

STATED MEETING, FEBRUARY 2, 1903.

The President, RICHARD H. HARTE, M.D., in the Chair.

BILATERAL BONY ANKYLOSIS OF THE TEMPO-  
ROMAXILLARY ARTICULATION OF TRAU-  
MATIC ORIGIN AND ITS SURGICAL  
TREATMENT.

WITH REPORT AND PRESENTATION OF TWO CASES RECENTLY TREATED  
BY OPERATION.

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BONY ankylosis of the temporomaxillary articulation of traumatic origin, not complicated by the results of infection, is probably comparatively rare, and I am strongly of the opinion that it invariably results from some variety of fracture involving the bones comprising the joint. It could therefore quite properly be considered among the sequelæ of fractures of these bones. The title of this paper, therefore, not only excludes many other etiological factors producing fixation of the mandible, but all the other forms of ankylosis of whatever degree.

In this report I hope to establish the true etiology in each of the two cases presented; to point out a symptom very apt to mislead in reference to the true condition; to demonstrate a most valuable method for determining the true condition of the articulations, a method which shows whether both articular surfaces are involved and also the degree of involvement of each; the report also deals with the practicability of the treatment employed, the dangers to be anticipated, and the methods of meeting them.

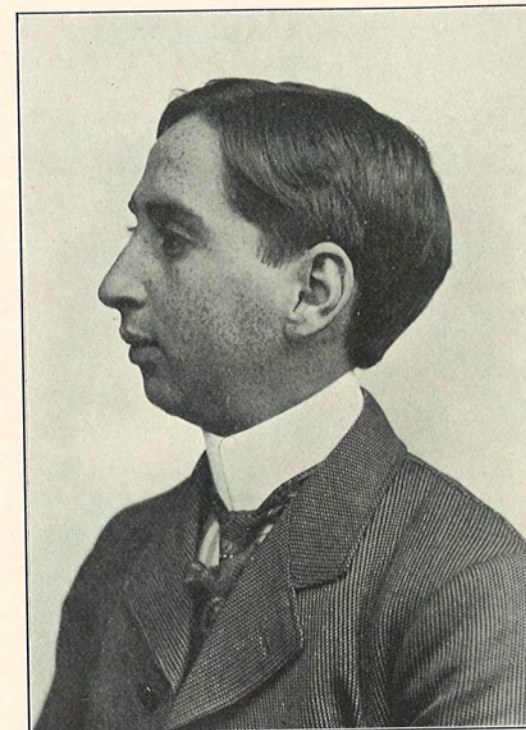


FIG. 1.—Case I. Showing the recession of the chin and the fulness in the region of the temporomaxillary articulation.

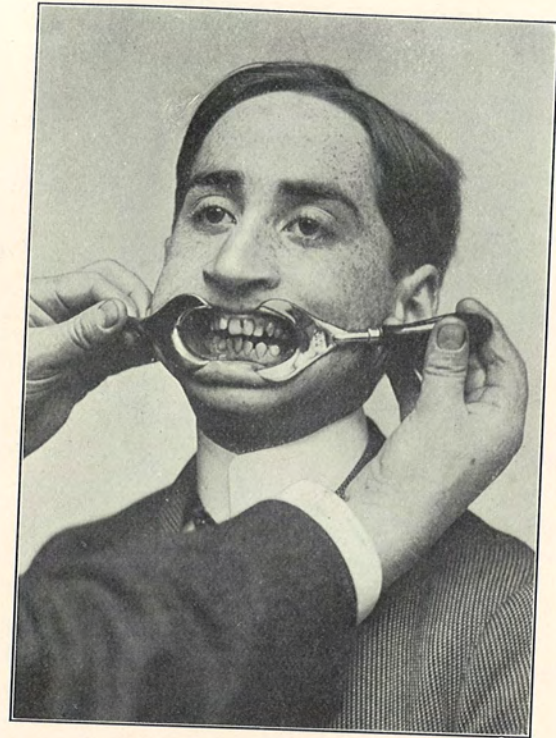


FIG. 2.—Case I. Showing the posterior teeth in occlusion and the anterior teeth separated some distance.

CASE I.—F. H. H., aged eighteen years, when eight years of age met with an accident while coasting. The sled which he and two others were upon ran into a barbed wire fence, and he was thrown violently against a post, striking his chin. He was unconscious for a short time, but regained consciousness while being conveyed home. He again became unconscious, and remained so until the following morning, a period of about twelve hours. He had a wound about one and one-half inches long beneath the chin, exposing the bone, and there were evidently multiple fractures of the mandible. The wound was dressed, and the mandible was bandaged for five weeks, at the end of which time the bandages were discontinued, when, in attempting to open the mouth, it was found that ankylosis had taken place.

About five years after the accident, he said, he came under the care of Dr. Fowler, at the Sney Methodist Hospital, Brooklyn, who gave him ether and forcibly opened his mouth by means of levers. This treatment was followed by the use of a screw-gag three or four times daily during a period of about three months, at the end of which time fixation was again practically complete. Two years later, Dr. Glass, of Utica, repeated the same operation and after-treatment, and subsequently on two occasions, at intervals of two years and one year, with like results. An additional attempt was made under ether in the office of a dentist.

