INTERMAXILLARY WIRING.

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FREQUENCY OF USE.

OF ALL of the various methods of apparatus and other means of immobilizing fractures of the mandible, the use of intermaxillary wiring between the upper and lower teeth is perhaps employed as extensively and more universally than all other splints combined. When the general surgeon has to reduce a fracture of the mandible he usually uses some plan by wiring the teeth together unless he uses a Barton or a Plaster bandage, it would perhaps be surprising to know the number of fractures of the mandible treated with intermaxillary wiring by general surgeons thruout the United States in the course of a year. Great numbers of dentists do not consider any other method of immobilization of fractures of the mandible than by the use of intermaxillary wiring, and dental officers are often obliged to resort to this as their only method of treating fractures of the mandible in the field or in small stations.

It is a bit strange in noting the fact that this method is so extensively employed and possesses so many salient advantages in the sub-severance of some of the most important basic principles of fracture reduction that more statistics and literature are not on record on this subject. It is also a noteworthy fact in comparison with other phases of surgical technic that the methods of intermaxillary wiring have not been stand-

ardized in point of principles with certain variations rendering it adaptive to the range of individual cases.

Very little writings on this subject are to be found in textbooks of Oral Surgery and Operative Dentistry, or in the current periodicals and abstract literature.

The fact exists that while individual operators develop certain personal ideas on the subject, the general plan of procedure is usually clumsy, full of dangers, tedious to insert, easily loosened, difficult to tighten, easily broken, hard to repair and usually attended with harassing trouble to the operator, pain to the patients, the results of which usually make it necessary to retain the wires longer and not infrequently inviting complications which may partake of a very serious nature.

ADVANTAGES OF INTERMAXILLARY WIRING.

Perhaps the chief outstanding advantage of wiring the upper and lower teeth into close contact is the fact that this plan of reduction of malposition is founded strictly upon the basis of original occlusion, normal position of the fragments and absolute rest to all parts in normal position, including the muscles of mastication and those of expression, as well as other overlying tissues. There is no bone in the body which demands more exactitude in the accuracy of reduction of fractures than in the mandible, for without the restoration of

perfect occlusion and harmony in the features when both passive and active, the solidified fracture is a failure. Frequently, when even a thin covering of material is attached in the form of a splint between the upper and lower teeth, there will be a slight change in the relations between the fassetts worn by the intimate contact of occlusion and attrition which, if only 1 Mm., will make the patient very uncomfortable permanently, unless the cusps of the teeth are ground into occlusion or otherwise adjusted by orthodontic procedure, all of which means permanent injury to the teeth, or an otherwise extravagant expense of time, material and energy. It has been a noteworthy fact in more than 100 fractures of the mandible treated with intermaxillary wiring in comparison with a greater number employing other methods that the patients who complain bitterly of the soreness thruout the Maxillo-Facial area before their teeth are wired together or if other forms of splints that have been inserted will, within the course of 24 hours after intermaxillary wiring has been inserted, be entirely free from all soreness, or even the sensation of tenderness in the parts. This point is a very important one and due regard should always be given it in the early considerations of a case, and should always be a factor included in the design of appliance selected.

The reason this relief is prevalent with intermaxillary wiring reverts back to the principle of perfect rest and normal position, and in view of the fact that the upper and lower teeth are bound into perfect relations, one of the greatest added points in favor of intermaxillary wiring is the assurance that the functional relation is going to be restored perfectly and with occlusion as the chief guide, it can be

safe to assume that the facial outlines cannot be materially displaced and changed.

Other advantages of intermaxillary wiring are:

1. Requires only a few instruments and a little material.
2. Economy of time which would be spent in the construction of splints.
3. Ability to insert under any conditions.
4. It may be inserted with comparative ease to the patient by the operator.

DISADVANTAGES OF INTERMAXILLARY WIRING.

The chief disadvantage is the liability of strangulation. After patient's injury has been examined and this method elected for treatment, the wires should *never* be inserted until after the patient has recovered from shock and other complications, as it will be found that the reduction of the fracture can be made effectively later. The liabilities of strangulation, from hemorrhage, nausea, etc., must be well guarded against. No patient should ever have the upper or lower teeth wired or locked together unless many teeth are absent when undergoing a general anesthetic or taking a sea voyage, or under any circumstances which would lead to a similiar effect.

