

A Technique for Treatment of Temporomandibular Joint Ankylosis

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In a case of true bony ankylosis of the temporomandibular articulation (and there are a great many pseudo cases), surgery is the only possible treatment. This paper will present an overall manner of treating and solving the problems associated with temporomandibular joint ankylosis which reflects the experience gained from the management of 146 cases.

First, it is fundamental to recall the factors that influence the formation of osseous tissue. Since a reversal of the order for the formation of osseous tissue is the principle on which the modifications and treatment presented in this paper are founded, it is necessary to review those factors that are deemed important.

Considering that the osseous mass constituting temporomandibular ankylosis is already formed, like any other bone, the plans are to create a pseudarthrosis which functions in the normal sliding movements that are needed for good mastication.

To lay the foundation for this technique, the evolution of a fracture callus and factors that influence it are briefly recalled. This review allows an easier understanding of the manner in which the surgical procedure is carried out.

The site of fracture initially organizes as in any traumatic focus. The blood (issued together with the tissues destroyed by the trauma), produces an inflammatory reaction chiefly due to stimulation of the parasympathetics by potassium which has become extracellular. The inflammatory reaction is characterized by a reactive hyperaemia and oedema of adjacent connective tissue.

The haematoma infiltrates below the open periosteum and causes the same reactions in the cells of this tissue. While the coagulation organizes, connective tissue cells are stimulated by physicochemical means and the concomitant oedema to take on aspects of the pluripotential embryonic cells of young mesenchymal tissues. Granulation tissue (which is composed of hyperaemic vessels that launch angioblastic sprouts toward the haematoma) and the surrounding young connective tissue cells begin to form so that in a few days all of the coagulum is substituted by this newly formed tissue.

When this happens, the local acidity of the medium (altered in a positive sense by the destroyed tissue and the irritation of the potassium) produces a combination between the ionic calcium and albumin. Thus an ambience of calcium albuminates is formed around the traumatic focus and the ends of the fractured extremities demineralize. Afterwards, when local acidity is being neutralized, catalization of the alkaline phosphates freed by muscular destruction will show the liberation of phosphoric acid in these phosphoric esters. Also, the combination of this phosphoric acid with the calcium from those primitive albuminates will form calcium phosphates whose apposition over the callus is definitive.

Before this can happen, invasion of the haematoma (organized by the young connective tissue) by young osteoblasts of the periosteum will start. In time, maturity of each of the formations will produce a solid osseous callus which will permit the definitive scarring of the fracture.

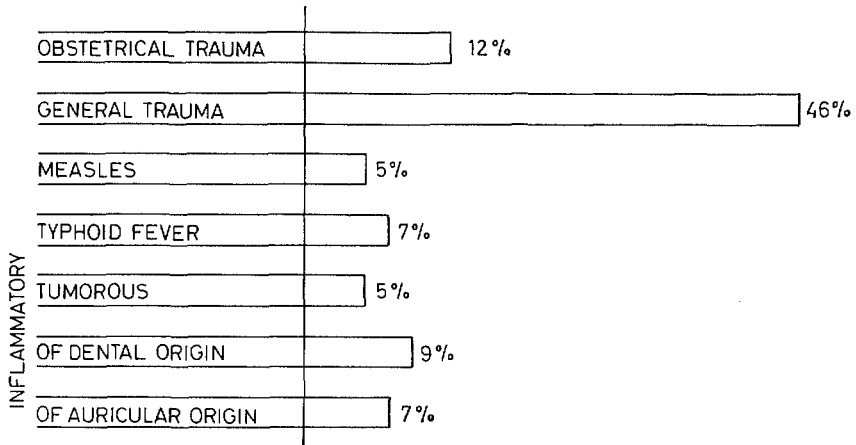


FIG. 1

Causes of temporomandibular joint ankylosis.

Mechanical, biological, physiochemical, vitamin, and hormonal factors also play a part in the processes just discussed. Only the mechanical and biological factors will be developed further, because they are the only ones which have a direct relation to the technique presented in this paper.

