THE PREVENTION OF DEFORMITY FOLLOWING FRACTURE OR RESECTION OF THE JAW.

A PLEA FOR THE EARLY USE OF SUITABLE SPLINTS.

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THE frequency of injuries to the jaws during the present War lends special importance to a consideration of the various splints which are available for their treatment.

The cases fall into two distinct groups: First, those in which the jaw is fractured in one or more places, but no bone is lost. Secondly, those in which the injury is accompanied by destruction of bone, and frequently, also, of the overlying soft tissues. The treatment in both groups of cases has this in common, that the portions of jaw must be placed and kept in their correct positions, so that afterwards the teeth may articulate properly with their opponents.

In the second group of cases there is added the further problem of preventing facial deformity. If, for instance, a portion of the mandible at the symphysis be lost or removed, then, unless a splint be inserted, the two remaining pieces of bone will inevitably fall together; the teeth will not articulate with those of the maxilla (see *Figs. 186 and 192*), and the face will be deformed. If the union be fibrous, treatment is possible but tedious; if bony, treatment must involve section of the bone—in other words, must begin *de novo*. Further, if coincidentally with the loss of bone, the skin over it has also been destroyed, then a plastic operation is necessary. Now, if a properly-made splint be inserted, not only will the remaining portions of bone be fixed in their correct positions—a great assistance to the surgeon in his subsequent task of fashioning and adjusting the skin flaps—but if the contraction of the scar tissue be prevented, experience suggests that the newly formed fibrous tissue will disappear, leaving the tissues soft and movable. *Per contra*, if no splint be used, the size of the flaps may be underestimated, and in any case contraction will follow. Thus, to the disfigurement of a deformed mandible may be added a contracted lip.

Splints, consequently, fall into two classes: first, those used in the treatment of fractures; and next, those employed after the removal of tissue by operation or injury. The methods described are based on experience gained chiefly in hospital work during many years; and although admittedly there are essential differences between civil and military practice, yet these cases have value in that they happened sufficiently long ago to enable the ultimate result to be known. At present this is true of few military cases. For instance, 'somewhere in France' fractures are being treated by wire sutures in cases which experience has shown could easily and properly have been treated by

splints. The results in three such cases are seen in *Figs. 184, 185, 186, 199, and 200.*

In the treatment of fractures the splint used should fulfil the following conditions. It should be easily made, and be inexpensive. It should guide the displaced portions of bone into their correct positions and fix them there. It should not cover the soft tissue, that is, the gum, nor injure it. It should be easily fixed in place. It should allow the mouth to be opened for cleansing and feeding purposes, and as soon as may be, permit soft food to be chewed. In an attempt to attain some of these objects many splints have been designed, but since they failed in one or another direction—generally in being too elaborate and expensive—they at no time met with general acceptance, and have ceased to be used.

In point of time one of the first splints to be used was the Tomes splint or Mutter's clamp. This consisted of a metal cap covering the teeth loosely and, in the forms figured, also the gum. It was lined with gutta-percha, which

FIG. 177.—THE METAL CAP SPLINT.

actually fitted it to the teeth and caused it to adhere slightly to these. This splint is interesting since it is the father of other forms of cap splints. With the introduction of vulcanite it fell into disuse, being supplanted by the Gunning.

The Gunning, for all practical purposes, is a Tomes splint made in vulcanite. Neither the Tomes nor yet the Gunning really grasped the teeth. They required external bandages. The jaw, being gripped by the bandage, forced the teeth into the splint, which in turn was pushed against the upper teeth, and so held. Thus the mouth could not be opened for cleansing or feeding purposes without disturbing the fracture. Hence arose a modification.

To the Tomes splint, Howard Hayward soldered two metal arms which, passing out at the angle of the mouth, curved backwards outside the cheeks. The splint being in place, a narrow bandage was carried from one arm to the other, passing under the chin. Hence the mandible was gripped between the bandage and the splint, allowing the mouth to be opened when necessary. To the vulcanite Gunning splint Kingsley added, at a later date, the same modification. Neither the Hayward nor the Kingsley are often used now in

the treatment of fractures of the mandible unless teeth are absent; but the principle involved is of distinct value in the treatment of those fractures of the maxilla which separate this bone from the cranium. In such cases the arms are fixed to a vulcanite plate covering the gums and palate in the case of an edentulous patient, or, if teeth be present, to the metal cap splint (*Fig. 177*) described later. The maxilla is then fixed in position by means of

bandages passing round these arms and over the top of the head, or else by straps passing from the arms to a closely-fitting skull-cap.

