they were taken as a matter of routine in the ward; but I believe they are correct. I think the fact that he did not lose weight can be accounted for on the basis of water retention. It was on the day of January 28 that the patient gained 2½ pounds. This was also the day the patient became sugar free. We all noticed on the following day that the patient looked edematous. He did not have an edema, but there certainly was an increase to the volume of his body. Previously his face had been drawn and shrunken, but on this day his face was full and gave the impression of a decided gain in weight.

Since the patient's discharge from the hospital he has been seen only occasionally. His condition had been variable. Certainly he is not any worse than he has been for the last year or two. He is a very unsatisfactory individual to manage, never being willing to cooperate except in one's presence.

SUMMARY

1. In the case reported, the sugar tolerance of a patient with a potential diabetes was reduced to approximately the least level for thirteen days by an acute infection. Later the patient had return of a moderate degree of ability to utilize carbohydrate.

2. There was a great increase in nitrogen excretion for the first nine days; on the tenth day it fell off decidedly, and never was again excreted in excess.

3. The patient was distinctly acid on admission, but became decidedly more acid during the first two days of starvation, as shown by determinations of the tension of carbon dioxide in the alveolar air. Although the patient was starved for eleven days, the acidosis gradually became less and less each day, until by the end of the fast the tension of carbon dioxide was back to practically a normal figure.

4. Acetone and diacetic acid excretion dropped very decidedly during the first day of starvation, and completely disappeared from the urine when the patient was utilizing 60 gm. of carbohydrate daily.

5. The patient was excreting approximately 30 per cent of nitrogen in the form of ammonia during the period when he was most acid; as the acidosis improved, the percentage of ammonia to the total nitrogen output remained the same.

6. The body weight of the patient was practically the same at the termination of the starvation period as it was in the beginning.

ANKYLOSIS OF THE JAWS*

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In his work on orthoplastics of the temporomandibular articulation, Murphy classified the ankylosis which occurs in and about the temporomandibular articulation under four heads: (1) intra-articular bony ankylosis; (2) intra-articular fibrous ankylosis; (3) subzygomatic cicatricial fixations, and (4) intra-alveolar buccal fixations.

The only part of this subject which I shall consider at this time is the first division of Murphy's classification, intra-articular bony ankylosis, or true ankylosis. While this affection is not rare, there have been comparatively few actual cases with results reported, and the work done along this line, and reported in medical or dental literature, is by no means extensive.

For the purpose of clearer statement, let us review briefly the temporomandibular joint. Owing to the character and location of this joint, it is particularly susceptible to traumatism and infection. When the complex mechanism and environment of this joint is considered, it can readily be seen that an injury, or an infection in it, or a combination of the two, is far from being amenable to normal repair.¹ In the temporomandibular articulation, the socket is formed partly by the mandibular fossa and partly by the articular eminence, and over the latter, an approximately congruent surface for the head of the condyle is formed by the articular disk. The two temporomandibular articulations act simultaneously. When the mouth is opened, the head of the condyle with the interarticular disk glides forward on the articular eminence, and when the mouth is closed, it slips back into the mandibular fossa. The opening and closing of the mouth are consequently attended by a sliding of the mandible (a gliding joint). In addition to this modified form of hinge movement, the articulation possesses a second kind of motion, viz., the lateral displacement of the mandible in reference to the skull. In this movement, one condyloid head remains in the mandibular fossa, and rotates or pivots on a center, while the other advances on the articular eminence, a movement which is impossible when the mouth is opened to its greatest extent. Both the hinge and lateral movements are combined in the act of mastication. Thus an inquiry or an infection involving this joint is much more complex than the same lesion would be involving a joint less intricate, and the process of repair is consequently much more complicated.

ETIOLOGY

What causes intra-articular bony ankylosis of the jaw? The two sexes are about equally affected, and this seems to be an affection into which sex selection has no controlling influence.

It has been my own observation, as well as that of others, that the predisposing age is from 1 to 10 years, that is, that the largest percentage of patients who come under our observation present a history of injury or infection in the early ages. Orlow found that ankylosis was established in 80 per cent. of his

* Read before the Section on Stomatology at the Sixty-Seventh Annual Session of the American Medical Association, Detroit, June, 1916.

