DENTAL CASES AMONGST SOLDIERS.*

BY

SAMUEL A. HOPKINS, M.D., D.D.S.,

BOSTON, MASSACHUSETTS, U.S.A. (— GENERAL HOSPITAL, FRANCE).

Of those men who have received dental treatment at this hospital 16 per cent. were suffering from gastritis or other digestive disturbances, and nearly every one of these had been sent back from the front for this cause alone. In every instance a rapid improvement was shown after the diseased roots were extracted and the mouth and teeth cleaned, although in many instances no artificial teeth were supplied. We have never had so many grateful patients. Man after man came back to us and told us how much better he felt after even the limited treatment we were able to give. Where the man was in other respects capable of going back to the front we have supplied artificial teeth when it was necessary and possible. Our rule has been that when a man had two upper and two lower molars which occluded fairly well, and also useful incisors and cuspids, not to make plates. We are forced to omit many cases that might be greatly improved; but we have treated the aching tooth, and treated and filled many that we felt sure would suffer if not treated. We have noted a condition in many mouths which we rarely see at home. In many teeth which have enormous cavities the dentine has hardened and the pulp receded far beyond its normal position. These we refrain from touching when there is no history of pain and no sign of abscess formation, because the time of the average patient in these hospitals is not sufficient properly to treat and remove the pulp and fill the root canals; the patients' chances are seemingly better if we soak the hardened dentine in a saturated solution of silver nitrate and omit further treatment. A few cases of pyorrhoea alveolaris have come to us in which the mouth was so sore that the patient could not chew. These patients were sent to the hospital for no other reason, and to our great surprise yielded quickly to treatment. In more refined circles this so-called Riggs's disease is a much more difficult disease to cure, and differs in many respects from the cases we have seen in the army. All of the cases among the soldiers are characterized by enormous deposits of tartar around the necks of the teeth, which deposits, however, do not seem to push their way down upon the periodontal membrane surrounding the roots, so that there are few deep incurable pus pockets, and the characteristic odour of advanced Riggs's disease is rarely present. There is usually pus at the gum margins; but with the removal of these great concretions, and very few treatments with iodine, the mouth clears up wonderfully.

I have come to the conclusion that the cleansing of the teeth of most hospital patients would be a most profitable undertaking, for invariably the patient comes back in a day or two and tells us how much better his appetite is, and how much better his food tastes. Nearly all of these patients have great tartar deposits, usually quite easy to remove, and nearly all are swallowing with each meal an appreciable amount of pus. The youngest graduate, or even well-trained three-year students, could do this work under a competent superior, and I am sure it would be a great economy. Many of the nurses could be trained to do much of this work. In some of the States at home we are beginning to employ dental nurses for just such treatment. Of course it would be better still if the men could be started with a reasonably sound and clean set of teeth; but I realize that we are dealing with a great emergency, which must be met in the most efficient and at the same time most economical way.

Some of the cases of rheumatism are undoubtedly due to mouth conditions, while the progress of other cases toward improvement must be retarded by the absorption of these mouth toxins. At the present time at home, if a physician has a rheumatic patient, that patient is immediately sent to a dentist for an examination of his mouth, and, if necessary, x rays are used to discover if there are any pus pockets at the ends of the roots of teeth. Perhaps the pendulum is just now swinging too far in the direction of

the teeth as causal factors in this and other diseases; but it has been proven beyond doubt that blind abscesses and other diseased mouth conditions are responsible for a very large number of cases, and the removal of these foci of infection marks the beginning of the cure.

The same is true of some of the heart and kidney irregularities; but because of the brief stay of the patients at these neighbouring hospitals it is not possible in many cases to see the bearing of the mouth conditions upon these diseases. Here, too, repair work and mouth cleansing could be practised with great profit.