The patient was kindly referred to me in October, 1901, by Drs. Roy E. Jones and Joshua T. Pritchard, of Remsen, New York. Photographs taken at that time show the appearance which he presented (Figs. 1 and 2). The noticeable features were marked recession of the chin and considerable fulness in the region of each temporomaxillary articulation. The facial measurements were as follows: from the hair-line to the glabella two and three-fourths inches, from the glabella to the line of the union between the nose and upper lip two and three-fourths inches, from the latter line to the point of the chin two and three-fourths inches, and from the point of the chin to the line of harmony one and one-fourth inches. The mandible was firmly ankylosed with the posterior teeth in occlusion, and the anterior teeth separated some distance, as seen in the photograph (Figs. 1 and 2). He was able voluntarily to separate the teeth in occlusion about one-tenth of a centimetre. Upon examination of the muscles of mastication, I found them fairly well developed,

evidently free from adhesions, and able to contract strongly, he having daily exercised their limited power. The size of the mandible led me to believe that development had practically ceased at the time of injury, as it apparently was not larger than that of a boy of eight years of age. The rami formed almost right angles with the body, and they were decidedly more vertical than normal. There was no apparent deviation of the chin to either side. There was no difference manifested in motion between either half of the mandible.

Being still in doubt in regard to the exact position of the condyles, I was fortunate in securing very excellent skiagraphs, which were taken by Dr. Charles Lester Leonard (Fig. 3). Each skiagraph shows the greatly enlarged condyle or mass of bone connecting the ramus with the temporal bone, about one-half of which is behind the posterior border of the ramus. This led me to believe that part of the original injury was a fracture through the neck of each condyle and union between the condyle and ramus at almost a right angle.

I decided to operate first upon the right side, and about one week later upon the left side, by the following method, which I will give in detail.

On December 2, 1901, while the patient was under ether anæsthesia, I made an incision opposite the neck of the condyle of the right side, beginning just below the zygoma and extending downward for a distance of one and one-fourth inches. The anterior border of the parotid gland was next retracted backward, exposing the masseter muscle. With a blunt-pointed dissector the fascia and fibres of the masseter muscle and periosteum were separated about opposite the middle of the skin incision; after dilating this opening with forceps two index-fingers could be introduced. Through this opening there was made a subperiosteal excision, with a chisel, of the mass of callus, including the condyle and neck, and a bridge of bone which was found present. It connected the outer surface of the head and neck of the condyloid process with the outer surface and lower border of the posterior portion of zygoma, and was about one-third of an inch in thickness and three-quarters of an inch in width. There was no union between the articular surfaces, and there was an apparent absence of the interarticular fibrocartilage. After clearing the border of the zygoma and making smooth the excised border

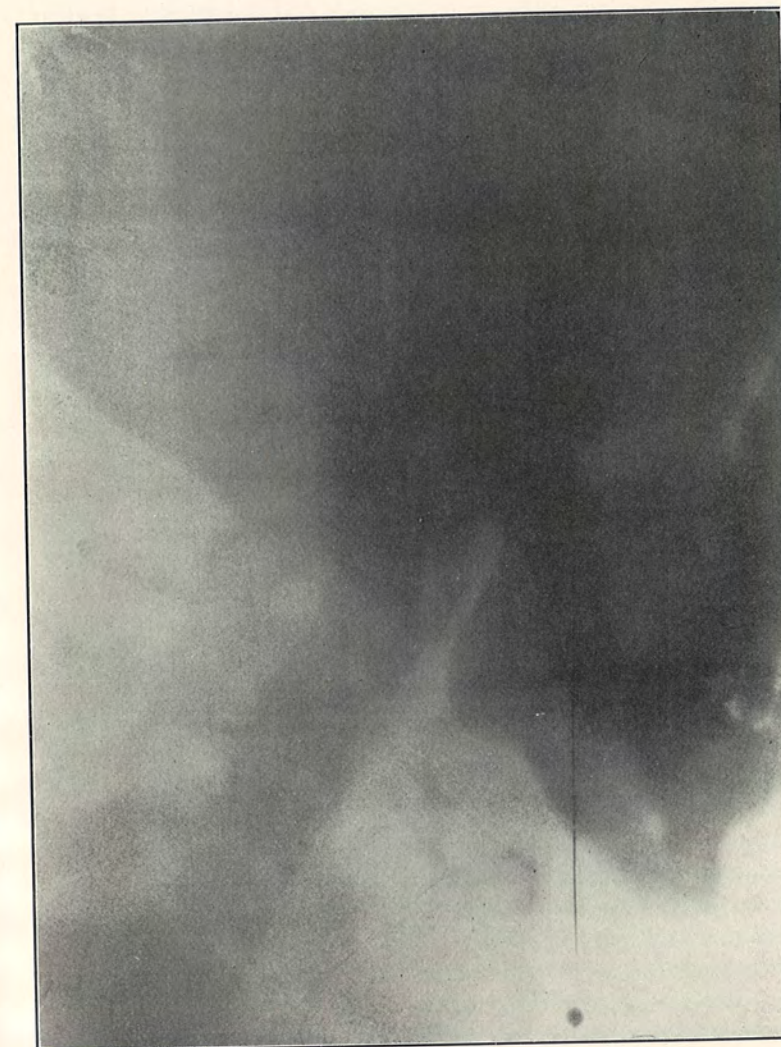


FIG. 3.—Case I. Skiagraph showing the bridge of bone connecting the right temporo-maxillary articulation, the angle formed by the occiput and mandible with the cervical vertebræ, and the position of the hyoid bone.