When the teeth are covered by a vulcanite cap, unless the cap be very carefully adjusted to the articulation, the back portion will gag the mouth open, so that the front teeth will not touch the cap. This frequently happened with the Gunning splint, the splint tending

FIG. 178.—THE HERN MODIFICATION OF THE GUNNING SPLINT.

to tilt and rise in front. This difficulty was met by the Hern modification (*Fig. 178*), which consists in building on the articulating surface of the splint on both sides, where it covers the lower molars, blocks of vulcanite with impressions into which the upper molars bite. Thus the mouth is purposely gaged open, facilitating its cleansing, and the feeding of the patient.

An earlier modification of the Gunning, the double Gunning (*Fig. 179*) consists of two vulcanite caps, one covering the lower teeth, the other the upper, these being fastened together at the back, but separated in the front. In simple fractures of the mandible there appears to be no advantage in the use of the double Gunning over the ordinary splint; indeed, to cover the upper teeth also, is to add to the difficulty in keeping the mouth clean. But the splint is of value in the treatment of fractures of the upper maxilla, and can be used with advantage in the treatment of fractures of either mandible or maxilla when no teeth are present either in one or in both.

FIG. 179.—THE DOUBLE GUNNING SPLINT.

All the splints so far mentioned fail to meet several of the conditions laid down. They guide the ends of the fractured bone into their correct positions, but do not fix them there without the assistance of external bandages. The mouth cannot be opened for cleansing purposes save at the risk of moving the fractured bone; indeed these splints themselves act as dirt retainers, and are always exceedingly foul. Even when the bone is sufficiently united to allow the removal of the external bandages, the splints must still be worn for a

time, and during the whole of this period nothing but quite a fluid diet is possible. Still, in default of the evolution of better methods, they are of use in the cases indicated.

The Hammond splint (*Fig. 180*) marked a great advance. It consists of a wire fitted to the necks of the teeth, and retained in place by wire ligatures passing between the teeth and over the wires. It is a very cheaply and easily made splint, since soft galvanized iron wire answers admirably. But it does not guide the portions of bone into their correct positions, and it is tedious to adjust, many ligatures being necessary before the fracture is securely fixed; hence considerable pain is caused. Food tends to hang about the wires; but this

FIG. 180.—THE HAMMOND WIRE SPLINT.

can be readily removed, for the mouth can be freely opened, no external bandages being essential. The splint is, however, useless unless teeth be present in each of the bony fragments.

Another method of treating fractures consists in making the teeth of the upper jaw the splint for the lower, the lower teeth being fastened to the upper. This is usually done by fastening round several teeth what are known as Angle's bands. Binding wire is then wound round the studs of the bands on the lower and upper teeth till fixity is attained. Given an alternative, this treatment seems needlessly cruel. It does not allow the internal surfaces of the teeth to be cleansed, and interferes with the taking of food. Nevertheless it is useful in treating fractures of the neck of the condyle, or cases in which there is loss of bone in the region of the angle. This method has the great advantage that the appliances can always be available and immediately

applied. It should have been used in many military cases, due to gunshot injuries, in which bone has been lost at and about the angle. Many such appear to have been left untreated for several weeks; as a consequence, the contraction of scar tissue has drawn back the horizontal ramus, leaving the front teeth displaced backwards and downwards, and widely separated from the uppers. In several cases subsequent treatment has only alleviated, and not cured, the deformity.