Another point which is of great economic value is the lowering of a man's resistance to disease because of the absorption of mouth toxins, and the derangement of his digestion because of his inability to chew. The unclean mouth harbours the germs of many diseases. The pneumococcus is present, so far as I know, in all mouths where Riggs's disease is present, and in many apparently healthy mouths also. The staphylococcus, streptococcus, streptothrix, and several forms of amoeba are found there in great numbers. In fact, the uncared-for human mouth is the prize bacterial garden of the world, and mouth-to-mouth infections are more common than we dare believe. Therefore—I say it with all seriousness—a supply of toothbrushes, and perhaps fine pumice, and a toothbrush drill at every training station, would be a most profitable investment of time and money. A number of us in the United States have started a dental hygiene movement; and because we know how impossible it is to teach an old dog tricks, we are confining ourselves to work on the children.

It is interesting to know the cost to a country of poor teeth, and these figures may give a rough idea. In the State of New York it costs 36 dols. a year for each child in the public schools; 40 per cent. of absences from school are caused by toothache; 67,000 children fail each year to pass their examinations, and cost the State an additional 36 dols. for an extra year's work; 40 per cent. of these fail because of wretched mouth conditions. A little simple arithmetic will show that the diseased teeth of her school children cost the State of New York nearly a million dollars a year; and I ask, simply as an economic problem, Does the care of the teeth pay?

DEFORMITIES OF THE JAWS RESULTING
FROM OPERATION OR INJURY.

BY

PERCIVAL P. COLE, M.B., CH.B., F.R.C.S., L.D.S.ENG.

HONORARY SURGEON, KING GEORGE HOSPITAL; ASSISTANT SURGEON,
THE CANCER HOSPITAL, AND SEAMEN'S HOSPITAL, GREENWICH;

AND

CHARLES HENRY BUBB, L.D.S.R.C.S.ENG.,

HONORARY DENTAL SURGEON, KING GEORGE HOSPITAL, LONDON.

ANALOGOUS types of deformity are occasioned whether the injury be accidental or, as in operations, deliberately planned. As, however, in the case of operation, the question of expediency and other modifying factors must necessarily be raised, it will be convenient to consider separately the deformities produced thereby. The method of treatment, however, depends on the type of deformity irrespective of the cause producing it. A survey of these deformities will give opportunity for the enunciation of certain fundamental principles of treatment and for the demonstration of methods adapted to giving them effect.

Traumatic deformities of the jaws fall naturally into two groups, according as they are, or are not, associated with loss of substance. Loss of substance may be the sole deformity, or be complicated by displacement of the remaining part or parts. In cases in which it is necessary only to replace a mass removed or lost, the problem is one of purely mechanical prosthesis. It is not our purpose to discuss at any length the technicalities of dental prosthesis, but rather to deal with those cases in which preliminary treatment is essential for success, or in which other than prosthetic apparatus is necessary.

* Read at a meeting of the Military Medical Society mentioned in the BRITISH MEDICAL JOURNAL of December 18th, 1915, p. 905, and December 25th, p. 938.

DEFORMITIES RESULTING FROM OPERATIONS.

1. Operations on the Upper Jaw: Resection of the Maxilla.

The deformity thus produced is typical of that resulting from loss of substance without displacement of the parts remaining. A satisfactory functional result can be obtained by the adaptation of a suitably constructed obturator, the objects to be attained thereby being threefold:

1. To separate the nasal from the oral cavity.
2. To restore the masticating surface.
3. To restore the facial contour.

Particularly in cases where the operator has been unable to preserve the orbital plate it will be found that the apparatus must of necessity be bulky. The usual method of securing the lightness essential for retention and comfort is to render hollow that portion of

FIG. 1.

FIG. 2.

the obturator which fills the gap on the affected side, and the material commonly used is vulcanite. We suggest an aluminium box, which can be cast separately, or a plate and box cast in one piece, together with the tags which serve to retain the vulcanite with which the teeth are afterwards attached. The apertures necessarily left are tapped and securely closed by aluminium pins with a corresponding thread.

The construction of the appliance, whether made of vulcanite or aluminium, presents no particular difficulties, but certain practical details deserve mention. It is sometimes stated that no attempt should be made to distend the cheek. This is certainly not the case. The cheek can be considerably built out. The cosmetic result is more perfect, no harm is done, and after the first few days no discomfort is felt.