The statement was current in America that in the early stages of the World's War, the British lost a number of soldiers by strangulation, from nausea caused by seasickness in crossing the English Channel with their jaws wired together. It is also a fact that serious dangers were experienced in the hospitals of the Allies, in France, from strangulation caused by secondary hemorrhage, intra-oral infections, and nasopharyngeal secretions, nausea and other involvements before the wires could be

cut. This method was employed very extensively by U. S. Army Dental Surgeons in the early treatment of fractures of the mandible. Upon studying the records of approximately 500 injuries of the mandible, it was found that this method was used with good judgment, and excellent results, but with great variety of designs. Some cases were treated with intermaxillary wiring to support extensively displaced fragments,

Figure 1.

while other splints were in course of construction, and other cases were treated exclusively with intermaxillary wiring. There was not a single soldier returned to the United States with intermaxillary wires in position as the result of a very rigid order prohibiting any patient from going aboard a vessel with the jaws locked together in any way. Patients who were being treated had their wires cut in the embarkation hospitals, and, if no other splints were inserted, they were allowed to remain open freely until treatment could be resumed immediately after debarkation.

Other apparent disadvantages of intermaxillary wiring are impaired feeding, and the unhygienic conditions caused by the mouth being closed. If the patient possesses all upper and lower teeth, the greatest handicap for the entrance of food thru the mouth is present, but, as a rule, a few teeth at least are missing and a patient can receive a great variety of nourishment, such as the full list of liquids and semi-solids, and usually the patient will weigh more at the end of six weeks with the mouth shut, and should at no time complain of hunger. From this standpoint of mouth hygiene, cleanliness can be maintained by methods described later.

METHODS OF WIRING.

The most positive attachment is to be made by twisting wires tightly into the cervical constrictions of all remaining upper and lower teeth, but when all of the ends of wires are twisted together, the bulk of material would be so great as to press into the buccal and labial mucosa, and keep these tissues abraded at all times. This and the difficulty of cutting these wires in an emergency makes such extensive wiring unnecessary, so that it should be considered that if the mandible can be supported in normal occlusion from three points of suspension that is quite sufficient, and will make impossible any motions of the mandible. The design of wiring should be easily inserted, easily tightened, and free from sufficient projection of the twisted ends which would cut into the soft tissues of the mouth.

Figure 1 illustrates the common method of wiring between posterior teeth. Suitable wire is twisted very tightly into the cervical constrictions of two upper and two lower teeth on each side of the arch; these ends are brought

together and tightened in the form of a cross tie, or all of the wires are twisted together. A review of this method presents the following conditions: Individual wires twisted tightly around the neck of a tooth must be too tight to slip, or the wire will loosen and is no good for the purpose. If these wires are tightened sufficiently they are very greatly weakened at the point of the twist, and breakage is very liable, and in the event of breakage the entire operation has to be done over again.

In wiring between four teeth, eight ends of wire are presented to be twisted together, which usually makes a large button of wire which has to be covered with cement or gutta-percha for protection. The large number of wires twisted together as per this plan makes it very difficult in case of an emergency to cut them loose. When these wires loosen by the natural forces of the mandible pulling against them, they can rarely be tightened without breakage, therefore, it is claimed that unless teeth which are standing alone *must* be used, it is never necessary to employ separate wires around teeth individually.

Herewith are submitted two methods of intermaxillary wiring which, in the writer's experience, have proven universal in application, have eliminated all the objections of other designs and have added in exchange many desirable qualities.

Figure 2. Illustration showing preparation of instruments and materials. The best wire should be as large as possible to pass freely between inter-proximal spaces, soft enough to be intimately adaptable, and tough enough not to break easily. The large sizes of Angle's ligature wire or 22 G. pure annealed copper are the best materials to be found. The instruments needed

are a pair of cerated broad-nosed pliers, cerated long-nosed pliers, a pair of short-nosed scissors, and a tenaculum or a small hook-shaped instrument. In preparation of the wire, a one foot length is folded around a small end instrument, and a loop is pinched into the form of an eyelet as shown in this illustration.

Figure 3. After selecting the teeth to be wired in pairs the ends of an eyelet-wire are inserted beneath the point of inter-proximal contact as shown between the right upper molars, one end is then drawn around the anterior tooth, and the other end around the posterior tooth, as shown adjusted around the left upper posterior teeth.