MECHANICAL FACTORS

Osseous extremities submitted to constant change of mechanical force, especially the sliding of one surface on another, undergo destruction (or at least the hindrance) of the newly formed osseous tissue and forms a fibrocartilaginous tissue which independently covers each of the fractured extremity surfaces.

In the physiopathology of pseudarthrosis, the great losses of osseous substance

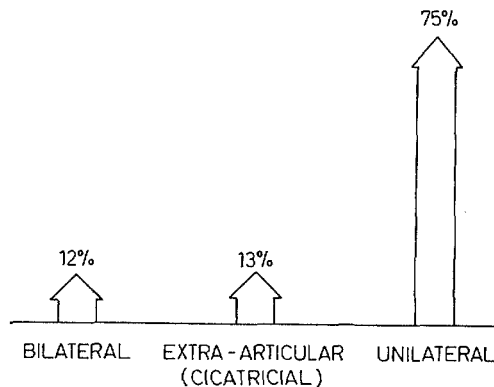


FIG. 2

Classification and frequency of temporomandibular joint ankylosis.

following excessive tractive force, which greatly separates the fractured extremities, impedes and handicaps the formation of a callus because those elements responsible for the formation of new bone are unable to fill the exaggerated existing dead space.

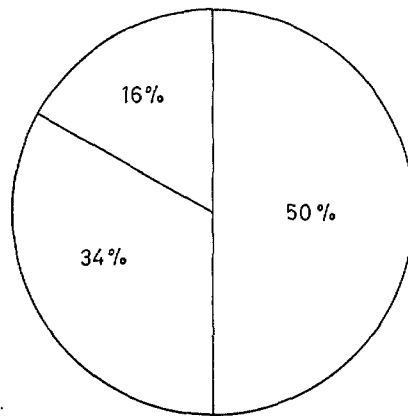
Functional excitation of bone produces a trophic-formative exacerbation. When pressure is applied, there is a major osseous apposition, and when there is no mechanical stimulus, an inevitable reabsorption is produced. To favour the creation of a pseudarthrosis, the possibility of functional mechanical stimulus should be completely eliminated by means of continuous traction force.

As a biological factor, the haematoma supplies an excitation that causes the formation of primitive or embryonic tissue. Since large haematomas are noxious as a result of exaggerated pressure created by medullary-periosteal hyperaemia, the same applies (although in the reverse sense) when the haematoma is very small or does not exist.

The interpositioning of soft parts in the centre of a fracture is said to impede the formation of osseous callus. This is true only when the interposing soft part is bulky and maintains its vitality between the osseous extremities. If it is a weak layer of tissue (either fascia or muscle) and is modified by the osseous extremities, it loses its vitality. The interposing soft part is then either eliminated by suppuration, or it stimulates the formation of fibrous tissue which favours a relapse.

Therefore, to create a pseudarthrosis in the temporomandibular articulation, all efforts should be orientated to the following effects:

1. The creation of a fracture in the osseous block (completely removing a part of it).
2. Drainage of the fracture centre to lessen the biological factor of coagulation in forming the first phase of a fracture callus.



HOW LONG WITH ANKYLOSIS

- 50% MORE THAN 10 YEARS.
 34% BETWEEN 5 AND 10 YEARS.
 16% LESS THAN 5 YEARS.

FIG. 3

Length of time with temporomandibular joint ankylosis.

3. Continuous intense traction to separate the surfaces of the fracture in such a manner that the processes of consolidation are made mechanically difficult and functional excitation is eliminated (Figs 7 and 8).