The date of insertion is an important point. As a rule, it should be from three weeks to a month after operation. Broadly speaking, the more removed at operation the sooner should the obturator be fitted. More particularly is this the case where removal encroaches on the pterygoid region. This was well exemplified in a case operated on by Mr. Joseph Cuning. The patient was a boy from whom Mr. Cuning removed the maxilla for a nasopharyngeal angio-fibroma which had filled the antrum and nasal fossa, had found its way into the orbit, and encroached on the temporal and zygomatic fossae. Within a month a firm cicatrix had formed which prevented efficient opening of the jaws. It was found necessary to divide the cicatrix under an anaesthetic to enable a reliable model to be taken. The appearances before and after operation are illustrated in Figs. 1 and 2. The cheek was considerably distended; mastication and speech were perfectly restored. Wherever possible, the soft palate should be retained intact. If, as in another case operated on recently by one of us (P. P. C.), it is necessary to remove one half of the soft palate, the remaining half should be drawn across and fixed to the raw pharyngeal wall.

II. Operations Involving the Lower Jaw.

The operations to be considered under this heading include those undertaken to give readier access to growths of the tongue, floor of the mouth or tonsillar region, and those undertaken for growths invading or involving the jaw itself. In the former case the mandible will be merely divided; in the latter case the operation will include the resection of a portion or one half of the mandible. The

objects to be attained are the thorough removal of the growth, and if possible a satisfactory functional result. Generally speaking, the functional results after resection are far from good. This is due, we think, in many cases to the fact that the surgeon does not fully appreciate how valuable is the assistance that can be rendered him by the prosthetic dentist, and in other instances to the lack of that personal collaboration between surgeon and dentist which is essential for success.

It is freely admitted that no considerations as to function should militate against the thoroughness of an operation once undertaken, but no operation on the jaws should be performed until the question of function has been fully considered and a definite plan formulated for its preservation. The surgeon tabulates freedom from recurrence as a surgical success. The patient's gauge of success is his ability to enjoy life. The surgeon preens himself on his achievement; the patient may wish himself dead. The functional problems associated with operations and injuries of the mandible are essentially different from those concerned in corresponding lesions of the upper jaw. The fundamental principle, if mastication is to be efficiently preserved, is the maintenance of the mandible whole, part or parts, in its, or their, normal relationship to the maxillae. In other words, the normal "bite" must be accurately maintained.

(a) Simple Division of the Jaw.

The intrabuccal route for removal of the tongue, in many cases of cancer of that organ, is open to criticism on the ground of insufficient exposure. In growths involving the floor of the mouth and the deep postero-lateral regions of the tongue it is admittedly inadequate. Splitting of the jaw in or about the middle line is a valuable aid to free access in such cases, and were it not that in the most favourable circumstances convalescence is considerably retarded, it would, we think, be more frequently employed.

The lower jaw has notoriously a poor blood supply, and the insertion of wire to coapt the fragments, in what is necessarily a compound fracture constantly exposed to septic infection, leads to delayed and often imperfect union, and in many cases to necrosis. Apposition can be firmly and accurately maintained by means of an interdental splint. The essential factor is the presence of two or three moderately firm teeth on each side of the division site. It may be urged that the necessary teeth may not be present; that, if they are, the better prognosis in edentulous cases should determine their removal; and that the apparently flimsy interdental splint must soon become loosened and so fail in its purpose.