The Lewin Payne cradle splint (*Fig. 181*) may be regarded as a further development of the Hammond. It consists of two wire frames fitted round the necks of the upper and the lower teeth respectively, these frames being connected by vertical wires passing from one to the other and soldered to each. This splint fixes the mouth slightly open, and therefore the wound can be syringed and kept clean. Though it has been used with success, it does not

FIG. 181.—THE PAYNE CRADLE SPLINT.

seem to meet all the conditions laid down. For fractures of the horizontal ramus of the mandible, when teeth are present in all the fragments, it does not seem to offer any great advantage over the Hammond splint. Nevertheless, in fractures of the angle where there is displacement upwards of the anterior portion, it is useful; it can also be used as an alternative to the Hayward in fractures separating the maxilla from the cranium. When one jaw is edentulous, but teeth are present in the other, a wire cradle for the latter, attached to a vulcanite or metal plate covering the former, is more cleanly than a double Gunning, and should be used in preference in the cases previously indicated.

The splint which meets the stated conditions most nearly is the metal cap splint cemented to the teeth. The writer has used this with success for some years, and it is being largely used by others. It consists of thin metal, cast or struck up to cover and closely fit the crowns of the teeth, but cut away at the neck, that is, at the gum margin. Having been made to a cast on which

any displacement of the fractured bone has been corrected, it follows that when the teeth are pressed home into the splint the fracture must be properly set. This is true also of the Gunning and of the Tomes when lined with gutta-percha; but whereas these do not retain the teeth in position, the cap splint does, for it is cemented to the teeth. For this purpose the cement (white stopping) used for filling teeth is employed. The splint is dried, and also the natural teeth as much as possible; the cement is now mixed, and the cap filled with it. The cap is then forced home or, more correctly, the teeth forced into it by pressure on the lower border of the mandibular fragments. An anæsthetic may be given if necessary; in any case a pad of wool should protect the

FIG. 182.—FROM A SKIAGRAM : SHOWING THE CAP SPLINT IN PLACE.

skin over the bone from the pressure of the fingers. Before the cement has set, the splint, when in place, can be closely pressed against and between the teeth with suitable forceps. After the cement has set, the excess is chipped away. If the splint over the molars raises the bite, the caps there can be ground off; but there appears no advantage in purposely perforating the splint at the cutting and grinding surfaces of the teeth, as has been advocated, since, when being forced home, the pressure on the cement is greater with the caps intact, and hence the splint is more securely 'stuck on.' Further, the cement being slightly porous in texture when set, the less it is exposed the better, since it tends in time to become foul. A similar splint was used by the writer for fixing teeth in their proper positions in the immediate method of correcting

misplaced teeth after alveolar section. Some fifteen years ago he extended its use to the treatment of fractures, and has used it since to the exclusion of other methods. Quite independently, the idea has occurred to others, and at present it is being more frequently used in Paris than any other form of splint.

In simple cases, seen immediately, when the teeth are good and the mouth clean, fractures so treated make an uninterrupted recovery. No external bandages are required; the patient is soon able to take soft food, and to go out and about doing his daily work, if not of a laborious character.

FIG. 183.—ANOTHER VIEW OF THE SAME CASE AS FIG. 182.

There is little reason to doubt that complications, as submandibular abscess, necrosis, etc., are largely prevented if the case is seen and a splint fixed early. It is true that with the use of external bandages only, many cases get well, and the union, though perhaps not ideal, is fairly correct. Under some circumstances splints may not be available. It is said by Mr. Hacking that this is at present the case in the Navy, where fractures happen as accidents of ordinary ship life. Mr. Hacking also states that the results are good. All patients, however, do not lead a healthy ship life, nor receive the attention of the sick ward. By way of contrast to what the patient may expect with the splint treatment described above, there may be quoted, in an

abbreviated form, the directions given by Mr. Pickering Pick for the treatment by a four-tailed bandage: "The patient is to suck fluid nourishment between his teeth. He may not speak, but shall use a slate. After three weeks he may have soft food, may masticate after five, but should still wear a handkerchief tied round his head to prevent violent movements of the jaw."

Figs. 182 and 183 show a cap splint in place. The patient, a soldier who fell out of a train, had a triple fracture of the mandible, one on either side in the canine region, and a third posterior to the last molar, the line of fracture running

FIG. 184.—FROM A CASE OF FRACTURE TREATED WITH A CAP SPLINT.
It also shows an earlier attempt to treat by wiring.

downwards and backwards, but with no displacement of the bone. The man came direct to the Royal Dental Hospital; the splint was fixed the following morning; no external bandages were used; no submandibular abscess formed.