4. Early mobility of this centre to favour the formation of fibrous tissue which implies a pseudoarthrosis.

5. No interpositioning of soft parts, a technique which is regarded as deceptive.

Comparative table

<i>Callus is favoured</i>	<i>Pseudarthrosis is favoured</i>
<ol style="list-style-type: none"> 1. Exudative haemorrhage factor 2. Functional excitation of bone by mechanical stimulus 3. Intense use of traction in a negative sense 4. Rest for the centre of the fracture 5. Interposition of soft parts impedes the formation of the callus 	<ol style="list-style-type: none"> 1. Drainage 2. By continuous distraction of bone, the stimulus and excitation disappear 3. Intense use of traction in a positive sense 4. Mobility of the centre of the fracture 5. Only if soft parts are bulky do they slow callus formation

TECHNIQUE

Those operations which do not lead to the normal placing of an articulation should be eliminated. Because of the advances made in anaesthesia and the availability of better instruments, it is an unusual circumstance when a bony ankylosis is not amenable to correction. Osteotomy in the articular zone tends to create a nearthrosis in the area of the destroyed articulation and has the advantage of re-establishing the normal physiology of the masticatory apparatus whilst respecting the bone's leverage, the musculature and the neurovascular bundle. The scar which results from the operation is insignificant and is practically invisible in the majority of cases.

The technique for unilateral ankylosis cases will first be discussed followed by discussion of bilateral cases. Common characteristics of the procedure for unilateral and bilateral cases will be noted as well as the differences.

Unilateral cases. Anaesthesia. General anaesthesia is always used. Former difficulties that existed in this field have been eliminated by advancements made in anaesthesiology. Nasal intubation permits control of respiration, and hypotension provides reduced haemorrhage that is helpful in this type of surgery. Local anaesthesia is not indicated for this long and detailed procedure.

Incision. A preauricular incision is used which is traced as near as possible to the external auditory canal and extended upward and forward at an angle of 45°. The incision provides a sufficient working space. It is helpful always to have an orientation point on the outer surface, the lobe of the ear serving as a reference to the location of the facial nerve situated directly below the lobe.

The mandibular condyle is always situated at the highest point of the tragus. The preauricular incision is, therefore, satisfactory for approaching the ankylosed zone. It is inadvisable to resort to other places of access and, especially, to the retroauricular area.

Additionally, an arched incision approximately 1 cm. long is made below the angle of the mandible. Bleeding vessels are ligated and fibres of the masseter muscle are separated with a fine spatula from the bone. A hole is drilled through the angle of the mandible and a wire is passed through this hole. The wire allows traction and control of the movement of the mandible after the osteotomy is completed and the fresh osseous edges are smoothed. Traction, which increases the distance between the two osseous surfaces, permits a digital exploration which is fundamental for checking total mobilization, especially in the deep areas which are the most difficult and deceptive to evaluate.

In very complicated cases with extensive zones of ankylosis, a double path of access is used, the preauricular incision and a lengthened curvilinear incision which borders the angle. After electrocoagulation of superficial bleeders and separation of the muscle from bone, the two incisions are connected at the osseous level leaving the facial nerve (which will be included in the dermal bridge) out of danger. The dual approach provides two ample exposures in which to manoeuvre from the angle to the preauricular zone.

Arthroplasty. After completing the incisions and providing superficial haemostasis, the osseous level is approached without fear of finding anything of importance, because the facial nerve branches are left below and in front of the incisions. Only the superficial temporary artery remains to be ligated.

Sometimes, and especially with children, traction effort at the angle of the jaw permits a glimpse of what was the interarticular line which then serves as the pattern of the resection. In other cases, the osseous block contains all of the neighbouring structures including the glenoid cavity, condyle, and coronoid process. At times the posterior part of the maxilla is included in this single block of bone, and the upper and lower molars are erupted without orientation.

An osseous resection which includes a complete excision of the condyle and coronoid process and a modelling of the whole upper edge of the ramus is done (Fig. 6). For this reason, neither a surgical cutter nor a Gigli saw should be used, especially when depth is involved, because cutting of the bone cannot be properly controlled. A mortise of a fine cut and a clean-pointed hollow-ground chisel are sufficient to carry out this surgical stage. The osteotomy should be started at the lower level, because if the cutting is started at the upper level, the lower cutting will be made more difficult by the mobility of the mandible.

