Osseous Resection in Periodontal Surgery*

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The gingivectomy has for many years been the basic periodontal surgical procedure. Various techniques have been advanced for its performance. Its objective has been the elimination or reduction of abnormal sulcular depth, and in many cases this objective is achieved. There are, however, many other areas in which this objective has failed because of a regrowth of the remaining gingiva to its original preoperative level or nearly so. Analysis of reasons for this regrowth and the consequent reformation of pockets has revealed that the form which the gingiva takes is qualified to some degree by the architecture of the underlying bone.

If periodontal destruction consisted only of an apical migration of the bone, with no change in architectural topography, periodontal therapy would concern itself only with soft tissue problems. If this were true, most gingivectomies would be successful. The underlying bone remaining normal in form with interproximal cones well intact with knife edged margins, would lend itself to a long bevelled incision which would eliminate the pocket and create acceptable physiologic gingival contours. In other words, the postoperative result would be one of good architectural form but more apical on the root surfaces. Unfortunately this is not the typical pattern of bone loss. If one is dealing with incipient periodontal lesions, he may not be confronted with any real modifications in bone architecture, but since the periodontist must deal also in more advanced lesions, it is here that problems arise and must be met.

In health, bone and tissue are adjacent to each other and consistent with one another in form. Fig. 1 represents a normal, healthy gingiva. The margins are well adapted and thin, papilla is cone shaped and blends into the interdental groove.

The physiologic contours possess self-cleaning qualities which are necessary for maintenance of health. Since this is a normal picture of health, all periodontal therapy should be directed toward this goal. This means that even in surgical management where the gingiva must of necessity be positioned further apically, the post operative result should still resemble this in form. Fig. 2 demonstrates the architectural pattern of bone usually found in health. This is the bone topography one would probably encounter if the soft tissue were removed from the bone and teeth of an individual such as that in Fig. 1. Notice that the form of both are quite similar.

In periodontal destruction, the architectural form is often modified or deformed. These deformities manifest themselves in bone as interproximal craters, heavy buccal or lingual ledges, infra-bony pockets, blunted interdental crests and numerous other bizarre patterns. This behavior is the exact opposite of that of soft tissue. The gingival tissue contour covering these deformities is often acceptable, or even enlarged; the difference in levels of bone and soft tissue are expressed in pocket depth. When the gingiva is excised in such cases it cannot adapt itself in healing to the deformed bony profile for any length of time. The inherent quality of soft tissue to revert to a scalloped pattern is responsible for a reformation of pocket depth. The hard and soft tissues are no longer consistent with, or adjacent to, each other.

The removal of bone in periodontal therapy is not new and had been advocated prior to Schluger's classic presentation in 1949. The earlier work dealt with the removal of bone in the leveling of the infra-bony pocket. Schluger developed the concept and set forth basic principles of plastic repair, just as Goldman did in the gingivoplasty. This concept deals with

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much more than bone removal for pocket elimination but enunciates the plastic principle of recontouring bone for the production of good physiologic architecture in all the involved tissues.\(^3\) Pocket elimination is not enough, since one must also treat the deformity that occurs as a result of the disease process. By so doing, normal structure and function can be restored to the organ treated.

Kronfield stated in 1935 that bone tissue under periodontal pockets is inflamed but vital, and never necrotic.\(^4\) It should be emphasized that any bone removed in cases described in this report was done for architectural reasons, and not because it is thought to be infected or necrotic. Healthy bone is removed in osseous resection, just as good healthy soft tissue is removed in the gingivectomy to achieve physiologic, self-cleansing qualities of the gingivo-marginal area.

The term “osseous resection” originally covered all phases of bone surgery in periodontal procedures. Recently, Friedman\(^5\) divided this term into two divisions—osteoplasty and osteectomy. Osteoplasty is, just as the term implies, a plastic recontouring of bone for physiologic architecture so that the gingiva may also have contours that are physiologic. This procedure of “festooning” the bone does not involve or sacrifice any of the supporting structure of the tooth. Osteectomy, on the other hand, is the procedure of removing bone which is part of the supporting structure, in order to eliminate the pocket and also to create proper physiologic contours.