Fig. 184 is the skiagram of another fracture for which this splint was used. It also shows an earlier attempt to treat by wiring. This had totally failed to promote union; indeed, when seen, the teeth on either side of the seat of fracture separated as the mouth was opened. The separation of the fragments during opening the mouth is sometimes very marked. A notable case was that of a boy, the victim of a motor accident, who in addition to other severe

head injuries, had a fracture of the mandible in the mid-line. Whenever the mouth had to be opened, the wound gaped to the extent of half an inch. A cap splint was used, and answered admirably. Any other form of splint would have been very difficult, or impossible, to adjust.

Fig. 185 shows a badly united fracture, the union being fibrous, which should have been treated with a cap splint. The skiagram shows evidence of the attempt to wire the fragments. The amount of absorption caused by the

FIG. 185.—SKIAGRAM SHOWING A BADLY UNITED FRACTURE WHICH SHOULD HAVE BEEN TREATED BY A CAP SPLINT. The union was fibrous.

sutures is worth noting. A piece of bone necrosed and separated, and the remaining portions fell together, leaving the deformity shown in *Fig. 186*.

Some modifications of this splint have been made. The first was designed to treat cases, not infrequently seen, in which no teeth are present in the posterior fragment, the fracture being in the premolar region. *Fig. 187* shows such a case, which is exceptional in that there was no displacement of the fragments. The question of the use of a splint at all in this case might arise; nevertheless, the fact that the patient was not seen for several days after the

injury, the fracture originally being overlooked, suggested it to be advisable. *Fig. 188* shows the splint in place. A cap covers, and is fixed to, the teeth; a wire soldered to this, arches backward over the seat of fracture, and is attached to a shield of metal resting on the gum over the posterior fragment. Thus the upward displacement of this portion by muscular action is prevented. In

FIG. 186.—THE SAME CASE AS FIG. 185, SHOWING THE DEFORMITY WHERE THE BONES FELL TOGETHER.

this case sequestra afterwards separated at the seat of the fracture, and displacement must have followed but for the splint.

A second modification is designed to treat those cases in which the teeth are not in complete series. Then the splint becomes two or more separate caps covering teeth or groups of teeth, these being joined by a metal rod placed

FIG. 187.—TO SHOW A MODIFICATION OF THE CAP SPLINT WHERE NO MOLAR TEETH ARE PRESENT.

FIG. 188.—THE SAME CASE AS FIG. 187, SHOWING THE SPLINT IN PLACE.

as far from the gum as possible. Hence the gum is not covered ; it can be kept clean, and if sequestra separate they can be easily removed from under the rod.

FIG. 189.—THE DOUBLE CAP SPLINT, A SUBSTITUTE FOR THE PAYNE SPLINT SHOWN IN FIG. 181.

FIG. 190.—DOUBLE CAP AND WIRE SPLINT.

For the group of cases for which the Lewin Payne splint was designed some have used a double cap splint (*Fig. 189*). This consists of two caps, one

for the upper, the other for the lower teeth, soldered together. It is difficult to cement in place, and one or other is apt to come 'unstuck.'

Mr. George Northcroft has used a cap splint cemented to the lower teeth, joined to a cradle splint wired to the upper, and has further modified it by cutting away the front of the cap so that the labial surfaces of the lower teeth are exposed. Four or five vertical rods pass from the margin of the cap downwards towards the gum; not only is the cap cemented in place, but it is also fixed by wires passing through holes in the splint, then on both sides of a tooth, and finally twisted over a rod (*Fig. 190*). It will be noticed that by

FIG. 191.—FROM A CASE OF COMMINUTED FRACTURE, THE RESULT OF A GUNSHOT WOUND.

the last modification the splint is becoming far too elaborate to construct for ordinary cases, and in the writer's opinion unnecessarily so; but in some cases Mr. Northcroft has found it to have advantages.

