

so that deglutition was very difficult and articulation imperfect. The health of the patient was only slightly impaired.

The specimen measured six inches in diameter, and weighed eight pounds.

As may be observed from the cut of the macerated specimen, more than half of the jaw-bone had been

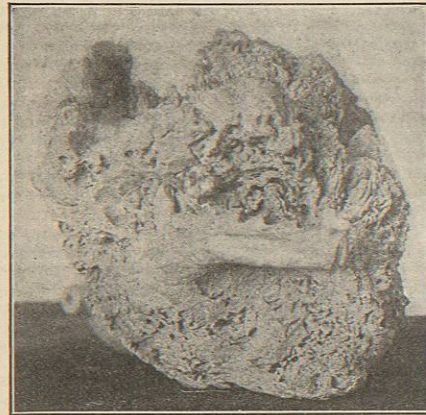


FIG. 2987.—Macerated Specimen of Osteochondroma Removed by Prof. W. T. Briggs. (From a photograph.)

absorbed. The second molar had been transported in the tumor half an inch above the alveolus.

The extraordinary size of the tumor may be estimated by the fact that the mouth had been so greatly distended that it was necessary, in the operation, to excise eleven inches of the patient's lip.

OSTEOMATA OF THE LOWER JAW may be either cancellated or of the kind known as ivory exostosis.

The cancellated osteomata most likely originate from the conversion of enchondromata into spongy osseous structure.

Ivory exostoses are frequently found near the angle of the jaw. Such tumors seldom reach very great size. They are as hard and compact as ivory, of painless, slow growth, and irregularly nodulated. These tumors may be removed by chiselling or gouging them out from the surface from which they spring. The probability of recurrence is small.

SARCOMATA.—The general appearance, symptoms, course, and treatment of this class of tumors are identical with those of similar affections of the upper jaw, given more fully in another part of this article. Sarcomata of the lower jaw are encountered more frequently and reach a larger size than those of the upper. Some of the largest tumors of the jaws have belonged to this type, among the largest recorded being one removed by Mr. Christopher Heath, which weighed six pounds four ounces.

The tendency to recurrence is one of the chief characteristics of sarcomata, and, therefore, in operations for their removal it should be the invariable rule to make sections through sound bone on each side of the growth.

EPITHELIOMATA OF THE LOWER JAW occur most frequently in old age, though they may occasionally appear in early life. The principal features of epithelial growths are rapid destruction of bone, tendency to form fungating masses that protrude in the mouth, glandular involvement, etc. Epitheliomata are sometimes secondary to epithelial growths of the lower lip, the disease in such cases extending directly from the lip to the bone.

The nature, diagnosis, prognosis, and treatment of epitheliomata of the lower and upper jaw are the same, though the chances of non-recurrence after removal are greater in the former, owing to its more isolated position.

The rule in excising portions of the lower jaw should be to go as wide of the disease as possible.

OPERATIONS UPON THE LOWER JAW.—Before proceeding to the performance of any operation the true nature of the disease should, if possible, be first ascertained. Rapid growth, infiltration of adjacent tissue, involvement of neighboring glands, the soft, pulpy consistence of the tumor, tendency to ulcerate, and impairment of the patient's health, should serve to distinguish malignant from innocent diseases.

It is important, also, to differentiate between the cystic and solid tumors, which may be readily done if the cyst is of large size and its bony walls have become so thinned by absorption as to yield the characteristic crackling upon pressure.

If doubt exists as to whether the growth is cystic or solid, an exploratory incision or puncture will usually clear up the diagnosis.

The special treatment appropriate to each variety of tumor of the lower jaw has already been given with the separate description of the various affections.

EXCISION OF THE LOWER JAW was first performed by Dr. W. H. Deadrick, of Tennessee, in 1810, although credit has usually been given to Dupuytren, whose case occurred in 1812. Dr. Deadrick's operation was undertaken for the removal of a large enchondroma, and was entirely successful.

When the tumor grows from the alveolus, and does not involve the entire thickness of the jaw, it is often possible to remove it from within the mouth with strong bone forceps and gouge, without making a complete section of the bone.