Shortly, a cubical osseous block is isolated and extirpated by freeing it (which is often very difficult) from the lateral pterygoid muscle insertions and from unforeseen fibrous attachments. Extirpation of the block is carried out using a clamp and twisting it which frees it from the muscular insertions. A careful check of the resection bed allows osseous projections to be found which are then levelled with bone files.

Once this stage is completed, the coronoid process is removed. This resection is justified by the following: first, one of the causes of relapse is eliminated; second, it is difficult to see if the coronoids are involved by radiographs and if they have fibrous tracts attached to them after having been immobile; third, surgical experience has shown how this process is deformed or involved in the majority of cases, as much in respect to angulation (especially in postnatal cases) as in the attachment of fibrous tracts to it which inevitably leads to relapse.

For this reason, the osseous resection is continued in a forward direction until this process is removed, a procedure which is difficult in many cases.

Having carried out the foregoing procedure, criticism could be raised because of possible

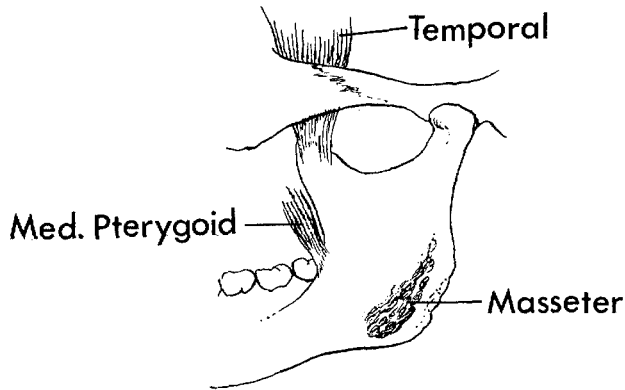


FIG. 4

Muscular components of the temporomandibular articulation.

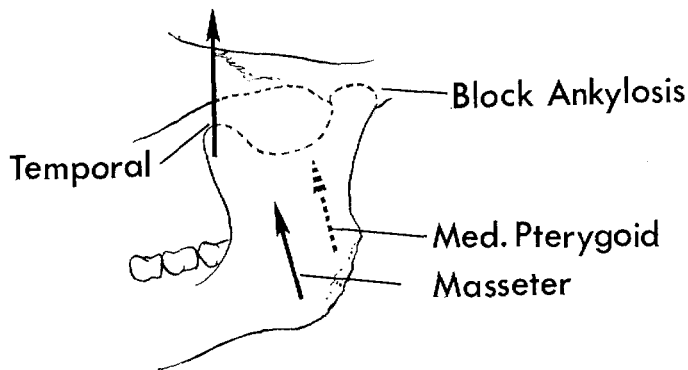


FIG. 5

Muscular components in an ankylosed articulation.

harm to masticatory function through lack of temporalis muscle action, but thinking of a possible relapse, apart from the supporting action of the masseter, excision of the coronoid process is of great advantage and does not seriously interfere with post-operative chewing function (Figs 4, 5 and 6).

Last, traction effort through the wire permits digital exploration of the wound for an exact control of the amplitude of the separation that has been effected. Also, the digital exploration determines whether fibrous tracts and attachments are present or not and allows a check on the levelling of the cut surfaces.

Following a check of the operative wound, a fine drain is placed between the cut surfaces of bone to facilitate drainage of the sanguinous exudate. One suture is placed with a fine atraumatic needle which ensures a negligible scar. The last detail is to place a compressive dressing which will accommodate the drainage from the wound.

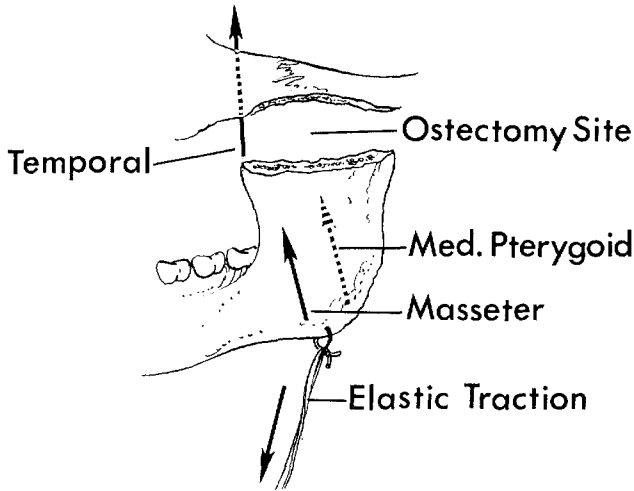


FIG. 6

Once the osteotomy has been affected, elastic traction counteracts the muscular action.