During the War a number of gunshot wounds have been associated with loss, or excessive comminution, of the mental portion of the mandible. Often it seems impossible to predicate whether or no bony union will follow. In any case the wound is very foul, and the shedding of sequestra, large or small, will continue for many weeks. In the case illustrated in *Fig. 191*, a piece of the crown of a tooth was cast off three months after the injury, showing how the

parts get churned up; yet in this case bony union followed. Hence the splint must not interfere with the irrigation and cleansing of the wound, nor with the removal of the sequestra. Yet the early fixing of a splint appears to be imperative for the following reasons: If the remains of the mandible are fixed, the patient is saved much pain; it has been noted that in many cases when gunshot wounds have been inflicted on the mouth and also in one or more of the extremities, it was the oral wound which caused the greatest pain, both at the time of infliction, and later during treatment. Again, the use of the splint retains the parts at rest; hence it assists healing, and allows the mouth to be more frequently and thoroughly cleansed. Lastly, and chiefly, the splint prevents malunion, or, if the union be fibrous, displacement by cicatricial contraction of the remaining portions of bone, thus preventing those permanent deformities which have been seen far too frequently of late.

FIG. 192.—A CASE OF GUNSHOT WOUND CALLING FOR THE USE OF A SPLINT TO PREVENT PERMANENT DEFORMITY.

In the cases actually seen, or of which the writer has casts, molar teeth frequently have been present in the uninjured portions of the mandible (*Fig. 192*). The splint used, or which should have been used, consists of a cap splint moulded and cemented to these teeth, the caps being joined by a stout wire bent to the normal curve of the jaw. If a portion of bone is destroyed and removed, a shallow metal trough, corresponding to the lower border of the mandible, may take the place of the wire. But in some cases this trough is reported to have interfered with drainage, and to have produced a depression full of pus. Probably the use of drainage tubes would have been an advantage.

When fibrous union has already taken place, and displacement inwards of the two sides of the mandible has resulted from the contraction of the scar tissue, attempts may be made to correct the deformity, and good results have

been obtained. The caps of the splint, instead of being joined by wire, have a jack screw inserted between them, and are slowly forced apart. In a Paris hospital, instead of a screw Dr. Holtz uses successfully a spring, which slowly separates the two portions. Mr. Rodway, in a paper read before the Manchester Odontological Society, states he has obtained a partial improvement by stretching the portions apart at the time of the insertion of the splint. Owing to the difficulty of keeping the portions apart and fixing the splint as a whole, he divides the wire between the caps, and makes the ends to lap over, each having a shoulder. Each half of the splint is separately fixed, the remains of the mandible being then pulled apart till the overlaps of the wires are in correct position; these are then fixed together by a screw.

Some of the patients seen have been further deformed by a contraction of the lower lip. The insertion of a vertical metal plate moulded to lie immediately behind the lip line, and fixed to the wire, or the trough of the splint, would not only have prevented the contraction, but if a plastic operation was needed, would, as previously suggested, have assisted in the estimation of the

FIG. 193.—COMBINATION CAP AND WIRE SPLINT USED WHERE BONE HAS BEEN LOST FROM THE POSTERIOR PORTION OF THE MANDIBLE.

size and in the adaptation of the flaps. It is admitted that the condition of the patient may contra-indicate any operation of a complicated nature; but if the surgeon be able to perform a plastic operation, it is contended that the fixing of a splint would not complicate, but rather assist matters.

A further modification of this splint is adapted to the treatment of those cases where the posterior portion of the mandible, including more or less of the ascending ramus, has been lost. Its use is perhaps more clearly indicated when the bone is removed because of the presence of a tumour, than when its loss follows a gunshot injury, with the coincident septic wound.