This writer feels that the above terms, “osteoplasty” and “osteectomy,” are useful terms in an academic sense. In doing an osteectomy, one carries out all the principles of osteoplasty; the only difference being that some of the attachment apparatus is removed in osteectomy. One of the purposes of this report will be to emphasize that most osseous surgery however, is osteoplasty and even in cases requiring extensive reshaping of the bone, the amount of supporting bone sacrificed is surprisingly small.

The most common deformity to be found as a result of the periodontal lesion is the blunted interproximal crestal bone. It is common practice to find the pocket deeper interproximally than on labial or lingual surfaces,\(^6\) and this may even be modified to state that it is not uncommon to see pockets on the interproximal and no pocket depth on labial or lingual aspects. Since the interproximal area is the chief site of the periodontal lesion and since the underlying bone in health is cone shaped from buccal to lingual, it is not difficult to realize that this cone of bone is resorbed, becomes blunted, and is therefore a common early deformity.

Blunting occurs on anterior and posterior interproximal bone, but most frequently in the posterior regions. Perhaps this could be explained by a comparison study of the anterior and posterior interdental architecture in health. The posterior cone is flatter and wider bucco-lingually in addition to having heavier cortical plates and can tolerate only minor changes before it becomes considerably modified. Fig. 3a will demonstrate a common deformity of this nature. Pocket depth of 4 m.m. was reduced on anterior teeth by gingivectomy. The interdental bone was found to be blunted and therefore limited the bevel that could be created by incision.
A thick, blunted, interproximal papilla would be the result. Notice that the incision is little more than at right angles to the tooth in the area between the lateral incisor and canine. At the most apical extension of the bevel, one can insert an explorer into the tissue, readily probe bone, and determine that the bevel cannot be increased. Since the buccal margin of bone was not thick and an acceptable bevel could be obtained in the marginal areas, it was decided not to do a modified flap, but to utilize the diamond stones as originally advocated by Fox,7 and reshape the blunted bone through the soft tissue, Fig. 3b. This is osteoplasty in its simplest form. The post-operative result, Fig. 3c, can be compared with the interdental area between the two central incisors, from an architectural standpoint, which has not been affected by periodontal disease. The gingival contour of the soft tissue is quite the same, the papilla is cone shaped, the marginal area is thin and blends into the interproximal area and groove. This promotes self-cleansing qualities in function and home-care is made easier for the patient.

The interproximal bony crater is a very common finding and is merely a more advanced lesion of the blunted interdental crest. It often occurs in the presence of heavy buccal and lingual cortical plates. Clinically, no pocket depth is noted at the line angles; but a probe makes a sharp drop as it progresses interproximally. Roentgenographically, the crater is often obscured because the heavy buccal and lingual plates of bone are superimposed, giving a false image of the interproximal area. The soft tissue is often normal in appearance and intact along the heavy buccal and lingual plates of bone. Fig. 4a illustrates the topography of the lesion. The gingivectomy is limited to the buccal and lingual crests. The residual pocket depth plus the proliferation of the tissue coronal to the crests can only result in a regeneration of pocket depth. Such a result could be achieved with curettage. In order to eliminate the crater, one of the plates,
either buccal or lingual, must be reduced, Figs. 4b and c. It is usually the buccal plate because most patients find that it is easier to perform home maintenance from the buccal aspect and access is provided for the operative procedures.

After buccal or lingual plate has been reduced for crater elimination we are now confronted with the problem of creating physiologic form on the buccal or lingual side that was selected for recontouring. Fig. 4d shows the interproximal apical reduction performed, followed by Fig. 4e which shows the triangular removal of supporting bone on the two adjacent teeth. A gradual rise and fall of bone profile which is necessary for pocket elimination now exists. However, thick ledges of bone are still present in the interproximal areas. This presents the same problem as the blunted interdental crest. (See Fig. 3.) The procedure of festooning, Fig. 4f creates the vertical groove blending in with the papilla and adjacent areas for food passage.