1. Sobotta and McMurrich: Human Anatomy, W. B. Saunders Company.

Moving Picture Health Car.—In North Carolina the state board of health has an automobile fully equipped with a light and moving-picture outfit, with which moving-picture health shows are given throughout the state in cities and towns, at county fairs and other gatherings, in churches, halls, tents or out of doors. Any series of twelve towns may have the benefit of the outfit, which is provided with a mechanic and a lecturer, for a period of three weeks, the show being given in each town one afternoon or evening of each week, and the program being changed each week. The towns are required to provide at least \$90 for the expenses of the first week, and the remainder is furnished by the state board. The subjects are not all health topics, but comic or other pictures are interspersed. The entertainments are popular and their educational value is said to be high.

patients between the ages of 1 and 10 years. Blair states that "the age at which ankylosis became established varied considerably, but in the great majority of cases, when the age was given, it was under 10 years." The primary causes for osteoarthritis, or bony ankylosis, seem to be traumatism and infection. There seems to be some diversity of opinion as to which of these etiologic factors should be assigned first place. Orlow states that in about 30 per cent. of his cases, injury to the joint was the cause of bony ankylosis. Blair asserts that "by far the most common single cause was trauma, this accounting for nearly 50 per cent. of all cases. The great majority of these injuries were not open wounds, and by far the most common form of injury was a blow, or a fall on the chin." Others believe that infection is the greatest etiologic factor in the affection, and some believe that in every case of trauma which seems to cause ankylosis, infection is a secondary factor of no mean importance.

My own observation has been that trauma has been at least the primary cause in by far the largest number of cases presented in our clinic. Authentic statistics in this regard cannot be procured readily, owing to the fact that the large majority of these patients are not seen until long after the condition is established. Sometimes several years elapse before surgical interference is resorted to, so that a complete history in such cases is not wholly reliable. The diseases which play a part in causing ankylosis of the jaws are scarlet fever, otitis media, dento-alveolar abscesses, diphtheria and gonorrhoea. It may also result from a metastasis, from foci of infection within the mouth, or elsewhere in the body. The presence of the beginning of ankylosis of the mandible during childhood appears logical when we consider that accidents and many of the infectious diseases to which it is due are more prevalent during the early period of life. The onset and development of ankylosis of the jaws is very insidious and slow, several years often being occupied in the production of lesions of any considerable extent. Usually the patients complain more of the disability which is caused by the affection than of any actual physical discomfort which it occasions. The general health of patients who are afflicted is usually little impaired. Digestive troubles seem to be the principal factors outside of the joint lesion, owing, undoubtedly, to the impaired function of mastication.

PATHOLOGY

In case of violent injury to the joint, ankylosis is usually brought about by the proliferation of fibrous tissue into or around the region of injury.

Should the articular cartilages be preserved in whole or in part, they sometimes undergo direct metaplasia into fibrous tissue or fibrocartilage, or into mucinous tissue, which gradually becomes fibrous. In many of these cases the fibrous tissue is trifling in amount, and the ankylosis is produced mainly by cartilage and bone. In some cases the ankylosis is due to cartilage and bone intermingled. Immediately following a dislocation or intracapsular fracture, or a contused wound to the joint, there is more or less

abundant hemorrhage into the joint. Later, inflammation sets in. The capsule and surrounding parts become swollen and edematous, infiltrated with inflammatory products. There is an effusion into the synovial cavity. Portions of the coagulum may persist and become organized, forming osseous tissue in the joint. When an infection is the predominating etiologic factor, there is produced a synovitis with effusions into the joint cavity. These infections may be purulent, and chronic synovitis results. The joint synovium becomes thickened in the early stages, while the surface of the cartilage is rough and fibrillated. Marked inflammatory changes are induced in the subcartilaginous marrow spaces and the cartilage is destroyed. Milen believes that the degeneration of the cartilage is due to some interference with nutrition, or is produced by the extension of the exudate which destroys the cartilage. Adami² states that the resorption of the cartilage is brought about by the subchondral medullary substance. In the early stages not all of the cartilage may be destroyed, but there may remain islets of cartilage throughout the articulating surfaces. These islets may in time be converted into bone.