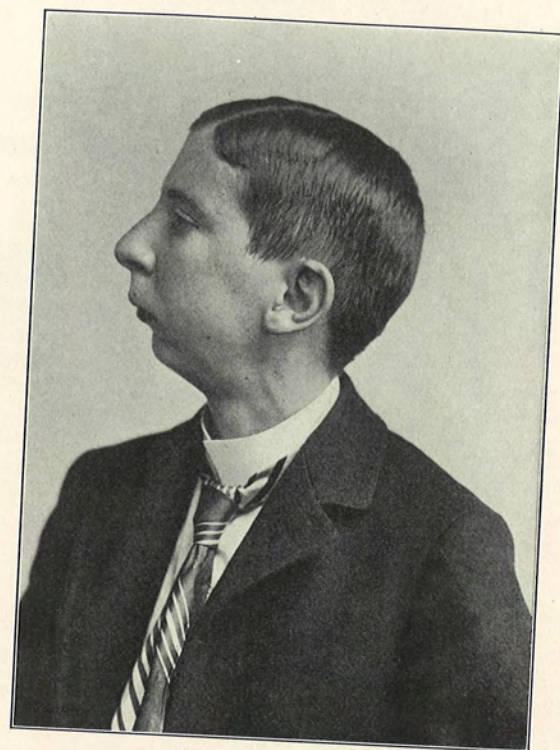


FIG. 4.—Case II. Showing the recession of the chin.

of the ramus, it became possible to pass the index-finger freely between the ramus and glenoid fossa, and to spring the mandible sufficiently to demonstrate that, except for its muscular attachments, it was free upon that side. After carefully flushing with water to remove any chips of bone, the separated fibres of the masseter muscle and fascia were brought together with buried catgut sutures. The skin wound was closed with Halsted's subcuticular suture, using silkworm gut. This is in accordance with the view of Gregg, who recommends closing the wound without drainage. (*Practitioner*, December, 1899.)

The same procedure was repeated on December 9 upon the left side, and almost precisely the same condition of the articulation was found. As soon as the section through the neck of the condyle was complete, the mandible dropped a little distance. When the excision was completed, and before the wound was closed, an ordinary mouth gag was placed between the teeth and opened until the mouth seemed about the normal size. Then by grasping the mandible some lateral manipulations were made, after which the wound was closed.

There was no special interference with respiration during either operation, and the patient made a rapid and uninterrupted recovery from each. The wounds healed by primary union, and in each case the sutures were removed on the eighth day. He was allowed to open his mouth as freely as the bandages would permit, and ten days after the second operation, when he left for his home, he could voluntarily separate the anterior teeth to the extent of one inch, and was learning to masticate solid food. Three weeks later he could open his mouth one and one-eighth inches. There was paralysis of the muscles supplied by the malar and infraorbital branches of the temporofacial division of the seventh nerve, from which condition he gradually but completely recovered in two months. He has actively exercised the muscles connected with the mandible, and at the present time can open his mouth one and one-quarter inches, and has considerable lateral movement.

CASE II.—E. W., aged eighteen years, when five years of age fell from a roof to the brick pavement, a distance of about fourteen feet, striking his mouth and chin. He bled profusely from the mouth and nose, and two of the upper front teeth were knocked out. Dr. Winter was called, and upon examining him

found nothing wrong except injury to the teeth and gums, and, after controlling the hæmorrhage, ordered the application of ice-bags to the sides of the face. Considerable swelling took place in the region of the mandible, and the tumefaction was especially marked upon each side at the sites of the articulations. He was referred by Dr. Winter to Dr. Brown, a dentist, who removed two other teeth that were loose, and then fastened several lower teeth in place by wiring them. The patient was never able to open his mouth as wide after the fall as before, and a gradual decrease in the movements of the mandible was noticed, until at the end of nine months only very slight motion was possible. He applied for treatment at several hospitals in Philadelphia, and at one institution he received treatment three times each week for a period of five months. The following plan was pursued: His teeth were separated as far as possible by means of a screw-gag, and then a wedge of soft wood was placed between them, after which the gag was removed, leaving the wedge of wood between the teeth for three days, provided he was able to bear the pain. It being necessary to use the gag in order to remove the wedge of wood, the patient almost invariably returned in twenty-four hours, but occasionally endured the suffering for two days. When the wedge was removed, the mandible could not be moved voluntarily, but would gradually close the space acquired between the teeth, and in doing so would give pain at the site of the articulations. The treatment was abandoned by the patient at the end of five months, owing to the suffering caused and the absence of any improvement in his disability.

He was referred to me by his family physician, Dr. Heller, about fifteen months previous to the time at which I operated. Photographs taken at that time show the appearance which he presented (Figs. 4 and 5). The noticeable features were marked recession of the chin and absence of any fulness in the region of each articulation. The relative displacement of the point of the chin was three-eighths of an inch below and one and three-eighths inches behind its proper position, according to the line of harmony, the divisions of which measured as follows: from the hair-line to glabella two and one-fourth inches, from the glabella to the line of union between the nose and upper lip two and one-fourth inches, from the latter line to the point of the chin two and five-eighths inches, and from the point of the chin to



FIG. 5.—Case II. Showing the posterior teeth in occlusion and the anterior teeth separated some distance.

