INJURIES TO THE JAWS AND FACE: AN OUTLINE OF TREATMENT.

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The value of the intimate liaison which has always existed between the medical, dental and nursing services is of particular significance in the treatment of injuries to the jaws and face, and it is thought that a discussion of some aspects of these cases may be of use to many readers of the Journal.

The incidence of maxillary injury in the Army is high, even in time of peace. For example, "The Annual Report on the Health of the Army for the Year 1924" shows that cases of fracture of the jaws take third place in the aggregate of fractures, being only exceeded by those of the clavicle and of the nasal bones.

In peace these accidents arise mainly as a result of falls, blows, kicks from horses or mules, or from boxing, football and gymnastic exercises.

The development of recreational training in recent years may tend to increase the liability to this form of injury, but it is probably balanced by the encouragement of temperance through the expansion of regimental institutes, cinemas, etc.

It will, however, be desirable to consider mainly the treatment of gunshot wounds of the face and jaws, as the care of these cases is undertaken under much more arduous conditions, and methods which have been proved in the stress of war can hardly fail to be of value in normal routine.

ÆTIOLOGY.

Present-day warfare has very greatly raised the incidence of facial injuries as, apart from what may be regarded as an intensification of the peace risks, we are confronted with the increasing power of explosives, the greater range, precision, rate of fire and concentration of modern weapons, the massed use of tanks and aircraft, trench warfare, and the introduction of the steel helmet.

In a campaign developing into trench fighting the proportion of head injuries will always be much higher than in open warfare, while the use of the steel helmet increases the number of survivors with facial wounds. Low-altitude machine fire and bombing from aeroplanes and tank operations add materially to the risk of facial injury, and fractures of the maxillae are common sequelae to an aeroplane crash, the pilot's or observer's jaws being brought into violent contact with guns, instrument board, or cockpit.

In addition, the introduction of the 106 instantaneous "daisy-cutter" and similar fuses has done much to augment face and jaw risks in warfare between highly-organized powers.
Projectiles may be divided into those of high and low velocities. Many may fall into either category, according to the range or distance of the burst from the casualty. Bullets, rifle or machine-gun, and high explosive fragments are usually of high velocity, while shrapnel and spent bullets are of comparatively low velocity.

The amount of destruction of bone is dependent upon the angle of impact, the velocity of the projectile, and the density of the tissue.

Thus, a glancing blow may severely comminute the mandible, while a direct hit at a right angle may completely remove a relatively small fragment.

Actual hits from signal rockets have been observed, and facial burns are frequently caused by petrol ignition in tanks and aircraft, or by cordite fires in dumps or gunpits, resulting from shell-fire or from "prematures."

Secondary projectiles may also do damage, as in the case of stones, screw pickets or pieces of reveting material thrown up by an explosion.

Bayonet wounds of the face are rarely seen.

In all cases left-side injuries are more common, as that side of the face is more exposed when sighting a rifle, but there is very little information as to the frequency of injury to the superior and inferior maxillae. Some German figures published during the Great War claimed that of every seven gunshot wounds of the maxilla, five involved the inferior, one the superior, and one both. Of these cases it was estimated that one-quarter could be rendered fit for return to active service within a reasonable period. This proportion is, no doubt, a reasonable one and, in the absence of accurate statistics, may be accepted as a working basis.

**Signs and Symptoms.**

In simple fracture of the mandible, the usual signs and symptoms, in brief, are pain, abnormal mobility, loss of function, derangement of the occlusion of the teeth, sublingual hæmatoma, and intense salivation.

In many cases one or more of these signs may be absent, for instance, in a vertical fracture through the symphysis there may be little or no displacement. Crepitus may, but should not, be obtained, as much damage may be done to the bony structures as a result.

In the maxilla the same signs are present, except that hæmatoma is not always observed, and many of the abnormalities are less obvious.

In the case of a gunshot wound all these phenomena are usually more pronounced, and are complicated to a varying degree by the destruction or loss of hard and soft tissues.

It must not be forgotten that remote and obscure injuries may have been caused, and these should always be excluded.

As an example, the writer remembers a case in which a fragment of high explosive had entered in the region of the infra-orbital foramen, passed through the hard palate, fractured the body of the mandible on the opposite side, and emerged at an exit wound in the neck. A hard lump was felt
deep in the tongue, and proved to be a disc of vulcanite, punched from an upper denture which the patient was wearing at the time he was wounded.

TREATMENT.