The interproximal crater does have four hard walls for protection of a blood clot, however, reattachment in the crater type lesion has been extremely limited and one could hardly list it as a probable method of pocket elimination for the crater.

The isolated deep interproximal pocket should receive only a brief discussion due to the resemblance of the technique for its correction and that of the crater. This type of deformity is comparatively uncommon, while less precipitous supra-bony pockets are very common. Actually an isolated deep interproximal pocket is no more than a crater that has had both buccal and lingual plate reduction. The correction is the same procedure as that in Figs. 4e and 4f, for the crater. Tissue

Fig. 3. 3a-Gingivectomy performed. Proper bevel was prevented by blunted interseptal bone. 3b-Osteoplasty thru the tissue with the aid of rotary abrasives. 3c Post operative result of good interdental grooves and knife-edged margins.

Fig. 4. 4a-Topography of the interproximal crater. High walls of bone buccal and lingual to the bottom of the pocket. 4b-Bone ramped to eliminate the sameer shaped deformity. 4c-Post operative result of the selective recession desired, viewed from buccal lingual. 4d-Viewed from the side selected for recontouring, showing interproximal apical reduction. 4e-Demonstrates the removal of bone on the two adjacent teeth so that a proper rise and fall of bone profile is accomplished. 4f-Festooning principle, or creating the vertical groove, blending in with the papilla and adjacent areas for deflection of food. (After Schlügler)
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will not adapt itself to a precipitous change in bone profile and it is only a matter of time until the pocket depth recurs to approximately its original depth. The gradual rise and fall of the underlying bone by sacrificing bone on the two adjacent teeth is apparently the best means we now have for treating this situation.

Bone loss on buccal and lingual surfaces, usually posteriors, frequently results in a loss of the knife-edged form and consequently, ledges and shallow, wide-mouthed infra bony pockets are formed. This is particularly so if the buccal plate is heavy. In Fig. 5a, an incision was made which immediately eliminated the pocket. The heavy buccal plate present from canine to second molar became a very real obstacle and made it necessary to make an incision practically at right angles to the teeth. At this point one could expect no more than a flat interdental papilla and a heavy buccal ledge which would not deflect food. Long before this bone could reshape itself and thin out, the tissue would proliferate, pathology become re-established, and the surgery would have been in vain. The bone topography becomes clearly evident when a modified flap is performed exposing the area, Fig. 5b. The buccal ledges and the interproximal blunted crests were festooned to conform to a physiologic pattern, Fig. 5c. This is a simple procedure and can be done in a fairly short time with practice. In Fig. 5d, the post-operative result is one of health; notice the interproximal, vertical grooves, the knife-edged gingiva and the papilla tucked in between the contact points. Again, this will maintain itself with the minimum of assistance from the patient.

The bifurcation and trifurcation involvement of molars present real problems to the periodontist and to the dentist performing restorative procedures. Many such involved teeth are in key positions for a prosthetic program and should the tooth be sacrificed, the entire treatment plan may be altered.
with a lowering of therapeutic objectives. Their roentgenographic and clinical detection are frequently overlooked and one must cultivate a thorough technique for the inspection of all bifurcations and trifurcations during the examination. The thin, worn, sharp curette is an excellent instrument for exploring the area as it can best follow the topography of the pocket. A close examination of bifurcation involvements on lower molars and buccal of upper molars reveals a very significant finding—the attachment level on the mesial and distal roots to the bifurcation involvement are nearly always at a much higher level. It is very common to probe a deep pocket involving the bifurcation and find no pocket depth to the mesial or distal. Fig. 6 is a roentgenogram of a lower first and second molar with Hirschfeld silver points in place—the first molar having a 5 mm. pocket at the buccal bifurcation and the second molar with a 6 m.m. involvement. There was no pocket depth on the buccal of the mesial or distal roots. This particular patient presented with all lower molars involved in a similar pattern as described and yet was pocket-free in all other areas of the mouth. The tissue covering the bifurcations was in acceptable form with an exudate being the only symptom of disease.