If the tumor is large and occupies the body between the symphysis and angle, as is most frequently the case, excision of a segment of the jaw between those two points is generally required. This operation has been performed from within the mouth, notably in two cases by Mr. Maunder, referred to by Heath, but the operation is a very difficult one, especially in cases in which the neoplasm has attained any volume. The greater ease and thoroughness with which the bone may be excised by the external operation more than counterbalances the advantages obtained by operating so as to avoid a scar.

The operation for removal of the jaw between the angle and the symphysis is performed as follows: The patient is thoroughly anesthetized, his head raised somewhat, and an incision made directly down upon the bone from the symphysis to the angle beneath the lower border of the bone. If the tumor is so large as to require more room than is afforded by this incision, another incision may be made in the median line through the lip and joining the anterior extremity of the first. The facial artery and vein will be divided by the first incision at the point where they cross the border of the jaw, and should be ligated before proceeding further with the operation. The soft parts are now rapidly dissected from the bone, and the tumor is thoroughly exposed to view. If the tumor is innocent, the surgeon should ascertain at this stage of the operation whether it can be removed without sacrificing the entire thickness of the jaw. If feasible, the growth should be enucleated or gouged out of its bed, and the lower border of the jaw left intact. If excision is determined upon, the internal surface of the bone should be cleared of its attachments with knife and elevator.

If the extent of the disease makes it necessary to divide the geniohyoid and geniohyoglossus muscles, a stout ligature should be passed through the tongue, by means of which it may be drawn out and thus prevented from falling back into the pharynx and causing suffocation, as has happened in a number of cases.

A tooth on each side of the tumor having been extracted, a saw is now applied to the bone at the points at which the jaw is to be divided, and the bone partially severed at each point. The sections of the bone may now be completed with bone forceps and the part removed. The fragment of jaw with morbid growth attached having been removed, all bleeding points should be ligated, the wound thoroughly irrigated with carbolized or iodized water, and its surface dusted over with

iodoform. The flaps of skin may now be brought in place and the wound closed with interrupted sutures of catgut or carbolized silk, and a drainage tube inserted at the most dependent angle of the wound. A light compress of tow or cotton, placed over the wound and retained by a few turns of a bandage, will complete the dressing. The ligature through the tongue should be fastened to a part of the dressing or to the cheek with a piece of adhesive plaster, and not removed for several days, when the tongue shall have formed new adhesions. The patient must be fed for some days upon a liquid diet, which frequently has to be administered through a tube. The mouth should be carefully cleansed by the frequent use of an antiseptic wash.

The dental artery in the divided bone may give rise to troublesome hemorrhage, to check which it may be necessary to apply the actual cautery, or to plug the dental canal with a piece of soft wood.

If the tumor encroaches upon the angle and ramus of the jaw, removal of half the jaw, with disarticulation, should be done; for even were the greater portion of the ramus sound, if it were left in place the powerful contraction of the temporal and external pterygoid muscles would tilt the fragment forward in such a position as to render it a constant source of irritation and discomfort.

For the removal of half the jaw an incision should be carried under the border of the bone to the angle, where it is joined by a vertical incision along the posterior border of the ramus to the level of the lobe of the ear. A third incision, from the inner extremity of the first incision vertically through the lip, may be required in cases of large tumors.

Occasionally the incisions cannot be made in conformity with any given rules, but must be adapted to suit the case, and in exceptionally large tumors it may be necessary to take away large segments of the skin.

The flap of skin should be dissected from the surface of the tumor, an incisor tooth extracted at the point at which the section of bone is to be made, and the jaw entirely divided with a small saw. Before proceeding fur-

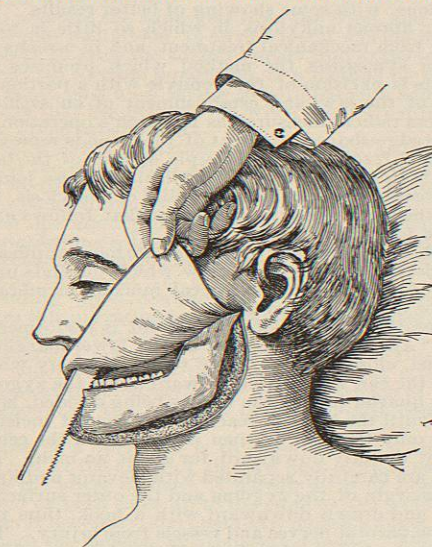


FIG. 2988.—Excision of Lower Jaw—Soft Parts Raised. (Erichsen.)