At the risk of stating a platitude, it must be emphasized that, in the treatment of gunshot wounds of the jaws, the first efforts must be devoted to the saving of life, and to this end the dental officer can be of much assistance.

According to the conditions of warfare and the nature of the casualty, he will first see the patient at a field ambulance or at a casualty clearing station.

The normal channel of treatment and evacuation is regimental aid post, advanced dressing station, main dressing station to casualty clearing station; but, according to the nature of the campaign and the military situation at the time, the patient may not pass through the complete chain. Thus, he may be picked up near the advanced dressing station, treated there and, if a motor ambulance waggon is available, evacuated direct to the casualty clearing station.

In a campaign of pursuit, or in difficult country with extended lines of communication, much more may be done at the main dressing station, but normally the ideal unit for definite treatment is the casualty clearing station.

At the first available opportunity the patient will have received an injection of antitetanic serum, and preliminary treatment will be devoted to resuscitation, consisting of measures to combat the three primary dangers in all jaw cases. These are: (1) Dyspnœa; (2) shock; (3) hæmorrhage.

If possible, the patient should be placed in the sitting posture, but if his condition is too critical he should be laid face downwards on the stretcher. The tongue should be controlled, if necessary, by passing a ligature which is secured to a tunic button, and he should be placed in the resuscitation ward or marquee. Warm blankets and hot bottles are supplied and heat maintained by means of a “Primus” or “Beatrice” stove placed under the raised stretcher and surrounded by a blanket screen.

Hæmorrhage is controlled by plugging or ligation of vessels and transfusion of blood or glucose saline performed when indicated.

Camphor in oil, three to five grains hypodermically, is often of value in the treatment of shock, while morphia should be administered with discretion, as it tends to induce laryngeal paresis.

At the earliest opportunity radiographs should be obtained to disclose the extent of the bony injury and the presence and location of foreign bodies. A mobile X-ray unit is normally attached to every casualty clearing station group and there should be no difficulty in obtaining this very necessary aid to diagnosis and treatment.

The anaesthetic of choice for jaw operations is the intratracheal
insufflation of warm ether by the Shipway method, the rubber tube being introduced into the trachea by the nasal route, thus leaving the surgeon a clear field of operation and permitting the packing of the pharynx with swabs as a precaution against the entrance of septic material into the air passages.

If, for any reason, this is impracticable, rectal ether may be employed, but the technique is more complicated and is not so well suited to routine treatment in the field. Should chloroform be used, it must be remembered that the use of adrenalin is contra-indicated.

It is at this stage of the treatment that the co-operation of the dental officer is of value.

Injuries to the soft parts are treated by careful cleansing with picric acid, iodine, or mercuriochrome and, whenever possible, by primary suture, but, if much inflammatory reaction is present, it may be desirable to wait a few days and then proceed with delayed primary suture. All ragged edges should be excised and smoothed and the parts sutured in close apposition, with a view to minimizing subsequent cicatricial contraction and deformity.

When there is much comminution of bone or other potential cause of sepsis it is desirable to arrange drainage.

The question of what hard tissue to conserve and what to eliminate is one of much difficulty and must be dealt with on the merits of the individual case. As a broad principle it may be laid down that all septic roots, isolated non-viable fragments of bone, and the teeth on either side of the fracture should invariably be removed. This question of the removal of possibly sound teeth, merely because they are involved in the area of fracture, has been much discussed, but the consensus of opinion is that, sooner
or later, they become sources of infection, delay healing, and therefore cannot be allowed to remain.

Whenever the loss of bone is less than two to three centimetres, every effort should be made to secure bony union, as the mechanical advantages of osseous over fibrous repair far outweigh the relatively slight amount of malocclusion which is inevitable; but where the loss of tissue exceeds this amount the field should be prepared for subsequent treatment by bone-grafting.

In either case immobilization of the fragments must be secured, as this aids repair, relieves pain, controls sepsis, and reduces subsequent deformity.

There are so many methods of intraoral splinting, many of which are highly technical, that it is impossible to discuss them in detail within the compass of an article in these pages.

![Fig. 2.—Vertical wires passed through loops.](Image)

It may be said, however, that surgical wiring of the fractured mandible should rarely, if ever, be attempted, but that the parts should be controlled either by interdental wiring or by dental cap or wire splints, coupled with the aid of some form of external support such as a sling or aluminium chin boot.