The following cases illustrate its use:—

Because of a growth, Mr. Pepper removed the left portion of the mandible, extending from the mid-line to about half an inch below the sigmoid notch. After the removal of the bone and arrest of hæmorrhage, but before replacing the skin flaps, the splint shown in *Fig. 193* was inserted. The cap splint was cemented to the teeth in the remaining half of the mandible, whilst the anterior inferior angle of the remains of the ascending ramus was placed to lie loosely in the hood. The skin flaps were then replaced, and the mucous membrane

brought under the wires connecting the cap and hood, and sewn to that of the skin flap. Subsequently the hood and posterior portion of the wire became embedded in granulation tissue. This splint remained in place for about three months, the patient being able from the first freely to open her mouth; there was no displacement of the remaining half of the mandible, and little external deformity of the left side of the face. But a small sinus persisted, running up to the cap, due either to its presence, or, as Mr. Pepper thought, to the necrosis of splinters of bone, which was much thinned by the growth, and splintered freely when divided. Therefore the splint was removed

FIG. 194.—SKIAGRAM OF A JAW WHICH HAD BEEN PARTLY DESTROYED BY AN ODONTOME.

earlier than would have been otherwise advisable. The remaining portion of the bone was freely movable; but to obviate the possibility that some contraction might take place, metal caps were cemented over the lower and upper teeth on the right side. To the outer surface of the lower, a strong vertical metal rod was fixed; which rested and moved on a flat vertical metal plate soldered to the outer surface of the upper cap (a similar but movable apparatus is shown in *Figs. 196 and 197*). Hence, the remaining portion of the mandible could not move to the left. The patient was not seen again, as she lived in Northumberland; but she wrote to say that two years later the splint came

away, and that the lower and upper teeth articulated well. In other words, no cicatricial tissue formed to draw the remains of the mandible to the left. This and other similar cases seem to show that if cicatricial tissue cannot contract, in time it disappears, be the explanation what it may.

That the hood embedded in the tissues is not necessarily an irritant to these, is shown in the following case. For a woman, who was edentulous, Mr. Cope removed the lower half of the ascending ramus and half the horizontal ramus of the mandible, the seat of an epithelioma. There being no teeth, a modification of the cap splint could not be used; therefore a splint was inserted having a hood to cover the anterior inferior angle of the remains of the ascending ramus, connected by a metal rod to flanges which passed to the labial and lingual surfaces of the remains of the horizontal ramus, to which they were wired. During the early days following the operation, the patient was able to move her jaw freely. Over six months have now passed, and the whole splint has become buried in the tissues; but the patient remains so comfortable that she refuses to have anything further done.

FIG. 195.—COMBINED CAP AND VULCANITE SPLINT USED IN THE CASE SHOWN IN FIG. 194.

It is possible that in this case it would have been well to have made the splint in platinum, the only metal which remains absolutely unaffected by acids, etc., and to have aimed from the first at completely embedding the splint in the tissues. Sir Frederick Eve has used a piece of wire fixed in the end of the bones with success. The method does not prevent facial deformity, due to the falling in of the cutaneous tissues; but when the operation is for the cure of a malignant growth, which in a certain percentage of cases may recur, this is not so important a matter.

Splints which aim at completely preventing facial deformity are necessarily more elaborate, and if a malignant growth recur, will be more in the way than the wire frames used above. *Fig. 194* shows the skiagram of a jaw largely destroyed by an epithelial odontome, slowly growing, and recurring after many partial removals, over a period of twenty years. In such a case, with total removal no recurrence was to be anticipated. An attempt was therefore made, not only to prevent displacement of the remains of the mandible, but to obtain a depression in the floor of the mouth into which

ultimately a movable apparatus should fit, and lift up the cutaneous tissues. One difficulty in making splints is to be sure of the distances between fixed points; to know exactly where it will be necessary to divide the bone. Such a skiagram as *Fig. 194* helps very much—it shows the anterior border

FIG. 196.—APPARATUS USED TO CORRECT THE DEFORMITY IN THE SAME CASE.

FIG. 197.—THE APPARATUS SHOWN IN FIG. 196, PLACED IN POSITION.

of the ascending ramus to be destroyed, but the posterior intact. A hood would be of no use; but, on the other hand, if the posterior border was left, it would form a resistance to the backward movement of a splint shaped as shown in *Fig. 195*. Here a cap splint is united to a block of vulcanite, shaped to

resemble roughly the body of the jaw, by a gutter of metal to represent and take the place of the lower border of the front portion of the jaw. This splint was inserted at the time Mr. Warren Low operated. It was worn for three months, and on the whole answered well. There was a slight displacement of the remaining portion of the jaw, but it remained freely movable, so that the attachment to the dentures, made subsequently, of a plate and vertical arm (*Figs. 196 and 197*), similar to that used in the previous case, has corrected the deformity.