ther, the tongue should be secured in a looped ligature. The bone should now be seized with the lion forceps and drawn forcibly outward, in order that the attachments to the buccal surface of the bone may be divided. Especial pains should be taken to keep the edge of the knife

directed against the bone, in order to avoid wounding anteriorly the submaxillary gland and, nearer the articulation, the internal maxillary artery.

With the fragment still in the grasp of the forceps, it should be forcibly depressed so as to cause the coronoid process to start forward and thus permit of the division of the temporal muscle. The joint being exposed, the knife should be applied over it, by which the capsule is opened and the condyle released. In this step of the operation care should be taken not to twist the fragment of jaw too far externally, as the internal maxillary artery may be thus pressed around to the front and wounded at the same time the capsule is opened. In very large tumors it is frequently impossible to reach the coronoid process.



FIG. 2989.—Showing the Degree of Deformity left After the Removal of the Entire Lower Jaw. (From a photograph.)

Under these circumstances the ramus should be divided as high up as possible, leaving the coronoid and condyloid processes to be dissected out after removal of the tumor. The few remaining attachments of the soft parts to the bone having been divided, the jaw is removed.

The close proximity of the internal maxillary artery to the neck of the condyle makes it very liable to be wounded, and it is therefore always necessary to observe the greatest caution in disengaging the condyloid process. When the artery is divided hemorrhage is very profuse, necessitating the immediate application of a ligature, or if on account of the great depth of the artery this cannot be done, the temporo-maxillary artery should be ligated.

To prevent the remaining half of the lower jaw from falling inward, it has been proposed to fasten the teeth of the lower to those of the upper jaw by means of wire or metallic caps, but the measure has not been attended with much success.

The removal of the entire lower jaw, from one articulation to the other, for morbid growths is very seldom required on account of tumors, but in cases of phosphorus necrosis it was frequently performed. When excision of the entire bone is required on account of tumors, the incisions can be made to follow no special set of rules, but should be made to suit the requirements of the case.

For example, in the removal of the large osteochondroma by Prof. W. T. Briggs, mentioned above, one incision was carried from the commissure of the lips (as near as could be judged) to the articulation of the side from which the tumor had commenced, and a second incision was then commenced on the opposite side and carried through the lip vertically downward for several inches, and thence in a curvilinear direction under the tumor to the outer termination of the first incision, thus removing a large segment of skin and lip.

The results of operations for the removal of portions or the whole of the lower jaw are equally good as in excisions of the upper jaw. "Of 419 cases tabulated by Prof. O. Weber, only 83, or 20 per cent., perished. Of these, 246 were excisions in continuity, with 46 deaths; 153 were disarticulations of one-half the bone, of which 117 recovered, and 20 were extirpations of the entire jaw, with only 1 death. Pyæmia, erysipelas, and exhaustion were the principal causes of death."

Deformity after removal of portions of, or even the entire, jaw is remarkably slight (see Fig. 2989). The

gap left by the removal of the bone is filled with a thick, firm band of fibrous material, which takes the shape and general direction of the removed bone, and is in many cases sufficiently firm to support artificial teeth.

CLOSURE OF THE JAWS may exist in one of two forms, viz., temporary or spasmodic, and permanent or organic.

Spasmodic closure of the jaws is most frequently due to firm contraction of the masticatory muscles, especially the masseter and the internal pterygoid, superinduced by prolonged irritation of branches of the third division of the fifth pair of nerves.

The most common cause of this condition is the difficulty that sometimes attends the eruption of the wisdom tooth, either from the fact of its being misplaced or because the space between the second molar tooth and the ramus of the jaw is insufficient. Among other causes of spasmodic closure may be mentioned alveolar abscess in the vicinity of the last two molars, suppurative tonsillitis, necrosis of the jaws, etc.