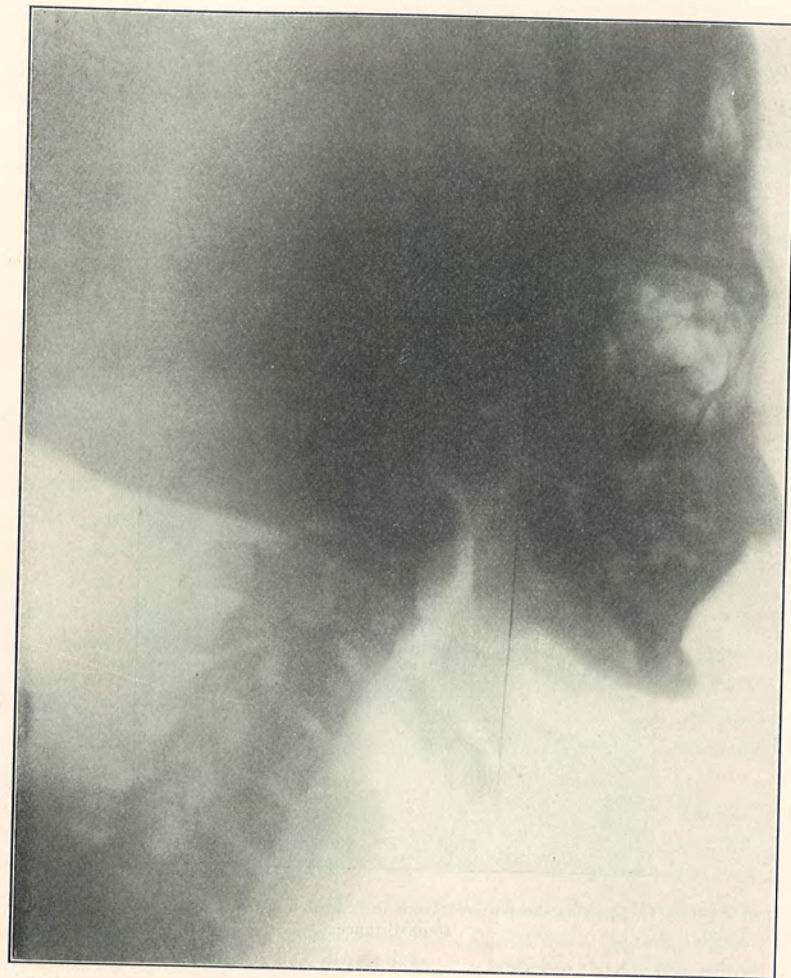


FIG. 6.—Case II. Skiagraph showing the bridge of bone connecting the right temporomaxillary articulation, the angle formed by the occiput and mandible with the cervical vertebrae, and the position of the hyoid bone as compared with Fig. 3, Case I.

the line of harmony one and three-eighths inches. The mandible was ankylosed with the posterior teeth in occlusion, and the anterior teeth separated the distance shown in the photograph (Fig. 5). He was able voluntarily to separate the teeth in occlusion about three-tenths of a centimetre. The muscles of mastication were fairly well developed, evidently free from adhesions, and able to contract strongly, he having exercised their limited power daily. The development of the mandible had evidently ceased at the time of the injury, as the bone was apparently not larger than that of a boy five years of age. The rami were almost at right angles to the body and were decidedly more vertical than normal. There was no apparent deviation of the chin to either side, and no difference during passive or induced motion in either half of the mandible. I was again fortunate in securing skiagraphs (Fig. 6) taken by Dr. Charles Lester Leonard. Each skiagraph shows practically the same condition as did those of the other case, and I therefore concluded that the original injuries and the results were similar. Having decided to employ the method used in the previous case, I operated February 13, 1902, upon the right side, and found the assumed condition existing, except that the dimensions of the bridge of bone were somewhat less. The details of the operation were precisely as those previously described. The operation was uneventful, and the only point of interest, especially in connection with future developments, was the occurrence three times of embarrassed respiration, followed by slight cyanosis, which disappeared upon the temporary discontinuance of the ether; this, however, did not cause any alarm or apprehension, as I have frequently seen the same condition more marked under ordinary circumstances. His convalescence was rapid and uninterrupted, and on February 20 I operated upon the left side, employing the same method, and found practically the same condition. In this, as in the first operation, the ether was administered by Dr. W. R. Roe; some slight difficulty was experienced, as noted in the first operation, and special care was therefore exercised to administer the minimum quantity under which the operation could be performed, and he was barely under the influence of ether at any time. When the section through the neck of the condyle was completed and the mandible dropped slightly, more decidedly embarrassed respiration occurred, and continued to some extent while the work of

removing the condyle and making smooth the zygoma and upper portion of the ramus was being completed. When the mouth gag was placed between his teeth and the jaws separated, respiration ceased; in order to restore it, rhythmical tractions were made upon the tongue, while an assistant made artificial respiration by Sylvester's method. In addition, the patient was placed in the Trendelenburg position and given hypodermically one-tenth grain of strychnia sulphate. Different positions of the head were also tried. These means failing, an attempt was also made to reach the epiglottis with the index-finger; but this failed, there not being sufficient separation between the teeth. Having spent probably more than a minute in these unsuccessful attempts, and the patient being in a state of complete relaxation, with extreme cyanosis, a rapid laryngotomy was performed by plunging a scalpel through the cricothyroid membrane, cutting down to the cricoid cartilage in a vertical direction. Finding this space insufficient, the incision was extended upward between the two lateral halves of the thyroid cartilage. This gave ample room to open the larynx widely, and, as the artificial respiration was continued, the cyanosis lessened and soon natural respiration was re-established. Fearing that infection of the wound upon the left side might have occurred during the attempts at restoration of the patient, and also because some hæmorrhage was taking place, the wound was packed with gauze, and then closed as in the other operations, except at the lower portion which the gauze occupied. As soon as the dressings were applied and the mandible was held in its original position with the bandages, he began to breathe partially through the mouth and nose. A tracheotomy tube was kept ready to introduce at once if such a step should become necessary to keep the laryngotomy wound open. The laryngotomy wound was closed one hour after it was made, as he was breathing naturally, and there seemed no further use for the artificial opening. In closing it, three sutures were placed in the skin, allowing the lateral cartilages and cricothyroid membrane to approximate, as they readily did. A gauze drain was placed between the cartilages and the skin, and was brought out at the lower angle of the wound. He made an uninterrupted recovery, not a single dose of medicine was given, and the only thing he complained of was some swelling of the tongue (the result of the application of the forceps), and insomnia. The

gauze drain in the laryngotomy wound was removed in two days, the sutures in five days, and on the eighth day the wound was entirely healed. The packing was removed from the left articulation on the third day, the sutures on the eighth day, and the wound was entirely healed on the twelfth day, no infection having taken place.