Fortunately the lower front teeth are usually the last to be lost and will, in the majority of cases, be found standing in patients already otherwise edentulous. Fortunately, too, their configuration and position render them peculiarly amenable to conservative methods, scaling, etc., and their preservation, if suitably treated for a week or ten days cannot conceivably add to the risk of the operation. That the splint is adequate to maintain apposition till union has occurred has been amply proved in two cases operated on at the beginning of the year (1915) by one of us (P. P. C.). In one case the growth involved the fore part of the floor of the mouth. A laryngotomy was performed, and the contents of the submaxillary triangle, together with the growth and half the tongue, were removed in one piece, aided by median division of the mandible. Some secondary haemorrhage occurred in the mouth on the tenth day and a lateral fistula persisted for three weeks, but rapidly healed after two applications of x rays. Fig. 3 shows the splint *in situ* in this case. In another case—that of a soldier invalided home from France—the epithelioma involved the lateral margin of the tongue far back. A complete dissection of the anterior triangle, with the removal of the sterno-mastoid and jugular vein, was carried out. Ten days later laryngotomy

FIG. 3.

was performed, the jaw divided, and half the tongue removed.

In both cases interdental splints were fixed on the operating table, and the progress of the patients was precisely such as occurs after an intrabuccal operation. Both patients were fitted with artificial dentures, and were able to eat as well as though the jaw had not been touched.

Even moderately firm union cannot be expected in less than six weeks, and union will occur more quickly if a very fine saw be used to effect the division. This is due to the fact that the splint is fitted to the jaw before division, and, when fixed after operation, the fragments will be found separated by an interval exactly corresponding to the thickness of the saw used. It is necessary to obtain an absolutely dead fit, and to this end the splints were cast in aluminium. They were fixed to the teeth with a rapidly setting copper phosphate cement. No cement can be relied on to retain in position for such a length of time a badly-fitting splint presenting such a small surface and, for this reason, we emphasize the importance of casting in the preparation of this and other interdental splints.

(b) *Resection of a Portion of the Mandible.*

Invasion of the jaw is of grave significance, occurring, as it usually does, when the disease is far advanced. Many of these cases will be regarded as inoperable, both from the point of view of immediate risk and of ultimate prognosis. Resection certainly renders an operation more formidable and attended by greater risk, but from the nature of these cases great risks may justifiably be taken. In addition to the risk may be added the fear of the bad functional results obtained in these cases, and this latter consideration may be the deciding factor in deterring the surgeon from attempting a radical operation. The functional problem is here complicated by the loss of substance necessarily entailed. Difficulty arises only where removal implicates the whole thickness of the jaw, and these cases alone will be discussed. It is obvious that bony union cannot take place if the normal "bite" is to be maintained. It is, in other words, a question of union *versus* occlusion. It may be definitely stated that, in all cases attended by loss of substance, union must be unhesitatingly abandoned in favour of the preservation of the normal "bite." The attainment of this object is much more difficult if the patient be edentulous, and it is particularly in this class of case that treatment is rendered more easy by a discriminating conservatism as regards the teeth. If the requisite teeth be present, an interdental splint can be adjusted, or a modified and reinforced Angle's appliance can be adapted to both upper and lower jaws. The bite in the latter case is controlled by lateral guiding shoes in the manner described by Aehner. In edentulous cases the principle of the Gunning splint must be adopted.

(c) *Resection of One-half the Mandible.*

The remaining half of the jaw, if subject to no control, is pulled backwards, downwards, and inwards, and the condition of the patient is truly pitiable.

We have been enabled, by the courtesy of Mr. W. E. Miles, to adapt a modified Gunning's splint to two such

FIG. 4.

FIG. 5.

cases under his care (Figs. 4 and 5). It will be noted that no attempt has been made to deal immediately with the gap left on the affected side, the sole object of the apparatus being to retain the sound side of the mandible in its proper relation to the upper jaw. It may be objected that the presence of such a splint militates against proper

cleansing of the mouth; that it will not be tolerated by the patient; and that the lower jaw will fall away from the splint and be insufficiently controlled. These objections were not sustained in practice.

Readier access was obtained to the operation site, which, as a glance at the splints will show, was left entirely uncovered. The ward sister was emphatic that the mouth was more easily kept clean with the splint than without it; the patient pleaded to have it replaced when it was removed as a test; and the light pressure of the bandages keeping the dressings in place was found amply sufficient to secure a snug contact of the lower jaw with the splint.