Treatment.—The treatment of this affection is obvious, viz., to remove the cause. When the condition arises from difficult eruption of the wisdom tooth, the patient should be thoroughly anesthetized and the jaws forcibly separated by a screw-gag or lever, in order that access may be had to the seat of trouble. If the wisdom tooth is presenting normally, it may be sufficient to incise the gum freely or to extract it. Generally it is necessary to remove the second molar, in order that the wisdom tooth may have room to emerge. The cause of the irritation having been removed, the function of the jaw is in a short time completely restored.

PERMANENT OR ORGANIC CLOSURE OF THE JAWS is a far more serious affection than the spasmodic form, the management of which often taxes the patience and skill of the surgeon, as well as the endurance of the unfortunate sufferer; to the utmost. These cases may be conveniently divided into two classes, namely: those arising from diseases of the temporo-maxillary articulation, and those which have their origin in ulcerative action and cicatricial contraction in the perimaxillary soft tissues.

THE DISEASES OF THE TEMPORO-MAXILLARY ARTICULATION which, by causing fibrous or osseous ankylosis, lead to permanent closure of the jaws, are acute and chronic arthritis.

ACUTE ARTHRITIS may follow mechanical injury—for example, blows upon the side of the face, dislocations, or fractures that extend into the joint—or it may supervene upon the exanthematous fevers in connection with diseases of the middle ear.

Symptoms.—The symptoms of acute arthritis of the temporo-maxillary articulation are pain, redness, heat, and swelling and stiffness of the jaw, sometimes amounting to entire closure of the jaws. If suppuration occurs, the pus may escape through the external auditory meatus or by means of an opening in the overlying skin.

Treatment.—The treatment of this condition should be rest to the joint by causing the patient to abstain from mastication, the application of leeches over the joint, hot fomentations, and evacuation of pus as soon as formed.

CHRONIC RHEUMATIC ARTHRITIS of the temporo-maxillary joint is essentially a disease of old age, fortunately, however, rarely met with. It may affect one or both sides, but is more frequently unilateral.

Symptoms.—The symptoms are gradual enlargement of the condyle, which may often be plainly felt beneath the zygoma, pain on opening the mouth, and a peculiar creaking in the joint on moving the jaw, plainly perceptible to the patient. The neighboring lymphatic glands are enlarged. The face is distorted, the chin being inclined to the sound side when the disease is unilateral, carried prominently forward when bilateral. The pathological changes are the same as those of chronic arthritis of any other joint—the articular cartilage undergoes disintegration and absorption, the glenoid cavity is enlarged, the interarticular cartilage disappears, the eminentia articularis is levelled down so as to permit of partial dislocation, and the neck and head of the jaw are thickened

and enlarged. The muscles are in a state of tonic contraction in the effort to keep the inflamed joint surfaces in contact, and, as a consequence, stiffness of the jaws is always present to a greater or less degree.

Treatment.—In the treatment of this disease little is to be hoped for from the action of medicines, though active counter-irritation over the joint and the exhibition of increasing doses of the iodide of potassium have been recommended.

In the Transactions of the American Medical Association of 1881, Dr. D. H. Goodwillie, of New York, describes an ingenious method of making extension in the treatment of this disease, which in his hands yielded the most encouraging results. The apparatus consists of an interdental splint which separates the posterior teeth while the anterior remain free, and which is made to act as a fulcrum when the chin is elevated by means of elastic straps attached to a skull-cap, thus serving at the same time to keep the joint surfaces apart and to hold the jaws immovable.

ANKYLOSIS OF THE JAW, the result of arthritis, may be fibrous or osseous. No matter whether the disease is unilateral or bilateral, mastication is impossible.

The diagnosis between the fibrous and osseous varieties can be ascertained only when the patient is under the influence of an anæsthetic.

If the ankylosis is dependent upon the presence of fibrous tissue, the jaws may be forcibly separated, and the adhesions broken up by means of a screw-gag made for the purpose, or of levers and a wedge introduced between the teeth to keep the jaws apart. The tendency of the parts to become fixed again renders the daily repetition of this process necessary for months, and even for years. Even with the most constant care on the part of the surgeon, and the fullest co-operation of the patient, the result is very seldom satisfactory, and at the present time is rarely resorted to, except as after-treatment to more radical operations.