Thus the cartilages are gradually transformed into a vascular fibrous or fibro-osseous tissue. The joint cavity is traversed by dense fibrous bands, and is converted into a number of small spaces, bounded by dense fibrous tissue, and containing synovial fluid. In the advanced stages, the whole of the articular cartilages may disappear and be replaced by fibrous tissue, so that the original structure of the joint becomes well nigh unrecognizable. Secondarily, changes take place in the newly formed fibrous tissue, and in time it is converted into a mass of spongy bone, and complete osseous ankylosis results. It seems to be a characteristic phenomenon of cartilage that it is more or less interchangeable with fibrous tissue in the joints. It has been observed that when a joint cartilage is becoming atrophied, it becomes calcified, or transformed into a fibrillated structure, closely resembling fibrous tissue, while perichondrial fibrous tissue commonly becomes changed into typical hyaline cartilage. The deeper layers of the cartilage may also proliferate, forming nodules of hyaline cartilage or bone.

The greatest metaplasia, however, is found in subcartilaginous inflammatory process, where, as a rule, there is a great tendency to the formation of cartilage and bone. Thus, in an inflammatory condition of the temporomandibular articulation, either by traumatism or by infection, there is a marked susceptibility to metaplasia, with the result that the normal structure finally may become obliterated and a new structure results.

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Characteristics of the Disease.—On account of this disease occurring in the joint, and having its incipency in early childhood during the period of growth, the normal development of the mandible is considerably interfered with, so much so that it is marked by a conspicuous facial deformity. This deformity is



Fig. 1.—Course of the incision.

2. Adami: General Pathology, Philadelphia, Lea & Febiger.

characterized by perceptible recession of the chin. This may be due to the action of the geniohyoglossus muscles in their constant efforts to open the jaws. There is also a general atrophy from disuse of all the tissues of the lower jaw, including the mentalis and quadratus labii inferioris muscles. The deformity may be so exaggerated as almost entirely to obliterate the chin. Usually when the ankylosis has been established on one side in early childhood by trauma, and the disease has slowly progressed until the normal structure of the joint has become obliterated and the jaws closed, the opposite side also will be more or less affected on account of the disuse of the joint.

DIAGNOSIS AND TREATMENT

The differential diagnosis in the character of the ankylosis is not a complex problem. In fibrous ankylosis, even though the adhesion is quite firm, there will be some movement, especially lateral movement in the jaws. In bony ankylosis, the only movement which can be observed is the very limited movement of the elasticity of the structures involved. There can be no lateral movement in the lower jaw in intra-articular bony ankylosis.

The treatment of intra-articular bony ankylosis consists in surgical measures. Forced separation of the jaws will avail nothing. The surgical procedure consists in establishing pseudarthrosis, either in the site of the true joint or below it. Esmarch, in 1855, suggested an operation for intra-articular bony ankylosis by the removal of a wedge shaped section of bone, with base downward, three-quarters inch long, from the horizontal portion of the mandible. This did not prove satisfactory on account of the disturbance of the normal action of the masticatory muscles which followed. König, in 1878, introduced the operation of resection of the mandibular head. The results were unsatisfactory on account of the possibility of a recurrence.

Brophy³ states that he has obtained very satisfactory results by removing a crescent shaped section of bone from the region of the angle of the jaw. He places gutta percha between the ends of the bones which prevents the freshened ends of the bones from uniting. The gutta percha is allowed to remain for a period of six weeks, after which the wound is reopened and it is removed. During this time, it is asserted that a well organized membrane is formed which seems to form the intra-articular tissue.

The operation which has been very satisfactory in my experience is the operation similar to the one reported by Lilienthal,⁴ in which a section of bone is removed from the condyle.

Technic of the Operation.—Beginning about 5 mm. in front of the tragus of the ear, a horizontal incision is made through the epidermis and superficial fascia along the lower border of the zygoma, extending anteriorly for a distance of about 3 cm. A vertical incision is then made through the epidermis and superficial fascia, extending upward from the point of

beginning about 4 cm., running just in front of, and parallel to the ear (Fig. 1). The epidermis and superficial fascia are now dissected up to form a flap. The underlying tissues containing the branches of the seventh nerve and also the superficial vessels are pushed aside by the use of retractors and blunt dissectors until the joint and a portion of the condyle is laid bare (Fig. 2). Great care must here be exercised that the zygomatic and temporal rami of the facial nerve are not torn in the effort to expose the bone.