In both these cases the patients were almost edentulous. Should the necessary teeth be present, the modified Angle's apparatus, mentioned previously, could be utilized, but would probably not be so comfortable, at any rate in the early stages.

DEFORMITIES RESULTING FROM INJURIES.

These injuries have assumed considerable importance owing to their relative frequency during the period of the war, and to the functional disability that is apt to follow. This applies more particularly to injuries of the lower jaw, for, owing to its passivity in mastication and its fixity, functional incapacity, in injuries of the upper jaw, ensues far more rarely and can be readily remedied. The slightest inaccuracy in fractures of the lower jaw leads to a diminution in the efficiency of the masticatory power, and greater degrees of deformity result in more or less complete loss thereof.

In the case of a limb, shortening and deformity are not incompatible with the preservation of good function. In the case of the mandible, absolute accuracy of alignment is essential, and unless it is obtained smaller or greater loss of function must inevitably result. Such accuracy can only be obtained in the limbs by direct inspection and mechanical fixation of the fragments by plate or wire. In the case of the mandible, such a procedure as wiring is most emphatically to be condemned. Fortunately, the required accuracy can be obtained by other means. If each fragment can be adjusted and retained in its normal relationship to a fixed point—the upper jaw—it necessarily follows that the fragments are accurately adjusted as regards each other. Every fracture of the mandible should be treated in terms of the upper jaw. Special apparatus is necessary for each case, and, in view of the issues at stake, these cases should be immediately transferred to an institution where such apparatus can be made and where its application is understood.

(a) *Fractures of the Mandible without Loss of Substance.*

The fact that these patients usually possess an adequate number of teeth renders the task of treatment relatively easy. The treatment of a fractured mandible is not begun and ended with the application of a four-tailed bandage, nor should the policy of "good enough" be tolerated. There is no margin here for error, and no treatment is adequate which permits of its occurrence. The Hammond wire splint is easily made, but its use cannot be recommended where a choice can be exercised. To be efficient several firm teeth must be present on each side of the fracture, and in these circumstances the cast interdental splint is infinitely preferable and has a wider range of application. The drawings (Figs. 6 and 7), made from x-ray photographs, illustrate a fracture before treatment and the interdental splint in position. The patient is a soldier at present under our care. On y two shallow molars are present on the smaller fragment, and the displacement was considerable. Reduction could not be effected without an anaesthetic, and here again we feel certain

FIG. 6.

that the accurate fit of the splint is the factor responsible for the maintenance of firm retention. The patient suffers little or no inconvenience, and is able to eat minced meat.

FIG. 7.

Its retention is necessarily attended by some degree of discomfort. Its use should be reserved for those cases not suitable for an interdental splint. The scope of the interdental splint can, we think, be considerably enlarged, and we are at present experimenting with some modifications to that end.

FIG. 8.

FIG. 9.

Rectification of slight degrees of mal-occlusion can be corrected by long and tedious orthodontic treatment, but such treatment is open to serious objections, and at best is a sorry means of dealing with what might easily have been prevented.

(b) Fractures with Loss of Substance.

Fractures with loss of substance are usually compound both outside and inside the mouth. The loss of bone may be immediate or result from consequent necrosis, which, in the case of the lower jaw, readily occurs. It is absolutely essential that these cases should be efficiently treated from the beginning. The main fragments must be retained in their correct position in relation to the upper jaw. Here, as in the case of partial resection, all considerations as to union must be abandoned in favour of the maintenance of this correct alignment. Teeth should be preserved wherever possible, for their presence renders more easy immediate and ultimate treatment. The most suitable apparatus will vary with, and be determined by, the needs of each case, and considerable scope for ingenuity is afforded. The methods finally to be adopted for the restoration of function will depend on the size and position of the gap, and on the number and disposition of the teeth remaining. These methods will be prosthetic alone or prosthetic and surgical combined. The purely surgical measures will consist of plastic operations for the reconstruction of the damaged soft parts and the introduction of bone grafts, to restore, where necessary, bony continuity in the basal portion of the jaw. It must be remembered, however, that owing to the configuration and articulation of the mandible, a lower denture can exercise, if teeth be present and favourably placed, the functions of an efficient splint and restore to the lower jaws that rigidity which has been necessarily lost or impaired. It will be found that in many of these cases a suitably adapted and strengthened lower denture will suffice to restore mastication completely.