Division of the fibrous bands by a tenotome passed through the mouth into the articulation has been frequently done, with some showing of better results.

In both fibrous ankylosis, in which so little is to be hoped for from mechanical treatment, and in osseous ankylosis, or synostosis, the method which promises the best results is excision of the condyle with a portion of the neck of the jaw, and establishment of an artificial joint. Less radical measures, as Esmarch's operation, in which a wedge-shaped segment of the bone is removed, and that of Rizzoli, in which simple section of the bone is made—both with a view of establishing a false joint—are occasionally practised for the relief of ankylosis, but not with the same measure of success that follows excision of the joint.

Esmarch's and Rizzoli's operations are more applicable to the variety of closure of the jaw which depends upon cicatricial formation in the buccal mucous membrane, and will be described later on.

The operation of excision of the joint is performed as follows: "An incision is begun at the lower margin of the zygoma, close in front of the temporal artery where it adjoins the ear, and carried forward along the zygoma one and a quarter inches, the tissues being divided, layer by layer, until the bone is reached. A second incision, involving only the skin, is then carried from the centre of the first directly downward for about an inch. The soft parts are carefully separated with elevator and knife from the margin of the zygoma and the outer surface of the joint, and drawn downward with a hook, thus preserving the parotid nerves and vessels from injury. The neck of the condyle is then freed by working around in front and behind with a small elevator, keeping close to the bone so as to avoid injury to the internal maxillary artery, and finally divided with a chisel. If there is bony union between the condyle and temporal bone, the chisel must be again used to separate them, its edge being kept directed somewhat downward so as not to break through into the cavity of the cranium."³

PERMANENT CLOSURE OF THE JAWS may be due to cicatricial contraction following extensive ulceration and sloughing of the buccal mucous membrane.

This condition may be the result of cancrum oris, profuse pyalism, or necrosis. In reference to closure of the jaws from the excessive employment of mercury, Gross says: "Such an occurrence used to be extremely frequent in our Southwestern States during the prevalence of the calomel practice, as it was termed, but is fortunately diminishing. Children of a delicate, strumous constitution, worn out by the conjoined influence of mercury and scarlatina, measles, or typhoid fever, are its most constant victims; but I have also seen many examples of it in adults or elderly subjects. In the worst cases there is always extensive perforation of the cheeks, permitting a constant escape of saliva and inducing the most extensive disfigurement."⁴

When the mucous membrane of the cheek, from one alveolus to the other, is involved, the cheek is bound so closely to the jaw that all movements of the jaw are rendered impossible, and often the space between the teeth and the cheek is so limited as scarcely to admit the passage of a probe.

Frequently the new tissue has bone developed in it, which occasionally is present in the shape of an osseous bridge extending from one jaw to the other, thus serving to bind the bones even more closely together.

The condition of the patient is pitiable in the extreme, as food can be carried into the mouth only in fluid form, or by being rubbed against the teeth.

Treatment.—Attempts at relief of this condition by division of the cicatricial tissue and forcible separation of the jaws have proved unsatisfactory, since as soon as healing had taken place contraction of the new cicatrices occurred.

Excision of the nodular tissue entirely, and transplantation of healthy mucous membrane, as proposed by Dieffenbach, or of healthy skin, as practised by Jaesche, is nearly always impracticable, on account of the difficulty of obtaining healthy mucous membrane or skin near enough to be utilized.

To separate the adhesions from the bone, and, in order to prevent readhesion, to adjust metal shields worn over the teeth to keep the surfaces apart, and at the same time to keep up forcible separation, is a method of treatment that is not only most trying to both surgeon and patient, but one that has never, even when fairly tried for a long time, given satisfaction.

Dieffenbach's operation of making an artificial joint behind the contraction, by simple section of the bone, has proved inefficient on account of the liability of the divided bones to reunite.

The operation proposed by Esmarch, of Kiel, in 1855, of establishing a false joint in front of the contraction, by excising a wedge-shaped piece of the bone, is the most rational treatment yet devised for closure of the jaws depending upon contraction of cicatricial tissue. Of course this operation is applicable only to cases in which the disease is limited to one side.