In the first case, while the patient was under ether, the mouth was opened widely by stretching the muscles and fascia connecting the mandible, and it was made readily movable. In the second case a similar procedure had been begun, but the mouth was opened only about half-way when respiration failure occurred. It is unfortunate that this procedure was not completed while the patient was breathing through the laryngotomy wound, as it could then have been done with safety. Fearing a repetition of interference to respiration if he were given an anæsthetic to complete the opening of the mouth, the use of the mouth gag was begun twelve days after the operation. This plan is to be noted, for each method had its advantages and disadvantages. In the first case, the overstretching of the muscles so long contracted would necessarily result in strain and laceration of some of their fibres, and thus cause weakening of the muscles. The cicatricial contraction of healing would also lessen their ultimate functional power. In the second case, although believing that the slight stretching of the muscles was free of the dangers incident to the overstretching of the same, and promised better development, it seems possible that the resistance of the fascia would not be sufficiently overcome to secure an extensive range of motion to the mandible. The mouth gag was used at intervals of two and three days, and then only with very moderate force, owing to the fact that slight pressure upon the teeth caused considerable pain, as the tissues of the alveoli had never been accustomed to resisting pressure by mastication.

Considering both cases carefully, it appears that the results are just as good after the second plan as after the first. Paralysis of the same group of muscles as occurred in the first case was present in the second, but it had entirely disappeared at the end of two months. The laryngotomy was followed by some functional disturbances, for instance, slight hoarseness and inability to speak loud, from both of which conditions he entirely recovered. His present condition is very satisfactory. He can open his

mouth one and one-quarter inches, but has practically no lateral motion.

With a view of ascertaining the strength of the muscles of mastication in these two patients, I used an instrument, the gnathodynamometer, invented by Dr. G. V. Black, Dean of the Northwestern University Dental School of Chicago. As to the average strength of the human bite, trials taken two years ago by Dr. Black in his senior class gave pressures with the molar teeth all the way from forty to 275 pounds, or the total number of pounds registered by the instrument. The average of these trials was  $171\frac{6}{10}$  pounds. Trials taken a year later in his senior class averaged 132 pounds on the molars and but fifty-two pounds on the incisors, and varied all the way from thirty to 275 pounds on the molars. These trials included about 125 persons each, and were taken without any selection of persons whatever, and usually a person made but a single effort.

The results seem to depend almost entirely upon the condition of the peridental membranes. The large majority stop because of pain in the peridental membranes, not because they have used their full muscular strength; consequently, the results, taken as a whole, do not give the muscular strength of the jaws, but are simply an index to the condition of the peridental membranes.

I was disappointed by not being able to use this instrument satisfactorily in either of these cases for the following reasons: The first molars were badly decayed and were extracted subsequent to the operation, and, owing to the lack of development of the mandible, the position of the second molars was so far posterior and the distance between the blades of the instrument being thirteen-sixteenths of an inch, there was not sufficient space between the occlusive surfaces of these teeth to introduce the instrument sufficiently to prevent its slipping.

In the first case, with the instruments between the anterior teeth, it registered fifty pounds and in the second case forty pounds. It was quite evident that neither patient exerted his full muscular power, but stopped owing to pain in the peridental membranes.

The first thing which this report seeks to establish is the true etiology in each of the cases. It seems evident that ankylosis resulted from fractures through the neck of the condyloid processes, for the following reasons:

Fracture of the neck of the condyle is not as infrequent as is generally supposed. In forty-one cases of fracture of the mandible which Dr. W. R. Roe and myself have treated, the line of fracture in six cases (two of which had multiple fractures) was through the neck of one condyle, and in one case the lines were through the necks of both condyles. The displacement at the site of the fracture in each of these cases was forward and upward, the fragments being brought closer to or in contact with the lower border of the posterior portion of the zygoma. If the sharp ends of the fragments are in contact with the zygoma, they may have denuded this process of its periosteum at the time of the injury; or if the fragments are not in contact with the zygoma, but are nearer the same than if they were retained in their proper relation to each other, and not completely immobilized, the irregular masses of callus which form in the process of repair frequently reach the lower border of the zygoma, and mechanically denude the same of its periosteum. This will explain the gradual and frequently slow occurrence of bony ankylosis in a number of reported cases. The skiagraphs in each case show clearly the angular displacement upward and forward of the neck of the condyle. This displacement, in connection with the more vertical position of the posterior border of the rami, together with the separation of the anterior teeth and the occlusion of the posterior teeth, tallies accurately with the conditions which theoretically should result from such fractures. The delineation of the skiagraphs was verified at the time of operation, and the bridge of bone was found to exist.

A very misleading symptom in reference to the true condition was the ability to move the mandible one-tenth of a centimetre in the first case, and three-tenths in the second case. This might seem to prove that true bony ankylosis was absent, because we assume that in true bony ankylosis there can be no motion. Cabot first called attention to this, and said it was due to the springing of the bone. In both of my cases it certainly was due to this cause. The skiagraphs demonstrate a most valuable method for learning the true condition of the



articulation, and they also show whether both articulations are involved and to what extent. The negative is placed against the side of the head, and the tube is adjusted so that the rays pass through the articulation in a direction obliquely upward, in this way avoiding the opposite ramus and angle, the shadow of which would not be as clearly defined as the ramus, which is in close contact with the negative.

As regards the practicability of the treatment employed, it is preferable to operate upon one side at a *séance*, choosing for the first operation the side most involved. Both articulations could be operated upon consecutively during the same *séance*. The advantages of this would be that the operator could satisfy himself, while the wounds were still open, that sufficient bone had been removed to obtain freedom of movement; the necessity of the second etherization would be avoided, and possibly there would be a lessened period of convalescence. Against this, however, is the increased danger from shock by prolonging the operation to just twice the length of time, as it is practically impossible to do synchronous operations; also the great danger of infecting the first wound, as it is very difficult to keep it protected from the fluids escaping from the mouth when the head is turned to that side while operating upon the opposite articulation. The wound in one week after operation will be sufficiently healed to obviate the danger of infection during a second operation.