One deformity which may follow the removal of the anterior portion of the mandible for a malignant growth infiltrating also the base of the tongue, is the disappearance of a chin during the contraction of the scar tissue. Such a result followed in a case of Mr. Pepper's, in which the removal of the whole of the mandible anterior to the molars was necessary. After removal of the bone and a good deal of tissue at the base of the tongue, the

FIG. 198.—SPLINT DESIGNED TO RESTORE THE CONTOUR OF A DESTROYED CHIN.

splint shown in *Fig. 198* was inserted, and the wound closed. The immediate result was remarkable; but unfortunately the contraction of the scar tissue pulled down the lower lip so that the chin splint failed in its purpose and was removed, a thick wire being soldered to the caps to take its place. Some months later the splint was removed, when it was found that the remaining portions of the mandible were freely movable, there being an almost entire absence of fibrous bands, the chin—or rather the tissues where the chin should have been—being soft and pliable. A denture was then inserted. The patient lived and did his work for about five years, dying of pneumonia a couple of years ago. He had, before operation, an exceptionally well formed chin, giving him a notably manly look; hence the difference in appearance afterwards, in the absence of a chin, was very marked. Thus the problem of producing a pouch into which a movable appliance would fit and lift up the skin to produce a chin, seems one worth solving in such cases. Probably it was the fibrous tissue forming at the base of the tongue and drawing

the skin on to the hyoid bone which here caused the failure. For a similar case a splint was made with a plate to pass between the skin and this bone, which, it was hoped, might have prevented this result; but the patient in the end refused operation. The pocket produced by this plate would naturally require the insertion, for a time, of a tube for drainage.

It must be admitted that in some cases curiously little displacement of the remains of the mandible follows loss of a considerable portion of bone, even when no preventive treatment is adopted. *Fig. 199* shows such a case, the remaining teeth articulating almost normally. This was a patient admitted to a London hospital about three weeks after receiving a gunshot injury. The mouth was foul and the breath extremely offensive. Into the

FIG. 199.—FROM A CASE OF GUNSHOT INJURY. To illustrate the comparative absence of deformity which sometimes occurs after considerable destruction of the mandible.

inner surface of the cheek a thick wire was found sticking, which on investigation proved to be part of a suture connecting two large sequestra. The removal of these and several smaller ones, leaving the space shown in *Fig. 200*, was followed by rapid improvement. Nevertheless, when this skiagram was taken it was too early to be sure of the absence of displacement, and the patient, since his discharge, has not been seen.

Maxilla.—The use of a splint after removal of the maxilla, whether by injury or operation, has three objects: to prevent facial deformity by obviating cicatricial contraction; to keep the skin-flaps at rest while they are uniting;

and to relieve the patient of pain whilst the cavity is being plugged or syringed. A movable splint may prevent deformity, but being never really at rest it rather increases than diminishes the coincident discomfort. Moreover, being removable, when it does produce irritation, and even pain, it may be and often is impossible to persuade the patient to continue to wear it.

If teeth be present in the remaining maxilla, or portion of maxilla, by a modification of the cap splint it is fortunately possible to design a fixed apparatus which meets all requirements, and the use of which is strenuously advocated in suitable cases.

FIG. 200.—ANOTHER VIEW OF THE CASE SHOWN IN FIG. 199, AFTER THE REMOVAL OF SEQUESTRA.

A metal cap to cover the remaining teeth is prepared, in exactly the same way as for the cap splint. The plate is continued over the portion of the palate to be left (*Fig. 201*), or better, as made in recent cases, since it is more easily cleansed, from the cap two or three bars pass across the palate to join a median band running antero-posteriorly, and having its outer or free edge extending outwards over the margin of the remains of the hard palate. The whole of this, caps and bars, can be made by the new casting process in one piece. A vertical metal plate is then shaped to correspond roughly with the facial surface of the bone lost—or to be removed—and is attached to the caps and frame.