Esmarch's operation is superior to the method of Rizzoli, which consists in the establishment of a false joint in front of the contraction by simple division of the jaw, on account of the tendency of the divided bones to reunite.

Esmarch's operation is thus performed: "An incision is begun at the angle of the jaw and carried two inches along the lower border. A narrow strip of bone is then cleared on both sides up to the edge of the gum, a tooth drawn if necessary, the chain-saw passed around the bone through the incision, and the section made. The anterior fragment is then depressed and protruded through the wound, and a wedge-shaped piece, from one-third to one-half an inch in width at the widest part, cut off with cutting forceps."⁵

Dr. J. Ewing Mears, of Philadelphia, in vol. i. of the Transactions of the American Surgical Association, reported a case in which he made a false joint for closure of the jaws from a gunshot wound by resection of a portion of the ramus of the jaw, together with the

coronoid and condyloid processes, and obtained a good result.

In the discussion that followed Dr. Mears' paper, Prof. W. T. Briggs reported a case of closure of the jaws from double synostosis resulting from arthritis, caused by a fall upon the chin, in which he removed the anterior portion of the body of the jaw. In this case the object of treatment was to obtain an avenue into the stomach, and excision of the jaw was the only method by which this object could be effected, inasmuch as the cause of the condition existed on both sides—the lower jaw was undeveloped, and occupied a position some distance behind the upper jaw; the lower teeth were buried in the mucous membrane of the palate, and the masticatory muscles had degenerated into fibrous tissue from long disuse.

In such extreme cases of closure of the jaw, excision of a portion of the bone is the only resort of the surgeon.

Charles S. Briggs.

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- ⁵ Stimson's Manual of Op. Surgery, p. 191.
- ⁶ Stimson: Fractures and Dislocations.

JECORIN.—Jecorin is a complex organic body containing phosphorus and sulphur, and which resembles in many respects lecithin. It was first prepared by Drechsel¹ from the liver of the horse in the following manner: The liver was extracted by cold dilute alcohol; the alcohol was evaporated at a low temperature, and the residue shaken several times with absolute alcohol, by which many impurities were removed while the jecorin remained undissolved. The jecorin was then taken up in ether containing water and precipitated by absolute alcohol; by repeating these operations several times the jecorin was finally obtained in pure form.

By drying in vacuo over sulphuric acid jecorin is obtained in the form of a light yellow, amorphous mass, which is so hygroscopic that when exposed to the air it becomes soft and sticky. On the addition of more water it swells and finally forms a turbid solution; after evaporation on the water-bath it is insoluble in ether as well as in water.

Jecorin is precipitated from its solutions by concentrated hydrochloric acid, copper acetate, and silver nitrate. The silver precipitate is soluble in an excess of jecorin, the solution being opalescent; on adding ammonia and warming the solution becomes ruby red.

Drechsel found the following elementary composition for the jecorin from the horse's liver: C 51.4, H 8.2, N 2.86, P 3.5, S 1.4, Na 2.72. Drechsel proposed the following formula from the above analysis: C₁₀₂H₁₅₄N₈SP₂Na₃C₁₆.

Baldi² isolated a substance having properties very similar to those of Drechsel's jecorin from the liver of the rabbit and dog; analysis of the latter preparation gave results somewhat different from those obtained by Drechsel: C 46.88 to 46.89, H 7.81 to 8.09, N 4.36 to 4.88, S 2.14 to 2.70, P 2.29 to 2.75, Na 5.72.

These analyses show that jecorin may be regarded as the sodium compound of an acid closely related to the "protogons."

When jecorin is boiled with sodium hydroxide and copper sulphate the latter is reduced, showing the presence of a sugar-like substance. When jecorin is warmed with sodium hydroxide alone, stearic and other fatty acids are split off; the soaps so produced form a gelatinous mass on cooling.

On boiling jecorin with barium hydroxide, cholin and glycerin-phosphoric acid, as well as fatty acids and a sugar (probably dextrose), are formed; this decomposition shows that jecorin is very similar in composition to lecithin.³

Baldi, making use of the method of Drechsel, found jecorin in the spleen, muscle, and human brain, and in