It must be remembered that one of the first principles of the medical services in war is the early and systematic evacuation of sick and wounded. Unless casualties are rapidly treated and evacuated, a state of congestion will arise which may seriously impede the course of operations by choking medical units and dislocating rail and motor transport, to say nothing of its disastrous effect upon the moral of the troops. The man who has been wounded must be removed to a place of comparative safety as soon as his condition permits, and the troops should have confidence that this will be done.
For these reasons, the writer ventures to suggest that elaborate splinting, requiring careful preparation, is quite out of place in field medical units, and that the expense of equipping them with the necessary apparatus would only be justifiable in the case of positional warfare on a large scale, where "quiet areas" might reasonably be expected.

Intraoral, interdental wiring affords an excellent, speedy and inexpensive method of securing immobilization, provided that sufficient teeth remain in situ, and, with the increasing dental care of the soldier, it may be assumed that such cases will be the rule in any future campaign.

The method adopted is the ligation of teeth by means of strands of 24-gauge brass wire. By its use reduction may be secured by binding together two or three teeth on each side of the fracture and uniting the wires into one common strand on each side. These are then twisted up until approximation of the fragments is achieved. Two or three teeth should always be united in each fragment in order that stress may be distributed and not all thrown upon one tooth.

Where it is necessary to maintain occlusion without bony apposition, the maxillary teeth may be secured to those in the mandible, suitable eyelet twists being first made in the ligatures, through which are passed vertical wires lacing the two jaws together.

An excellent description of this technique is given by Ivy and Curtis, in the Dental Cosmos, vol. lxviii, p. 439.

It has been successfully used by the writer, and the accompanying photographs of the models of an actual case may help to explain its application.

In addition, some form of chin support should be fitted, rubber-dam slings being more cleanly and preferable to a four-tail or Barton bandage.
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Subsequent care is directed to the support of the patient by two-hourly liquid feeding, *per rectum* if necessary, and constant douching of the oral cavity with mild antiseptics. In this connexion a Higginson enema syringe has been found to be of great value, as it enables an unlimited and powerful spray to be directed into any part of the mouth.

*Post-Operative Sequelae.*

The complications most to be feared are acute bronchopneumonia and erysipelas. The former will usually be prevented by careful anaesthetic and surgical technique; the sitting or stomach posture, inhalations of tr. benzoin co., and routine ward attention to irrigation and cleansing of the mouth are prophylactic measures of the highest value in both conditions.

An acute rise of temperature without visible cause should always arouse suspicion of the onset of erysipelas.

The patient is then evacuated and should be transferred to a base or home hospital, where specialized treatment is available.

It is in this connexion that the value of simple interdental wiring is enhanced, as the patient may suffer from train or sea sickness, and it may be of vital importance for the medical officer or sister, without specialized dental knowledge, to be able—by untwisting the strands of wire—to open and swab out the mouth and then replace the wires, although this should, of course, only be done in a case of urgency.

In the absence of suitable pliers, haemostatic forceps are well suited to the purpose.

*Secondary Sequelae.*

Secondary complications are suppuration, secondary haemorrhage and pneumonia, but these are, fortunately, of rare occurrence when the case has received early and efficient treatment.

*Late Sequelae.*

The most common of the later difficulties are adhesions, deformity, and ankylosis of the temporo-mandibular articulation. All these, in so far as they affect the dental organs, may be dealt with by suitable dental appliances, again of types too diverse to be dealt with here.

*Late Treatment.*

1) *Hard Tissues.*—Loss of bone may, and sometimes must, be rectified by the supply of a prosthetic appliance, but is best dealt with by autogenous bone-grafting. It is necessary to wait for some twelve to fifteen months after the original injury, and at least three months after the last trace of sepsis, before attempting this operation. A blood test and careful overhaul of the circulatory and excretory systems should first be performed. Deep Röntgen-therapy is of great value in lighting up any traces of latent sepsis.
The graft used should be autogenous, but if, for any reason, this is impracticable, the donor must be Wassermann-negative and of the appropriate blood-group. Heterogeneous grafts are of little or no value.

In modern technique the crest of the ileum is selected as the source of the graft, as it is rich in medullary elements, has a curve approximating to that of the mandible, resembles the latter in structure, and readily forms callus.

Absolute immobility of the fragments is a sine qua non, and is usually obtained at this stage by cementing cast metal cap splints to the teeth. Essentials in operation are absolute asepsis, speed (the closure of the ileal incision being left to an assistant), accurate adaptation with exclusion of blood-clot between the ends of the fragments and graft, retention of periosteum on the graft, and the avoidance of any opening into the mouth, i.e., through the mucous membrane on the lingual aspect of the jaw. Some form of step or peg lock is usually provided.