The lower first and second molars in Fig. 7a have buccal bifurcation involvements. Shallow pockets were present on the mesial and distal roots with a much deeper pocket funnelling into the interradicular area. On the second molar, bone was removed on mesial and distal roots to obtain similar levels of attachment. Osteoplasty was then performed on both teeth to produce a knife edge bone in marginal areas and to treat the bifurcation area as if it were an interproximal one. The latter part of this statement is worthy of explanation. The bone ledge apical to the bifurcation is ramped and hollowed out which produces a long bevel and vertical groove, Fig. 7b. This is quite like the interdental groove and is for the same purpose of providing an escape for food. The soft tissue at the bifurcation can now be recessed and behave as if it were an interdental area, Fig. 7c. This is of great importance and must be made so, surgically. A deep V-shaped gash would be the post-operative result of a
simple gingivectomy for pocket reduction. This is an impossible profile for tissue to maintain and this factor coupled with the impingement of food on the thickened free margin, results in a heavy roll of tissue. It is only logical that the patient's access to the bifurcation is hampered and is a matter of time until the interdental stimulator must be pointed apically to reach the bifurcation. This is no less than a gouging effect into the tissue. An acute exacerbation may be the result.

The first and second molar area in Fig. 8a exhibits fairly scalloped soft tissue form; but in Fig. 8b we observe a sharp deviation from that of the overlying soft tissue. Note the bizarre pattern of the bone and particularly the deep funnel-shaped deformity on the second molar. Also notice the more extensive bone destruction on the mesial root of the first molar, than on the distal. Both molars have trifurcation in-

Fig. 8. 8a-Pre operative picture demonstrating the soft tissue form overlying the bony deformities seen in 8b. 8b-Notice the aberrations in form, particularly the second molar. The standard gingivectomy could offer very little to this case. 8c-Post operative result. Attention is directed toward the papilla like pattern of soft tissue in the trifurcation area of the first molar. The bone has been ramped in the area of the second molar eliminating the funnel shaped deformity and the soft tissue reflects these plastic corrections.

Fig. 9. 9a-Recording of pocket depth on gingiva and incision performed. 9b-Soft tissue removed and modified flap performed exposing the multiple craters and ledges on anterior teeth. 9c-Interproximal corrections were made and labial bone was sacrificed for good bone topography. 9d-Margins are well adapted, interproximal areas are cone shaped and blend into the interdental groove. Proper structure and function has been established.
volvements. The area was reshaped and bone was sacrificed on the distal root of the first molar. The lateral wall of bone making up the peculiar deformity on the second molar was reduced by osteoplasty. There was no supporting bone removed on the second molar. Fig. 8c is the post-operative result. Observe the first molar, with the papilla-like soft tissue in the trifurcation area resembling that of an interproximal one. Good deflecting contours are present, permitting proper food escape.

Most of the problems dealt with up to this point refer to posterior teeth. However, the anterior teeth demonstrate similar problems except that they are not so frequent or so bizarre. In Fig. 9a, pocket depths have been recorded on the gingiva and the gingivectomy incision carried out in the routine fashion. Fig. 9b, soft tissue is removed and the area presents multiple craters in conjunction with thick ledges or actually lip-like projections. After interproximal corrections of craters, high levels of bone remained on the labial surfaces of the incisors. Similar levels of bone were then produced in interproximal and labial areas by sacrificing labial bone, Fig. 9c. The post-operative result, Fig. 9d, is one of well adapted knife-edged margins, cone shaped interproximals, and good generalized contour. The marginal gingiva is now more apical to the cervical line of the tooth but a normal form with a near zero sulcus depth is present. Compare this final result in regard to form with Fig. 1 of a normal healthy gingiva.