The results in these cases depend largely upon the preservation of the function of the muscles of mastication; and it is important not to cut through the masseter muscles by a horizontal incision below the zygoma, as many operators have done. The method which is best is a vertical incision one and one-fourth inches in length, carried through the skin only, the fascia and fibres of the masseter muscles and the periosteum being split; this mode of division does not weaken the muscles to any appreciable extent. If the incision is limited to the skin, it is not possible to divide Stenson's duct or the temporofacial branches of the facial nerve. The temporary paralysis in each case was probably the result of overstretching of

the nerves. If special retractors are used, this method gives sufficient room for thorough and careful work. The function of the external pterygoid muscle is necessarily lost. Considerable lateral motion has been observed in many cases of unilateral ankylosis operated upon, due to the action of the opposite external pterygoid; but in bilateral cases lateral motion is frequently entirely lost. It is best to close the wounds without drainage when safe, as the facial contour is better preserved, especially if the muscles and fascia are held together by buried sutures. There is always considerable danger of the wound becoming infected when drainage is employed; and it is of the greatest importance to prevent infection, not only on account of its immediate danger, but also because it causes formation of a much greater quantity of cicatricial tissue, which will greatly limit the functional results; a depression inevitably results when drainage is employed. Some have packed the articulation with gauze for the purpose of keeping the surfaces of the bones more widely separated. When the wound is closed, the empty space will become distended with blood-clot, which will to some extent serve the same purpose; but if a wider separation of the false joints is desired, it is better to employ the method suggested by Cabot, of placing wedges of cork between the posterior teeth to maintain separation. Although this method was not used in the above cases, it seems to have special advantages, and should be used when practicable.

The most important question of all is the consideration of the dangers to be anticipated, and how to meet them.

I quite agree with Ranke, who said the greatest danger is from asphyxia; and I heartily sympathize with any operator who is confronted with this difficulty. In studying these two cases, I have endeavored to explain the occurrence of this condition in so serious a form in one, and to so slight an extent in the other. The ages of the patients were practically the same; they were both in good general physical condition, and the same care and technique were employed in each. The following reasons exist for believing that asphyxia is dependent

upon mechanical conditions, and a knowledge of them may be of some help in anticipating its occurrence in the future.

The normal position and function of the larynx are dependent upon the muscles which suspend it, the anterior group being connected with the mandible. It is reasonable to infer that the earlier in adolescence that development of the mandible ceases, the more abnormal will be the position of the tongue and larynx. In consequence of the mandible maintaining a fixed position in relation to the head while ankylosed, the muscles connecting the hyoid bone, the tongue and epiglottis, with the mandible, are accustomed to perform their functions with a limited power of contraction. If the mandible is dropped to a very slight extent, you can readily see how the functions of these muscles would be greatly disturbed. The relative difference in the two patients is quite marked and easily demonstrated. The first patient was eight years of age when the injury occurred, and the second five; and, although the subsequent development of the mandible practically ceased, the three years' difference in the ages of the patients at the time of the injury has made a marked difference in the condition of each. In the skiagraphs of the first patient, the position of the head in relation to the cervical vertebra is about normal, the lower border of the mandible making an angle with the bodies of the vertebra, five degrees less than a right angle, and the hyoid bone is shown one centimetre below the border of the mandible. The skiagraphs in the second case show considerable extension of the head upon the cervical vertebra; there is an angle of five degrees greater than a right angle, and the hyoid bone is seen three centimetres below the lower border of the mandible. The position of the hyoid bone is two centimetres lower in its relation to the mandible in the second case than in the first. The displacement of the larynx, hyoid bone, and the base of the tongue can be approximately estimated by the following measurements: there are one and one-half inches of the trachea above the manubrium, which can be increased on extension to one and three-quarters inches; in an adult there should be an average of two and

three-quarters inches; at ten years of age there should be two and one-quarter, and at six about two inches. The cricoid cartilage is opposite the body of the seventh cervical vertebra instead of the sixth. Therefore it is a reasonable calculation that the position of the base of the tongue, hyoid bone, and larynx is one inch lower than it normally should be, and their position remains practically the same in their relation to the manubrium as it was when the injury occurred, at five years of age. There are, I believe, two factors, both dependent upon the arrested development of the mandible, to which the faulty position of these organs is due. The position of the larynx and base of the tongue is dependent upon the position of the hyoid bone, it being suspended from the base of the skull by a duplicate set of muscles, namely, the stylohyoid, the posterior belly of the diaphragm, and the middle constrictor of the pharynx; and from the mandible by the geniohyoid, the mylohyoid, and a portion of the geniohyoglossus, and the anterior belly of the diaphragm. We will recall the fact that the position of the chin is one and three-eighths inches posterior to the position it normally should occupy, therefore it is evident that, if the chin should be carried forward to its normal position, the anterior group of muscles acting from that point would raise the hyoid bone at least one inch, which would be its normal position. And of still greater importance is this: that it would not only raise the hyoid bone, but would carry it forward, and with the bone the base of the tongue and larynx would be carried away from the posterior pharyngeal wall. The importance of this as regards the function of these organs, you will readily appreciate. I have gone into these details in order to make clear that, in the present condition of the patient, the hyoid bone with the organs which depend upon it for their position are not only displaced downward to the extent already given, but are also displaced backward, leaving practically very little pharyngeal space; and when the mandible is lowered to a very slight extent, the base of the tongue and the posterior surface of the larynx lie in contact with the posterior pharyngeal wall, making respiration very

difficult. I have frequently demonstrated this fact by retaining the mandible in a depressed position by means of the mouth gag, when the patient would become partly cyanosed and make violent efforts at respiration. At first I was inclined to believe that the obstruction to respiration was due to closure of the glottis by the epiglottis, the control of which having been lost by the changed position of the hyoid bone, as the movements of the epiglottis are practically dependent upon the position of that bone. It would be folly to attempt to exclude this as a factor, but I am strongly of the belief that the obstruction to respiration is due to the crowding of the larynx and base of the tongue against the posterior pharyngeal wall, leaving no space for air to reach the glottis, and, as a natural consequence, the epiglottis is forced against the glottis. In favor of this view are the following observations made at the time of operation. The respiration did not become impeded until the mandible was completely detached, in other words, until it dropped one-quarter of an inch; and it did not entirely cease until the mandible was depressed about one-half an inch by means of the mouth gag. Traction upon the tongue with the mandible depressed was of no avail, and it could not be while the base of the tongue was crowded against the pharyngeal wall.