Deformities that have been allowed to become established owing to tardy or inappropriate treatment have a cosmetic and functional aspect. The one is usually co-extensive with the other. Their prevention should be a

matter for earnest effort, as is their rectification a matter for urgent demand from the suffering patient. Ingenious and complicated apparatus has been devised for the rectification of these deformities. If, however, the deformity is not established, the necessity for such devices does not arise, and if deformity is established their ability to correct it must be considered as doubtful. Certain it is that in bad cases established deformity can only be rectified by surgical intervention. A case in point is now under our care. The patient had, since his wound six months ago, been under treatment both surgical and dental. Fragments of necrosed bone had been removed from time to time, and his jaw had gradually settled back on the affected side till his front teeth were biting far back into his hard palate. All but two teeth in the lower jaw had been extracted and a lower denture fitted in an endeavour to provide some kind of occlusion. His chin had receded almost to the level of the hyoid bone.

Skiagrams showed the lesion, situated in the right molar region, to be associated with considerable comminution. Consideration of his models and adjustment of them to the correct "bite" indicated that the jaw would have to be pulled forward to such an extent as to leave a gap of one to one and a half inches at the fracture site. Success seemed very doubtful, but his request was so urgent that we decided to make the attempt. Laryngotomy was performed, and by turning back a large flap extending well into the neck the site of the lesion was exposed. It was found that union, partly fibrous and partly bony, had occurred, necessitating the use of the chisel to break it down. Firm cicatricial bands were divided on the lingual aspect, and the main body of the jaw was eventually freed sufficiently to allow it to be brought forward to the desired extent. A previously prepared cast aluminium splint on the Gunning principle was immediately adjusted, a drainage tube inserted, and the wound sewn up. The patient's facial contour is completely restored, and a good functional result is confidently anticipated.

(c) Fractures followed by Trismus.

Fractures liable to this complication are those which occur in the region of the condyle. There may be no mal-occlusion, but the loss of function is more or less serious in proportion to the degree of trismus present. The knowledge that such complication may ensue will lead to the treatment of such fractures in the "open bite" position, thus obviating the crippling results of cicatricial contraction or callus formation.

ACCORDING to the *Journal of the American Medical Association*, a bill now before Congress proposes to appoint the surgeons-general of the army, navy, and public health service a board to select a site for a national leprosarium for the United States. The sum of £100,000 is provided for building and maintenance. The leprosarium is to be administered by the Surgeon-General of the Public Health Service, who will be authorized to admit any leper who presents himself or who may be apprehended or detained under the United States quarantine laws.

IN a paper communicated by Sir Oliver Lodge, F.R.S., to the Royal Society on January 27th, Mr. F. Tinker related the results of a study of the microscopic structure of semi-permeable membranes and discussed the part played by surface forces in osmosis. Photomicrographs of the common precipitation membranes showed that they were composed of small precipitate particles packed closely together, and ranging from 0.1μ to 1.0μ in diameter. Each of these precipitate particles was itself an aggregate formed by the flocculation of smaller ultra-microscopic particles. Of the membranes examined copper ferrocyanide and Prussian blue had the smallest particles. The pores in a copper ferrocyanide membrane ranged from 8 to $60 \mu\mu$ in diameter. Their size was such that they block colloidal molecules mechanically, but not the ordinary crystalloidal molecules, even when highly hydrated. A very close connexion was found between the osmotic properties of a membrane and the extent to which the membrane capillaries were under the control of surface forces. It was thought probable that osmotic effects were the result of adsorption phenomena occurring at the surface of the membrane and in the capillaries, the membrane being relatively impermeable to solutes negatively adsorbed, but permeable to solutes positively adsorbed.