Continuous traction. For many years, maxillofacial surgeons have been faced with the problem of preventing the relapse of a temporomandibular joint ankylosis after its correction by surgery. The following procedure is used to prevent a reoccurrence of the ankylosis.

A simple plaster of Paris head cast is used from which a rigid but malleable aluminium rod protrudes. The rod is joined or connected through a system of elastic bands to the wire that is used during the surgical traction manoeuvres. This system allows continuous traction to be exerted on the mandible at the opportune moment.

Relapses are produced by the muscular action of the masseters and pterygoids working during the postoperative period which place the cut osseous surfaces in contact. Intense continuous traction exerted in an opposite direction counteracts this muscular action (Figs 6 and 7).

After a postoperative period of 10 days and later, the articulation is directed by the muscles surrounding it.

The traction apparatus is attached with ease and should be applied immediately in the operating room after suturing and placement of the dressing and drainage. The apparatus has an advantage of mobility, because it allows the direction of traction to be varied by different combinations of the elastic bands hooking on to the rod. Also, the apparatus has a valuable re-educational function since it allows the patient to carry out the masticatory movements comfortably, and to bring the teeth into complete occlusion immediately after surgery. This is not possible with known re-educational devices because they all function intra-orally. Additionally, traction is maintained during sleep which makes a relapse virtually impossible.

An important point in therapy is that jaw mobility must be initiated at the precise moment when the patient recovers consciousness (Fig. 9). Jaw movement must be started early and must be continued conscientiously by the patient.

There is an enormous difference between utilizing this dynamic procedure and using a

static method of maintaining the bone separation by means of an intra-oral wedge which favours the mechanism of osseous apposition.

The data and information given are demonstrative, but a clinical story will further verify the results that are obtainable by the technique described.

A child, M.L., suffered a strong blow to the chin and presented herself for treatment two months later after being unable to open her mouth. Preoperative studies indicated

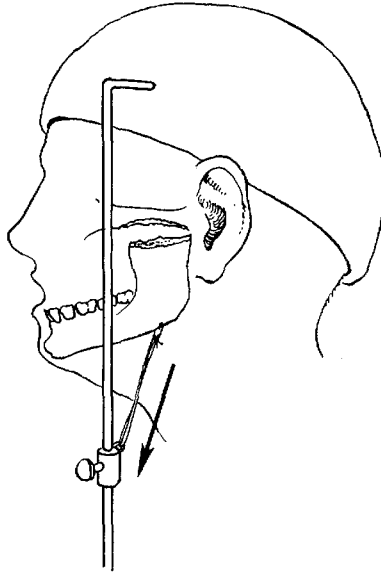


FIG. 7

Diagram of the fundamental action of the continuous traction after the intervention has been carried out (unilateral ankylosis case).

that a unilateral freeing operation should be done. The procedure was effected without incident. The child returned 12 months later with symptoms which suggested that a relapse had occurred. Believing that the side which had been operated on previously had reankylosed, the same side was opened. It was a fortuitous error because it showed that a perfect pseudarthrosis with impeccable osseous surfaces opposite one another and a great mass of connective tissue interposed between both osseous surfaces.

Attention was then directed to the opposite side which was found to be ankylosed. A further operation on this side resulted in a perfect postoperative functional recuperation.

The interpretation is simple. There must have been bilateral lesions produced on the occasion of the first trauma to the chin although it was not noticed because of such an obvious and clear-cut problem on one side. The probable traumatic lesion, although not appreciated at the first examination, produced an ankylosis as time passed by.