After the neck of the condyle has been cleared of the tissues by blunt dissection, a full curved aneurysm needle is used for the purpose of guiding a steel rib-bon $\frac{3}{1000}$ inch in thickness and 1 cm. in width, back under the condyloid neck (Fig. 3). This is for the protection of the internal maxillary artery in removing the section of the condyle. The section is removed by the use of the mastoid chisel, taking out about 1 cm. of the bone, including the periosteum. Then a flap of superficial fascia is elevated from the temporal muscle and interposed between the ends of the condyle, and sutured with catgut sutures. The wound is then closed with horsehair.

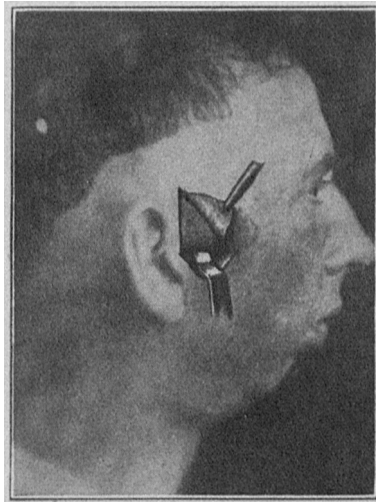


Fig. 2.—Exposure of the joint.

After the excision of a portion of the condyle, as indicated, has been accomplished, on one side, an attempt should be made to open the mouth. If the jaws cannot be opened, the same operation should be resorted to on the opposite side, when of course the jaws will be free. No attempts should be made to stretch the jaws or hold the mouth open until partial repair of the soft tissues has been obtained. After about the fifth day, my treatment has been to begin opening the mouth by the use of a graduated mouth gag. The patient will experience considerable pain at first, but the mouth should be opened until there is at least a space of 2 cm. between the opposing cuspid teeth. When this space is obtained, the graduations on the gag are noted and the gag placed in the same position

in the mouth and opened to the same degree, four or five times each day. Each time the gag is inserted, it is left in position for a period of five minutes. This treatment of stretching the jaws should be maintained for several weeks, the patient doing this himself, after being properly instructed.

Dangers, Disadvantages and Complications of the Operation.—One of the greatest dangers involved in the operation is that of infection. Owing to the close proximity to the hair line, there is a greater possibility of infection either in the wound at the time of operation, or subsequently, than in wounds of like nature elsewhere on the skin surfaces. Therefore the greatest precautions must be exercised that everything connected with the operation should be absolutely sterile and that extra precautions be taken in the subsequent dressings of the wound, that infection be warded off. An infection in the wound may ruin what would otherwise be a successful operation.

Necessarily after repair has taken place, there is more or less cicatricial tissue at the point of operation, which leaves a scar and sometimes more or less of a depression at the point of the false joint; but this, in my opinion, is of secondary importance. The dangers

3. Brophy: Oral Surgery, the Diseases, Injuries and Malformations of the Mouth and Associated Parts, Philadelphia, P. Blakiston's Son & Co.
4. Lilienthal: Ann. Surg., August, 1911.

to be encountered in the operation are, first, the inability of the anesthetist to control the tongue during the administration of the anesthetic. Some cases are on record in which tracheotomy had to be resorted to during the operation. Second, danger of injury to the temporal rami of the seventh nerve, whereby paralysis of the orbicularis oculi muscles may follow. Another danger to be encountered is injury to the internal maxillary artery. This vessel lies directly in the field of operation, and must be protected in some manner in removing the segment of bone in the process of forming the new or false joint. This may be accomplished by retractors, Murphy's periosteotomes, or any other instruments which may be easily inserted between the artery and the neck of the condyle. I believe that the steel ribbon which I have described is superior in the simplicity of its application, and effectiveness, to anything which has been called to my attention.

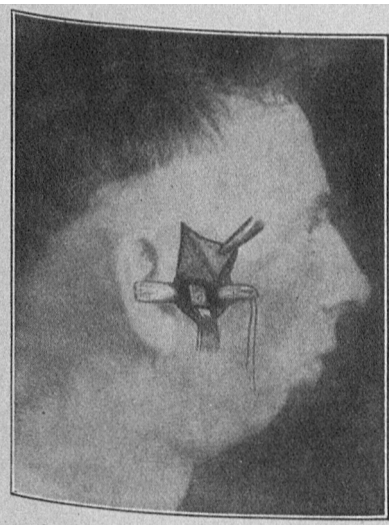


Fig. 3.—Insertion of steel ribbon.