Figure 4. The two ends of the upper wires are drawn thru the eyelets pointing downward and the ends of the lower wires are drawn thru the eyelets pointing upward. This forms a noose around the teeth which by twisting the ends, all of the excess can be drawn up, causing these wires to grip the teeth very tightly. For the incisors these loop wires may be laced around the laterals as well as the centrals in order to defuse the strain and prevent elongation. The upper and lower ends can then be twisted together, and after the twist is quite tight the ends may be pulled outward, thus drawing all of the excess to the point of the twist, then by twisting the pliers again and with the same motion of the arm bending the ends inward against the teeth, it will be found that the strain will be defused thruout the entire length of the wire and there will be no circumscribed point where breakage is liable. The great satisfaction of this method lies in the facts that:

1. There is no bulk of wire.
2. They may be quickly cut.

3. They may be tightened daily with ease to the operator.

highly satisfactory in practically every phase, at the same time it is possible to

Figure 2.

Figure 4.

4. They rarely break.

5. If a wire breaks it may be re-

improve upon it with a modification of the same idea. This illustration shows

Figure 3.

Figure 5.

placed without material injury to the others.

Figure 5. While the above method is

the employment of twenty-two gauge pure annealed copper wire with the eyelets placed for three points of sus-

pension in the same positions as in the preceding methods, but it is not intended that the ends of these wires are to be twisted together so it will be noted that in the upper arch instead of bringing the ends thru the eyelets, one end is passed beneath the eyelet and they are twisted together tightly at some remote point. In the lower arch the strand of wire crosses above the eyelet.

Figure 6. Illustrating the individual tie wires inserted thru the eyelets.

Figure 7 illustrates the individual tie wires twisted together. This method possesses all of the advantages of the preceding method with the following additions:

1. If a patient is to receive an anesthetic these wires may be placed so that the mouth may be left open until the danger of nausea is passed.

2. The tie wires may be cut in order to test the fracture and if it is found that solidification is not complete they may be immediately replaced without all the necessary work of starting from the beginning.

INTERMAXILLARY WIRING FOR POST-ELEVATOR FRACTURES.

Figure 8. Radiograph antero-posterior position illustrating the post-elevator fracture between the right neck of the condyle and the Symoid notch. It will also be noted that there is an inter-depressor fracture between the lower central incisors. This was an accidental fracture caused by a blow against the left side of the mandible.

Figure 9. Illustrating the method of intermaxillary wiring employed. Heavy copper eyelet wires united by means of Angle's ligature tie wires are attached to the posterior teeth, and inasmuch as the upper incisors were spaced and of poor anatomical form, it became necessary to

construct individual bands for these teeth, and to solder spurs pointing upward over which to attach the wires, and as a lateral force had to be exerted between the lower incisors, the band and spur method were also elected as shown in the photograph. When there is sufficient time and equipment at disposal, this band and spur method is well worth the time, and as a principle, it is very greatly to be relied upon. This case happened to be one exception wherein the consideration of the rationale of retaining the lower incisors in line of fracture was adopted against the general rule and which proved successful. Upon referring to Figure 8 it will be noted that the head of the right condyle was deflected outward by the direction of the force of the blow, and the line of the fracture. Upon making pressure over the fracture, crepitation was very apparent so it was decided to apply an extra-oral apparatus in conjunction with the intermaxillary wiring.

Figure 10. Extra-oral apparatus made by attaching two discs of metal $\frac{3}{4}$ inch in diameter to a loop of 8G. iron wire fitted over the vertex of the cranium to which pads were adjusted and a strap sewn to hold the loop in position securely, and to make it easily adjustable. The pad over the right condyle successfully depressed the posterior fragment and held it securely until it became agglutinated into position.

Figure 11. Radiograph antero-posterior position with the extra-oral head-piece in position.

INTERMAXILLARY WIRING FOR INTER-ELEVATOR FRACTURES AND LOSS OF SUBSTANCE IN THE RAMUS.

Figure 12. Radiograph lateral view illustrating a loss of substance of between 4 and 5 Cm. thru the middle

third of the ramus. Note that the upper and lower eyelet wires are in position.

between the fragments directly proportionate in amount, to the extent of which

Figure 6.

This radiograph was taken with the mouth open to show the effects of the

Figure 8.

the mouth is opened. This indicates that if occlusion is to be retained and if the radius from the condyles to the

Figure 7.

“open-bite” splint, for it will be noticed that the loss of substance allows the action of a false joint to close the space

Figure 9.

symphysis, as well as facial balance, are to be retained, “open-bite” splinting methods are incorrect and that such

methods as intermaxillary wiring are better indicated.

parison with Figure 12, twice as much space exists between fragments of

Figure 10.

Figure 12.

Figure 13. Radiograph lateral view, same case as Figure 12, illustrating

the ramus. Intermaxillary wiring for pre-elevator fractures (fractures of the

Figure 11.