Some writers advocate the subsequent administration of vitamins C and D, calcium, or thyroid extract, as tending to promote the formation of callus. Splints should be retained for at least six to eight weeks and drainage provided for the first few days.

Chubb reports ninety-three per cent of successes in bone-graft operations.

(2) Soft Tissues.—In plastic operations for the repair or replacement of soft parts, the same general principles of technique apply.

Plastic repair of these tissues may be performed by means of:

(i) Thiersch grafts.
(ii) Wolfe grafts.
(iii) Pedicle grafts.
(iv) Tube flaps and grafts.

A Thiersch graft is a surface shaving of skin, not including any hair follicles, and is used in the restoration of mucous membranes. It is best taken from the upper arm over the biceps.

A Wolfe graft is a whole thickness skin graft and is used for the restoration of skin in parts exposed to view or to friction.

A pedicle skin graft is a small strip, one end of which remains attached to and derives nutriment from its source, while the other is utilized to remedy some minor defect.

A tube flap is a long strip in which the lateral margins are united in the form of a tube, as it is found that such tubes have more vitality. They are used for conveying tissue from distant parts, e.g., from the scalp, neck, or chest, to the face.

There are various modifications of the tube flap, such as: (a) “Caterpillar” flaps in which the flap, not being long enough to reach the required destination in one operation, is first grafted, and later, when union has been effected, is dissected at the distal end and “stepped” to the final position; (b) “tube grafts” which, after dissection at one end, are allowed to hang
for two or three weeks, when they acquire a permanent roseate colouring and are used for the restoration of the lips; and (c) "double tube flaps," where one flap, of hair-free skin, is turned with its epithelial surface to the interior of the mouth and the raw surface outwards, to which a second flap is immediately applied. This modification is designed to prevent the introduction of hair-bearing tissue inside the mouth and is of value in the restoration of the cheeks, etc. In this and other cases, hair-bearing tissue may be conveyed from the scalp when desired, and the resulting growth often aids the cosmetic effect.

Accuracy of adaptation is essential and is secured by the maintenance of pressure or by suture, and the dental officer can often render assistance in the case of Thiersch and Wolfe grafts and in rhinoplasty by devising apparatus anchored to the teeth and arranged to secure constant pressure or support to the parts under treatment.

In the late treatment of cicatrices much assistance may be afforded by Röntgen or radium-therapy.

Local anaesthetics may be used for minor plastic surgery, but as they lower the local resistance they may determine the death of the graft, and these operations are, as a rule, better conducted under general anaesthesia.

It is probable that judicious ultra-violet radiation of the area preparatory to taking a graft would be of value in raising its resistance.

In cases where none of these methods can be applied with success, it may become necessary to supply a facial mask, and this may be constructed of thin metal by the process of electro-deposition, of vulcanite, gelatine, paraffin wax, etc.

GENERAL AIDS TO TREATMENT.

(1) Diet.—This question is a very important one, and every effort should be made to ensure that, even when liquids are given, the diet is varied and nourishing. Later, as function is restored, a steady increase in the masticatory effort is called for, and the diet should be progressively graduated accordingly.

(2) Maintenance of Moral.—There are few conditions more damaging to the patient's mental attitude than a prolonged period of immobilization of the jaws, coupled, possibly, with an almost endless series of minor operations for plastic restoration.

Tonics and general supportive measures are called for, and every facility should be given for suitable recreation.

Light manual exercise, duties or physical training, libraries, games, concerts and hobbies, are all of the greatest value in this connexion.

CONCLUSION.

Although this article is chiefly devoted to the active service aspects of jaw and facial injuries, it is hoped that it may prove of some value in routine treatment under everyday conditions.
Apart from personal experience, the publications of many writers have been drawn upon in the course of compilation, and the writer trusts that they will accept the bibliography as his acknowledgment, and that interested readers may find it of value should they desire a more detailed account of surgical and dental methods than is possible in these pages.

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BIBLIOGRAPHY.

Publications:—

The War Supplements of the British Dental Journal.

Colyer. "Dental Surgery."

Pickenhill. "Facial Surgery."

Martineau and Lemerle. "Injuries of the Face and Jaws."

Imbert and Real. "Fracture of the Lower Jaw."

The Official History of the War, Medical Services.

Contributions:—