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CONCLUSION

It might be stated that, outside of the dangers enumerated, this operation is comparatively free from serious complications or sequelae. The patient begins the mastication of his food in about ten days to two weeks following this operation. The movement of the jaws prevents the formation of too much fibrous tissue between the two ends of the bone, and after repair is completed, it will be found that the tissue which had become atrophied begins to take on a more nearly normal condition. The patient takes on weight, the general health and appearance improve, and he again resumes confidence in himself. The correction of ankylosis of the temporomandibular articulation is an operation which not only gives great satisfaction to the patient, but also is one which is very gratifying to the operator.

ABSTRACT OF DISCUSSION

DR. H. A. POTTS, Chicago: These results of injuries and infections are really more common than the general practitioner seems to think. Quite frequently we see, in large clinics, patients who present the same appearance as this one. The diagnosis as to the form of ankylosis is very important, and judging from the experience of previous operators and the conditions found at operation, the operation here described is certainly of the type which is best suited to the bony ankylosis. The dissection of fibrous bands and the treatment of the various classifications, as given, would permit of other treatment, but the bony ankylosis is best treated. Dr. Lyons is to be congratulated on the result in this case, which, if the patient does his part, will avoid a further complication, or even lessening of the space already gained.

DR. CHALMERS J. LYONS, Ann Arbor, Mich.: Of course, in these cases the patients must do their part. They are instructed to keep constantly stretching the jaws. These

instructions are very important. More can be accomplished by this stretching than by anything else, doing it several times a day, to keep the space already gained. This man has gained a little more space by this exercise.

DR. POTTS: If you put the index finger on the upper teeth and the thumb on the lower teeth, you can get a good deal of force in stretching.

DR. LYONS: That is a good suggestion. These exercises must be kept up continuously. In these cases, if nothing is done, there is a great tendency for the ankylosis to recur.

CALCIFIED HEMATOMA *

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DETROIT

Interest in the occasional development of bone masses in and beneath muscle following trauma has been great, especially since the Roentgen ray has made possible their clear demonstration. The condition has commonly gone under the name of myositis ossificans traumatica, because it has been believed that damaged muscle is actually changed into bone. Other names have been suggested depending on various theories of origin; for example, calcified hematoma, based on the theory that the blood clot following an injury becomes calcified, and periosteal callus, on the theory that the growth is merely misdirected callus formation. The best known theories so far put forward are, first, the hemic theory (Sadeler). This theory supposes that the hemorrhage following an injury to muscle is first transformed into cartilage which later ossifies. Second, that the tumors are aberrant sesamoid bones (Bard). Third, the theory that the growths result from bits of periosteum detached and included in the muscle. Fourth, that the fibrous tissue of the muscle undergoes a true metaplasia into bone. Fifth, that the bone develops from cells disseminated from the periosteum through the hemorrhage. All these theories have warm supporters and antagonists.

The best discussion which has come to my attention of the surgical and pathologic aspects of this condition

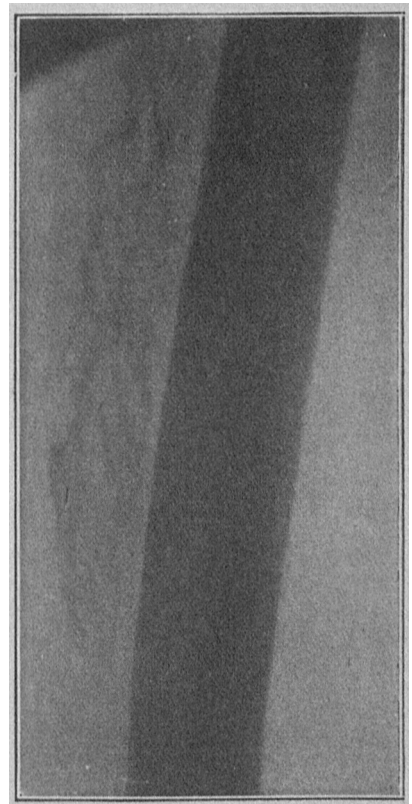


Fig. 1.—Before operation.

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