The vertical plate is shaped to a model obtained from a skull of about the same size. The depth of the plate will vary with that of the bone lost, being naturally deeper if the orbital plate is to be removed. The splint is cemented in place after the bone has been removed and the bleeding arrested. The orbital and nasal aspects of the wound are not covered, and can be clearly seen. The cavity is then plugged in the usual way, but behind the plate, and the skin flaps are replaced.

When any discharge from the wound has ceased, a metal palate, prepared beforehand, is fixed inside the splint to take the place of that removed. This, provided the soft palate remains, shuts the nasal from the oral cavity, and allows the patient to eat and drink without the food entering the former, an advantage much appreciated. In the case of an officer, a patient of Mr. Wilson, whose maxilla was smashed by a bullet entering the back of the neck, just missing the spine, and emerging on the face, the patient much appreciated the advantage of the apparatus in enabling him to smoke a cigarette.

FIG. 201.—MODIFIED CAP SPLINT FOR EMPLOYMENT AFTER BONE HAS BEEN LOST OR REMOVED FROM THE MAXILLA.

It is essential that all edges should be rounded, and curl inwards, since this splint should remain in place for several months, in fact till all chance of cicatricial contraction has passed; otherwise irritation may be caused, needing its premature removal. When removed, an obturator bearing teeth, etc., is made and inserted in the usual way. When no such splint is used, the obturator is inserted much earlier. This causes a good deal of trouble; the patient is usually hypersensitive, and the worry both to him and the dentist is very great. Commonly, a new one has to be made after a short period, for the contraction of the tissues still goes on.

When the growth is malignant there is always the risk of recurrence, but the splint can be removed if need be; and in any case a movable obturator would probably have been inserted before the recurrence commenced. The writer well remembers such a case, where he had to cut the obturator as the growth grew, and, to speak candidly, to bear the reproaches caused by the pain, since it was not expedient to tell the patient its real cause.

When it is necessary to remove the floor of the orbit the resulting deformity is greater than when this can be left. Hence, in such cases, the use of this splint is especially indicated. Then the vertical plate must be carried high up into the wound above the level of the mucous membrane of the mouth and so be in contact with raw tissue. In one such case, undertaken by Dr. Austen

for Mr. Gask, the granulations sprouted through the perforations made in this plate for drainage purposes, and developed into tissue of a fibrous nature, rendering removal of the splint difficult. In a recent case, these perforations have been omitted without apparent detriment. Indeed, the result is particularly pleasing, since the splint has entirely prevented that sinking in of the tissues at the level of the floor of the orbit which almost always occurs after this operation if no splint be used. No case could better illustrate the importance of preventing deformity if it be possible. The patient, a young officer, appears to have forgotten, even if he ever fully appreciated, the danger to his life of a sarcomatous growth from which he has escaped, and is apparently, perhaps quite naturally, solely concerned with regaining clearness of speech and his normal appearance.

When the bone has been lost as a result of a gunshot injury, commonly a plastic operation is necessary to close the skin wound. If possible, it is advisable that the splint be fixed before this is performed, since it restores the contour of the face, and the size of the flaps can be better judged. Even if the plastic operation has been performed, it is preferable to insert such a splint early, and wait several months for the movable apparatus. For, apart from the prevention of cicatricial contraction, unless the orbicularis oris has a mechanical resistance over which to draw the lip, it degenerates, and the mouth will not be symmetrical. This is especially true if, unfortunately, the flap cannot be made as ample as it should be.

The scope of this paper is not intended to cover the forms of the appliances used after the removal of the splints herein described, or when they have not been employed. But we do not desire to convey the impression that nothing can be done to alleviate the condition of those who suffer from facial deformity, with mal-occlusions of the teeth, the result of failure or absence of treatment. That is far from being the case. Nevertheless, the result attained can never equal that in which deformity has been prevented. No appliance can ever equal natural teeth in normal occlusion.

In proportion to the realization of this truth will grow the appreciation of splints and the desire to use them.