Premolar and molar saddle areas can be extremely broad precluding a satisfactory environment for the pontic in restorative procedure. The distal abutment for the fixed restoration, occasionally presents a broad bucco-lingual saddle area upon which food can be retained after passing over the pontic. This is difficult for patient maintenance and is not in keeping with our principles of physiologic contours for deflecting food. Many dentists subscribe to the narrowing of bucco-lingual diameters to both abutments and pontics. This would aggravate the problem of food retention, particularly if the saddle areas were broad.

Fig. 10a will demonstrate the heavy broad saddle area. The second molar has a buccal bifurcation involvement and as this tooth is to be used for an abutment, it must receive as much assistance as possible. The crowns and pontics were to be narrowed considerably and the broad platform-like saddle area must be reduced bucco-lingually also, if continuity is carried out in the treatment plan, as shown in Fig. 10b.

The multiple interproximal crater is, without a doubt, the most difficult of all osseous surgery. The operator's judgment is constantly being challenged and it is also here that compromises in post-operative results can occur. The final result is often not correct in form, particularly in molar areas because buccal and lingual plates extend occlusalward from interproximal corrections. A leveling of buccal and lingual plates to correspond with the interproximal corrections would open up bifurcations and trifurcations. This would be radical surgery and certainly contraindicated.

In these areas between interproximal craters, the choice inevitably arises whether to sacrifice the tooth or teeth in question, or to perform rather extensive or difficult
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Fig. 11. 11a Pocket depths interproximally range from 7 to 10 m.m. with shallow pockets on the buccal or labial and lingual. This pattern of pocket depth readily indicates multiple interproximal craters. 11b-Modified flap lifts the veil of soft tissue and exhibits the deformed bone pattern. Compare this with the normal bone form in Fig. 2. 11c-Interproximal correction, reducing the labial or buccal wall of the crater. Reversed or inverted pattern now needs further correction. 11d-Osteotomy, or sacrificing labial or buccal bone to create acceptable structure and form. 11e-Post operative result is not ideal but acceptable. There is much selective recession but the architectural form is physiologic with the exception of the inverted pattern between the molars.

bone recontouring. The answer to this question lies with the resourcefulness of the operator, the critical importance of the teeth to the restorative treatment plan and all the other factors which call upon the operator's judgment.

Fig. 11a illustrates a hyperplastic and edematous area around anterior teeth, the posterior soft tissue is prominent due to a heavy buccal plate; but the architectural pattern could be considered fair. Interproximal pocket depth ranges from seven to ten millimeters, with very shallow or no pocket depth on the labial, buccal and lingual of anterior and bicuspids teeth.

A gingivectomy was performed along with a modified flap operation. Fig. 11b shows the veil of soft tissue lifted and the underlying pattern of bone exposed. Deep bone craters are in evidence, the first premolar has an early bifurcation involvement, buccal ledge is very prominent on second premolar and first molar. A buccal trifurcation involvement exists on the first molar with a deep crater between it and the second molar. The first molar also has a trifurcation involvement on the mesio-buccal and lingual roots. The second molar has a distal trifurcation involvement. The deep pockets on the anterior teeth and the possibility of a poor esthetic pattern after pocket elimination must also receive consideration.
Fig. 12. Armamentarium. Left to right; bone chisel, Fox diamond stones, Carbide round bur, Huck files.

Fig. 11c demonstrates interproximal correction, making buccal and labial plates more coronal than interproximal areas. Fig. 11d shows the sacrificing of labial and buccal bone to create a fairly acceptable architectural form. If this procedure had not been performed, a generalized reversed pattern of soft tissue form would have resulted. The crater was eliminated between the molars but similar levels of bone could not be carried out, or even gradualized to the adjacent teeth as this would have required the sacrifice of too much buccal bone on the molars.

Fig. 11e is the post-operative result which reveals an acceptable gingiva form, with the exception of the reversed pattern between the molars. This compromise was anticipated, as stated previously. There is much selective recession but the gingival contour is within physiologic limits for long term maintenance in function.

The anterior teeth were later reshaped for esthetics but this reshaping was purposely postponed so that the amount of selective recession could be observed. An important point to remember concerning anterior teeth with deep pockets—if good architectural form is produced in hard and soft tissues, the esthetic problem is reduced considerably.