This case confirmed that, without introducing anything at all into the region, the space created by means of continuous forced traction produced connective tissue superior to any interposing foreign body which served to maintain the length of the ramus and acts as a barrier in separating the two surfaces of bone created by the osteotomy.

Bilateral cases. In bilateral cases the procedure to be followed is the same as described in the preceding section. The fundamental postoperative factor in therapy is to apply traction to the chin. The mandible should be distracted in a downward and forward direction with the articulations being controlled by the powerful muscles which normally act on the joints. Muscle pull is an indispensable anatomic factor in postoperative physiotherapy which was mentioned at the beginning of this paper.

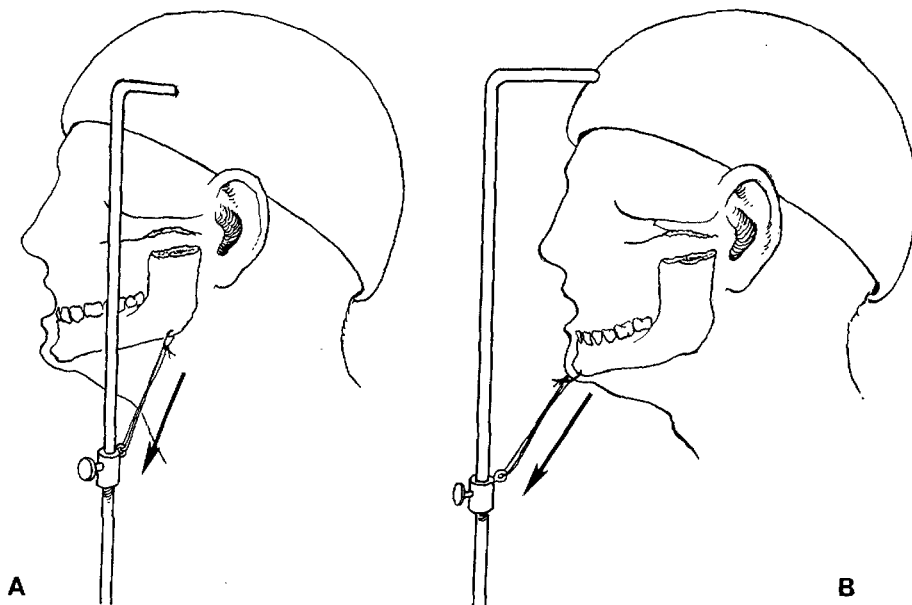


FIG. 8

Differences in the application of continuous traction in (A) a unilateral ankylosis and (B) a bilateral ankylosis.

Additionally, the dental occlusion is displaced forward by positioning the mandible in front of the maxilla via the traction. In maintaining mastication for a month in this manner, the very displacement helps to avoid a relapse, because every masticatory movement pushes the mandible downward and forward which are directions contrary to relapse. Second, the patient's appearance improves notably. The 'bird' profile disappears or, rather, it decreases without the necessity of interposing a foreign body between the two resected osseous extremities.

Finally, a brief comment is needed concerning the much discussed problem of treating bilateral ankylosis at one surgical intervention. The usual suggested waiting time for doing the two sides is a period of four to six weeks. Both sides can be operated on at the same time, because the advances made in anaesthesia allow the work to be done regardless of the time required and yet with safety for the patient.

In bilateral cases, the technique reported is recommended with great enthusiasm. Many of the patients with bilateral ankylosis in the current series were relapses after having previously been operated on by other surgeons. In applying the reported technique, all

have resulted in complete cures. The technique is especially recommended for patients with bilateral ankylosis of the temporomandibular joint.