How are we to anticipate the danger of asphyxia in any special case before operation? The first practical point would be the age at which ankylosis occurred, and at which the development of the mandible ceased. But this in itself has little significance if the operation is done soon after the occurrence of ankylosis, as the displacement of the hyoid bone, base of tongue, and larynx evidently increase with growth and reach the maximum at adult life. Consequently, the danger of asphyxia would increase in proportion to the time intervening between the occurrence of the ankylosis with arrested development and maturity. Further, ankylosis occurring after maturity would not cause any displacement or abnormality of the larynx, hyoid bone, and tongue, and consequently there would be no more danger of asphyxia than in any ordinary case.

Upon this important part of the subject I consulted by letter one who is recognized as an authority, Dr. Thomas Dwight, Professor of Anatomy in the Harvard Medical School, whose recent very valuable contribution upon the "Growth of the Face and especially the Pharynx" bears directly upon this subject. I quote the following from his reply:

"I am quite of your opinion that the very serious danger in your case was caused by the tongue (carrying the epiglottis with it) falling back and obliterating the pharyngeal space. I think it is not generally recognized how very small that space is under any circumstances, as it is well shown on frozen sections in the median line. Very probably in your patient the space was even smaller than usual.

"I cannot, however, agree with you concerning one point. You suggest that the want of development of the mandible was the cause that the hyoid was not carried up to its normal position. The fact is that in the infant the hyoid and larynx are very high and gradually descend, and for that matter the lower jaw descends too, for at birth its lower border is nearly in the same horizontal plane as the occiput. Consequently its function is not to pull the hyoid up. The uncommonly low position of the hyoid is a puzzle. So far as I know, it must be extremely rare. Can it be that the want of development of the jaw in some way failed to restrain its descent? I own I do not see how this should occur. I am sorry that this is all I can say."

I would answer the above question in the affirmative, believing that it is the proper solution. As already described, the bringing of the occipital and mandibular attachments of the muscles which suspend the hyoid bone closer together allows the muscles to assume an almost vertical instead of an almost horizontal position; and, again, the growth of the tongue would necessarily displace the hyoid bone downward, owing to the fact that it could not extend anteriorly on account of the teeth in an ankylosed and undeveloped mandible.

The external measurements of the mandible are as follows: between angles nine and one-half centimetres; between

angle and symphysis seven and one-tenth centimetres; between angle and zygoma four and one-half centimetres. Therefore not only the anteroposterior measurement, but the lateral measurement, was lessened, which, with the inward displacement of the teeth, would greatly restrict the space normally occupied by the tongue. My attention was called to this lateral narrowing of the pharyngeal cavity by Dr. D. Braden Kyle, who made an examination of the pharyngeal space, and coincided with the above views as to the cause of asphyxia. Having considered the age of the patient and its significance, a carefully elicited clinical history will aid materially in anticipating the danger of asphyxia. In Case II, ordinary respiration was attended by considerable stertor, and during the entire period in which the mandible was ankylosed he was never known to sleep without snoring loudly. To secure sleep he would generally assume the prone position, with the head turned to one side and extended over a pillow, or, if in a supine position, he would place one or two pillows beneath his shoulders, thus placing the head in full extension. In each of these positions he unconsciously followed the advice of Dr. Howard of London, who claims that "the best way to raise the epiglottis is not by pulling the tongue forward, but by extending the head and neck."

The necessity for full extension of the head during these years explains the acquired faulty position of the same with the vertebra, as shown in the skiagraph, and as already described, together with a marked prominence or anterior projection of the bodies of the first and second cervical vertebra, against which the soft palate is closely drawn.

Having considered at some length the dangers to be anticipated, the question of how to meet these dangers is of vital importance. When the danger of asphyxia is imminent, the absolute necessity of using the mouth gag while the patient is under the anæsthetic is disproved by the results in the two cases reported. In the second case the condition is quite satisfactory and equally as good as in the first case. This demonstrates the practicability of obtaining sufficient stretching of

the muscles and fascia subsequent to the operation. In any case, where more active use of the mouth gag is required, the metal shields should be used to cover the teeth. Greater force can then be applied. This plan was originally recommended by Dr. Goodwillie, of New York. (*New York Medical Journal*, July, 1875.)

To relieve asphyxia when present, instead of attempting to further depress the mandible, to make traction upon the tongue or reach the epiglottis as was done in my case, at once restore the mandible to the position it occupied when ankylosed, and thus place the parts in the best possible condition for easy respiration. In addition, if necessary, hook a tenaculum under the hyoid bone and lift it away from the posterior pharyngeal wall. This means failing, do a quick laryngotomy. The low position of the hyoid bone and the corresponding small amount of trachea above the manubrium would have rendered in my case a tracheotomy both difficult and dangerous, and hardly practicable in such an emergency. It is scarcely necessary to state that, in conjunction with different means employed, artificial respiration should be continued and all other necessary aids be used.