**TECHNIQUE**

The gingivectomy performed by the writer is the modified Black Operation. Briefly, it consists of measuring the pocket and recording this depth on the gingiva with a puncture mark. These puncture points are then connected by an incision made on a long bevel and the soft tissue forming the lateral wall of the pocket is removed. The modified flap is the next procedure for gaining access to the bone. This is by far the most acceptable method and is therefore used on practically all cases. A periosteal elevator may be used to detach the soft tissue from the bone. The writer uses a curette which is reversed and with this instrument a flap can be laid in a few seconds. The flap usually need not extend apically more than four or five millimeters, depending on the circumstances.

The round carbide bur will perform actually better than the coarse diamond stones, particularly after the diamond
stones have been used several times. However, the bur has its limitations and cannot be used when supporting bone is removed or beveled. In both instances the operator is likely to damage the tooth. This phase can best be performed with hand instruments. The chisel, Fig. 12 is very useful in the armamentarium and is utilized where marginal bone is removed. If the marginal bone is thick, it should be thinned down first with diamond stones and then marginal reduction is performed with greater ease.

The modified Buck file, is an excellent instrument for interproximal correction of the crater. In cases where the buccal plate is extremely heavy, the festooning of the interproximal should be performed first, then the interproximal apical reduction for crater elimination is a simple matter.

The short flap is debrided and without the aid of sutures is adapted to the exposed bone. If excess is evident, the flap can be trimmed with scissors. If the flap will not cover the bony field, due to retraction, adhesive foil can be placed over the area, followed by the preferred surgical dressing application.

When interdental grooves are accomplished in the festooning procedure of osteoplasty for interproximal areas, occasionally the gingiva will not adapt itself to the newly contoured areas. The tissue is taut over the grooves and the void between tissue and bone fills in with a blood clot. The end result may not be proper tissue form and therefore defeat our purpose. Vertical incisions of about 5 m.m. in the soft tissue over the recessed interproximal areas will permit the tissue to drape into, and adapt itself to the existing bone contour.

Extremely heavy buccal or lingual plates and exostosis in areas involved with pocket depth frequently require much bone reshaping. Even though rotary abrasives and burs are utilized, the procedure can be time-consuming, trauma-producing, and invite post-operative complications. The lingual of the lower is a very common example as it frequently presents a broad shelf of bone; the molar area often having both the shelf and a wide, shallow, infra-bony type deformity in conjunction. This is a good area to demonstrate because it deals with a bulk of bone to be reshaped, it is in an area where access can be difficult, and where post-operative problems are always a factor to be considered.

After gingivectomy has removed the excess soft tissue, a modified flap is performed. A bulk of bone is immediately visible to the operator. Extensive tissue retraction is contra-indicated and seldom necessary. A carbide bur is used to make vertical sections in the bone, Fig. 13. As stated, very little retraction is necessary because the groove is started coronally, approximately 1 m.m. from the tooth. The groove is extended apically and lingually, the exact bevel not concerning the operator at this point. As many sections are made as are needed; grooves are interproximal and interradicular. It is then a simple matter to engage each section separately with a sharp chisel and with a slight tap, the offending bone is removed. At this point the lateral soft tissue collapses now that gross bone reduction has been accomplished. This procedure has been termed “segmentation reduction.”

The large rotary abrasive is used in a contra-angle with the motor reversed so that the soft tissue will be forced back for good visibility. This also prevents unnecessary tissue laceration. With little effort the area can be finished down to proper contour.

Fig. 13. Segmentation reduction. This procedure is used particularly on the lingual of the lower posterior teeth where heavy, thick ledges of bone or exostosis are present.
SUMMARY

Bony modifications or deformities resulting from periodontal disease, preclude the possibility of hard and soft tissue being consistent with each other following therapy, unless the aberrations in form are corrected. The removal of large or small amounts of bone is incidental. The problem of creating deflecting contours for proper form and function is the primary concern.

Various types of bone deformities have been presented with possible solutions for their correction.

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