As a complementary measure in the surgical treatment of temporomandibular ankylosis, postoperative physiotherapy is indispensable to the operation. Efforts would be in vain if

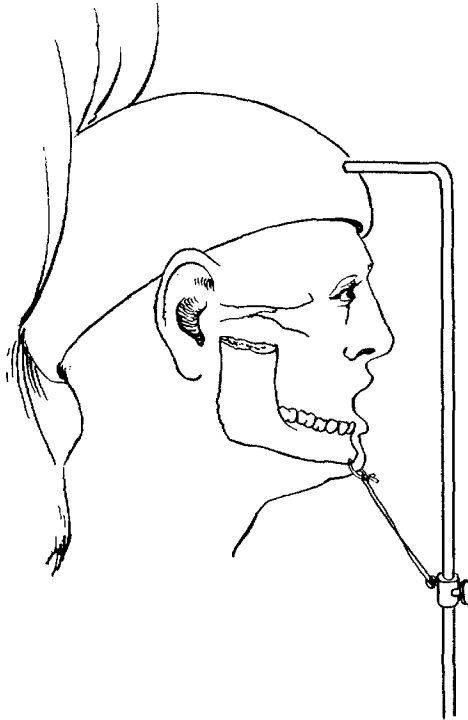


FIG. 9

The system of traction and continuous movement begins at the very moment of the surgical intervention (bilateral ankylosis case).

the patient did not receive correct re-education in use of his masticatory apparatus as well as adequate orthodontic and prosthetic follow-up treatment.

Muscle therapy plays a leading role because, apart from its action on cell metabolism and activating blood and lymphatic circulation, muscle action produces a marked exciting stimulus on sensory and motor nerve terminals. The therapeutic action is of an indirect type, but it stimulates the blood and lymph circulation. Therapy is done by, first, forming a small cutaneous fold overlying the muscle and allowing the two surfaces to slide over one another. The ball of the thumb, the index finger, and the middle finger of the right hand is used in this manoeuvre. After a few undulating and alternative movements of the skin and gentle percussive tapping, a cutaneous sensitiveness is eventually excited which produces vasodilatation and, eventually, an initial contraction of subjacent muscles.

The therapy sessions should last approximately 15 minutes, beginning with 5 minutes and progressively increasing the time, minute by minute, until reaching 15 minutes. For a sedative effect, it is preferable to do the therapy as the first thing in the morning and the last thing at night.

Sliding of the fingers is easier when talcum powder is applied to them. There should be scrupulous cleanliness before and after each session.

CONCLUSIONS

1. This report covers the most numerous statistical data that has been prepared in Spain in the treatment of temporomandibular ankylosis. In 1967, 146 cases had been registered. (Figs 1, 2 and 3.)

2. A nearly 100 per cent recuperation has been obtained without a death.

3. Diagnosis is based on a complete tomographical study of both sides.

4. After a diagnosis is established, surgery is done as early as possible, and sectioning of the bone is performed high up the ramus.

5. Access should be obtained by an ample preauricular incision, but at times, both preauricular and submandibular incisions are needed for good access.

6. At surgery, the bony parts are always distracted widely, because it widens the operative field and allows a close check to see if all unions have been eliminated.

7. An ample excision of bone with a chisel is recommended.

8. The coronoid process is routinely removed.

9. Continuous distraction of the bony parts is utilized to allow time for the formation of connective tissue between the separated parts.

(a) In unilateral cases, distraction is accomplished first by continuous traction and, later, by an activator or monobloc for overcorrection.

(b) In bilateral cases, distraction is maintained by continuous traction. Traction should be employed from the skull to the chin, which obtains a forward positioning of the occlusion, improves the profile, and avoids a relapse.

(c) In bilateral cases, both sides are always operated on at the same surgical intervention.

10. It is fundamental to place a drain in the space created by removal of bone.

11. Foreign substances are not recommended for placement in the pseudarthrosis.

12. Mobility of the jaw is recommended from the first immediate postoperative moment.

13. In extra-articular ankylosis with scarring present, an intra-oral removal of the coronoid process is recommended with separation and reconstruction of the vestibule with large-sized epidermal grafts.

14. Residual deformities should be filled out with bone grafts and complemented with or without compensating contralateral osteotomies according to the case.

To understand how little recognized and badly treated temporomandibular joint ankylosis is, of the 146 cases treated, 50 per cent of the patients had spent more than 10 years (some as long as 25 years) with their disabling deformity.

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