Figure 13.

mandible closed with tie wires in position. It will be noted that in com-

Angle) at this location in the mandible are perhaps more frequent than at any

other point with the possible exception of fractures thru the lower canine sockets, and usually these two locations become fractured at the same time. If an "open-bite" splint is employed in pre-elevator fractures, the fracture line becomes a substitute to the Temporo-mandibular joint thereby causing it to open. This allows the elevator muscles to pull the ramus upward, which in turn, projects the body of the mandible forward and opens the fracture so that fragments possess only one point of contact located at the posterior border. For these reasons, a fracture of this location perhaps indicates "closed-bite" splints or intermaxillary wiring more than any other region of the mandible.

Figure 14. Radiograph lateral view of pre-elevator fracture left angle. The third molar in line of fracture was extracted and the mandible secured to the superior arch by the passage of the ends of the wires thru the eyelets and twisted together.

Figures 15 and 16. Photographs showing point of exit, machine gun bullet, which passed thru the body of the mandible in the pre-elevator region.

Figure 17. Radiograph lateral view showing loss of substance of above case.

Figure 18. Mandible immobilized in correct occlusion by the method of placing auxiliary tie wires thru the eyelets between the upper and lower arches.

Figure 19. These arches were left untied until after the bone graft operation, in which the ends of the fragments were freshened, scar tissue excised between and periosteum from the tibia planted to the buccal and lingual surfaces.

INTERMAXILLARY WIRING FOR POST-DEPRESSOR FRACTURES.

Figure 20. Radiograph lateral view post-depressor fracture communicated

with mesial root of first molar. This tooth was left in line of fracture and a modified Gunning splint inserted as noted in this radiograph.

Figure 21. Condition of patient upon arrival at Walter Reed General Hospital Gunning splint in position. Infection draining from external sinus in neck as shown in this photograph.

Figure 22. Radiograph lateral view illustrating the same case as Figures 20 and 21, showing extraction of first molar and curettage of the tract, removing considerable sequestrum and granulation tissue. Mandible was then immobilized to the superior arch.

Figure 23. View of intermaxillary wiring employed which afforded the proper care for the soft tissues, rest in normal position for the bone fragments with successful results.

INTERMAXILLARY WIRING FOR MULTIPLE FRACTURES OF MANDIBLE.

Figure 24. Radiograph antero-posterior position showing post-elevator, pre-elevator and inter-depressor fractures situated thru the neck of the right condyle, left angle and right symphysis respectively. In this radiograph it will be noted that, as is typical in multiple fractures, the muscles have distorted the fragments in numerous directions, thus causing a non-occlusion and facial disfigurement.

Condition of patient upon arrival at Walter Reed General Hospital following automobile accident while on furlough, 15 days after, splints none, infection none, partial solidification in malposition. All teeth in line of fracture were extracted, upper and lower eyelet wires were adjusted and the tie wires put thru the eyelets, patient was administered gas-oxygen anesthetic and by forcible manipulation the fragments were loosened and placed in natural

occlusion, auxillary tie wires quickly twisted to position.

in position for six weeks, modified slightly by the exact conditions of in-

Figure 14.

Figure 16.

Figure 25. Tie wires in position. Mandible drawn up into correct occlusion with upper arch.

dividual cases. The patient is always *provided* with a pair of short-nosed scissors and is cautioned to keep them

Figure 15.

Figure 17.

In the average fractures of the mandible intermaxillary wires are retained

on the person or by the bedside *at all times*. This eliminates liabilities and

the feeling of anxiety or responsibility in case of an emergency, and the patient

with instructions to absorb at least 2400 calories equivalent of food per day.

Figure 18.

is instructed to cut or have cut the wires at any instant when strangulation is

Figure 20.

Carbohydrates and other bone-building foods should be the chief diet. For the hygienic care of the mouth the follow-

Figure 19.

Figure 21.

imminent. Patient is given a list of suggestions of liquid and semi-solid diet

ing triple mouth washes are found to be thoroly cleansing and refreshing:

1. Two mouthfuls tepid 25% Hydrogen Dioxide.

suitable proprietary mouth wash of refreshing flavor.

Figure 22.

Figure 24.

2. Two mouthfuls 1% Potassium Permanganate.

The patient is instructed to report to the office *daily* and the wires are watched carefully, kept tightly adjusted, and a

Figure 23.

Figure 25.

3. Liquir Antisepticus or Liquir Antisepticus Alkayinas (U. S. P.) or any

close observance maintained for the first signs of any complications or sequelae.