The clinical history of Case II would be incomplete without giving briefly the condition of the mouth, nose, and throat when examined subsequent to the operation. Besides several cavities in the remaining teeth, the first four molars were so badly decayed that practically only the roots remained, and these were extracted about three weeks after the operation. The second lower molars are opposite to the anterior angle, and are in a horizontal position, the crowns looking inward and towards each other. These teeth were so far within the arch that it was not possible to determine their presence until after the mouth was opened. For the care of his nose and throat, he consulted Dr. Walter J. Freeman, who very kindly sent me the following report of the condition which he found:

"After your operation . . . I found his difficulty in breathing due to the adenoids and relaxation of the soft palate. The velum lay on the back of the tongue, and the uvula

was so broad that the faucial opening was almost completely shut off from the throat. View of the vault could not be obtained through the throat, but the obstructing mass of pharyngeal tonsil could be plainly recognized through the nasal fossæ. I amputated the uvula, and the noisy respiration was immediately improved. With a snare I then removed a mass of the adenoids through the nose, and operations on this were continued by my associate, Dr. Baldwin, until the vault was completely cleared."

What prophylactic measures can be used to prevent possible ankylosis in cases of severe injury to the mandible similar to the two cases here reported? A careful examination of the mandible in the regions of the articulations will frequently disclose a fracture which, when present, should invariably be treated with an interdental splint with a closed bite, or the application of Dr. Angle's system of treating fractures with the teeth in occlusion. By either plan the fragments will be maintained in their proper relation to each other and be carried away from the zygoma, the danger of ankylosis being thus obviated. In seven cases so treated there was no appreciable interference in the movement of the mandible.

Of all the operations and methods resorted to in the past for treating permanent ankylosis of the mandible, only two are now being generally employed.

Excision of the head and neck of the condyle was first performed by Professor Humphrey, of Cambridge, in 1856 (*Medical Association Journal*, 1856), for the relief of ankylosis due to chronic rheumatic arthritis. The other operation is known as Esmarch's, who suggested it at the Congress of Göttingen in 1855. It was first successfully performed by Dr. Wilms in 1858. It consists in establishing a false joint in front of existing cicatricial tissue.

I cannot agree with David M. Gregg (*Practitioner*, December, 1899), who says "the only operation worth considering is excision of the neck and condyle;" nor can I agree with

the conclusion of Dr. Paul Swain (*Lancet*, July 28, 1894). "Taking, therefore, into consideration the simplicity of the operation as compared with the excision of the condyle and the superiority of the results, I think it may fairly be suggested that the modifications of Esmarch's operation is the one which surgeons in the future should prefer." I do, however, practically agree with the opinion expressed by Dr. A. C. Cabot (*Lancet*, August 7, 1897), "in cicatricial contraction due to noma, burns, or lupoid inflammation, the section of the bone must be in front of the cicatrix, forming a false joint in front of the detaining bands; Esmarch's operation producing the best mechanical condition possible. In bony ankylosis, the nearer the section is made to the joint, the nearer do the conditions simulate the normal."

The condition of the articulation and the surrounding tissue is the proper guide in deciding which operation to employ. In the absence of cicatricial tissue, as in my two cases, or when the tissue is present in such small amount that there is a reasonable assurance that it can be overcome by appropriate treatment, excision of the head and neck of the condyle is the proper operation. Where the muscles are destroyed or their function is held in abeyance by dense cicatricial tissue which cannot be overcome, the Esmarch's operation is clearly indicated and gives the best results. The preservation of the maximum amount of muscular function in bilateral cases is of the greatest importance. In unilateral cases it is quite possible to have good masticating power from the muscles of the uninvolved side, even if Esmarch's operation is done upon the opposite side and in front of the masseter and internal pterygoid. But when Esmarch's operation is done in bilateral ankylosis, the power of mastication is very feeble or is lost; and in one case reported the central portion of the mandible was so beyond the control of the elevator muscles that for two days after the operation it caused grave danger of asphyxia by its depressed condition.

Of considerable concern to me was the question whether

new bone would form from the periosteum after excision of the head and neck of condyle, which would subsequently lessen the range of motion. The results in these two cases and in the others reported demonstrate that this danger is scarcely to be apprehended, and that it is perfectly safe to make a subperiosteal excision.

#### STATED MEETING, MARCH 2, 1903.

The President, RICHARD H. HARTE, M.D., in the Chair.

##### PAPILLOMA OF THE VULVA IN A CHILD.

DR. GEORGE ERETY SHOEMAKER reported the case of a girl, aged six, who was seen with her physician because of a bleeding growth protruding from the vagina, accompanied by a persistent irritating discharge. The general health of the child had been impaired for a year, and adenoids of the nasopharynx had been recently removed by another surgeon. About eight months before a white vaginal discharge had appeared, and had since resisted treatment at the hands of various physicians. Bleeding had appeared six weeks before his visit, but the growth had been noted only for a few days, and had increased decidedly.

Examination showed several soft, easily bleeding, prominent papillomatous masses occluding the vulvar cleft. There was no involvement of the skin surfaces, or of the anus. The masses were pale pink in color, sharply elevated, pedunculated, and quite fragile, while some were flattened from side to side and serrated on top like the comb of a cock. One rounded portion half an inch in diameter sprang from within the urethra by a stem. Smaller growths sprang from pits beside the urethra, while inside the posterior commissure the bases of others, which were large and irregular, were attached. None appeared higher in the vagina. The discharge showed diplococci within the cells of typical gonorrhœal character.

After twisting off the growths, their bases were burned with the thermocautery, the one springing from the urethra being, however, tied off to avoid contraction. Protargol solution was ordered for the discharge. Recovery was prompt. The reporter added that these vascular tumors of the urethra were said by Pozzi to occur in poorly nourished children, and to be due to irritating discharges. They are more common in the adult. It is not thought necessary by some authors to consider them venereal in origin, though they are apt to accompany gonorrhœal or