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Resective Osseous Surgery – A Review

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Abstract: *Variety of treatment approaches have been developed and used to treat periodontal diseases associated with attachment loss. While the goal of periodontal surgical treatments is to access the root surfaces for proper debridement, the decision to remove or reshape the supporting bone has been controversial. Osseous resective surgery necessitates following the use of strict guidelines for proper recontouring of the alveolar bone and proper management and positioning of the gingival tissues so that the results from osseous resective surgery are highly predictable.*

Key Words- *Resective osseous surgery, bony defect, Piezosurgery*

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I. Introduction

The periodontal disease process results in destruction of the alveolar bone. One of the important goals of periodontal therapy is elimination or reduction of the periodontal pocket[1]. The pattern of osseous destruction is not uniform on contrary it is variable in nature. Periodontal tissue destruction is manifested by clinical attachment loss with formation of deep periodontal pockets with associated bleeding on probing. This is largely dependent on reestablishment of physiologic osseous contours and correction of deformities in the alveolar bone surrounding the involved teeth. Osseous resective surgery is the most predictable surgical treatment modality for achieving stable pocket reduction[2]. It comprises a series of carefully orchestrated steps for appropriate re-contouring of alveolar bone and management of the overlying soft tissues.

Osseous surgery can be either additive or subtractive[3]. Additive osseous surgery includes procedures directed at restoring the alveolar bone to its original level, whereas subtractive osseous surgery is designed to restore the form of preexisting alveolar bone to the level present at the time of surgery or slightly more apical to this level.

II. Definitions: -

1. Osseous resective surgery can be defined as a procedure to modify osseous support either by reshaping the alveolar bone to achieve physiologic form without the removal of supporting bone (osteoplasty) and/or by the removal of some alveolar bone (ostectomy), thus changing the position of the crestal bone relative to the tooth root[4].
2. World Workshop – 1989 - Aspect of periodontal surgery which deals with the modification of the bony support of the teeth.
3. Friedman[5]: surgical removal of the gingiva & reshaping of the bone to eliminate the pocket and correct unphysiologic bone architecture.
4. Sims and Carranza (1996): procedure by which changes in the alveolar bone can be accomplished to rid it of deformities induced by periodontal disease process or other related factors – exostosis & tooth supraeruption.
5. Glossary of Periodontal terms[6]: (1992) periodontal surgery involving modification of the bony support of the teeth.

III. Historical Basis

Prior to 1935[7], bone associated with periodontal disease was considered infected or necrotic and surgical removal of this affected bone was the most accepted treatment. Kronfeld's research demonstrated that control of inflammation was critical to treating periodontitis and that the underlying bone was neither necrotic

nor infected[8]. In addition to the introduction of the gingivectomy technique[9], there was a decline in osseous resective surgery. However, recurrence of pockets after gingivectomy became a concern and led to renewed interest in osseous resective surgery. The recurrence of pockets and regrowth of soft tissue following the gingivectomy procedure was due its inability to follow irregular contours of osseous deformities[10]. It was opined that because bone remodels at a slower rate compared to soft tissue, contouring of bone was necessary to facilitate gingival conformity and was further emphasized that gingival contour does not necessarily follow osseous contour since the soft tissues tended to follow a scalloped contour even in the presence of underlying osseous irregularities[11].

To summarize,
Osseous surgery : necrotic or infected bone.
Kronfeld (1935) – All bone is healthy.
Schluger (1949) : Father of osseous surgery.
Friedman (1955) : Osteoplasty , Osteoectomy/Ostectomy .
Goldman ,Cohen (1958) : Classification of bone defects.

IV. Terminology

The following terms are important to know when discussing osseous resective surgery[3]:

Osteoplasty: Reshaping of the alveolar bone to achieve a more physiologic form without removal of alveolar bone proper.

Ostectomy: The excision of a bone or portion of bone. In periodontics, ostectomy is done to correct or reduce deformities caused by periodontitis in the marginal and interalveolar bone and includes the removal of bone that is attached to the tooth.
The above procedures may be required individually or in combination depending on the situation to obtain the desired surgical result.

Positive architecture: Refers to the situation whereby radicular bone is at an apical level to the interdental bone.

Negative architecture: The opposite of positive architecture, i.e. situation whereby interdental bone is more apical relative to the radicular bone.

Flat architecture: This occurs when both the interdental and radicular bone are at the same level.

One of the major goals of osseous resective surgery is to re-establish positive architecture of the underlying bone as this is thought to be favourable for periodontal health and maintenance.

Definitive osseous reshaping: when further osseous contouring will not significantly improve the surgical result.

Compromised osseous reshaping: refers to the situation when additional bone removal in order to attain ideal osseous architecture is not done as this would significantly compromise the support of a tooth or teeth.

V. Indications of Osseous Resective Surgery

Indications for osseous resective surgery include[10]:
1. When gingivectomy alone fails to reduce the periodontal pocket
2. Deep isolated periodontal pockets
3. Mesial aspect of tipped molar teeth.
4. Saucer-shaped interproximal pockets.
5. Deep, isolated pockets

Overlying soft tissues generally 'tolerate' variations in alveolar bone height up to 30 degrees or 60 degrees in cases of prominent roots[10]. Furthermore, thick edges of bone around teeth should be thinned to a knife-edge margin to permit tension-free tissue adaptation against the osseous tissues during flap closure. Importantly, however, it must be recognized that despite the evident importance of developing positive or at least favourable architecture of alveolar bone, resective surgery is contra-indicated if bone removal requirements are so large as to have a negative impact on the bone support and architecture of bone adjacent to nearby teeth and/or will result in furcation exposure of those teeth or the teeth involved in the primary site of surgery.

VI. Advantages of Osseous Resective Surgery[12]

1. Visualization and accessibility of osseous defects
2. Minimal treatment time
3. Ease of technique
4. Elimination of additional surgical sites

VII. Disadvantages of Osseous Resective Surgery

1. Loss of attachment
2. Gingival recession
3. Post-operative sensitivity
4. Increased mobility of tooth/teeth in area treated

VIII. Factors to Consider Prior to Performing Osseous Resective Surgery

1. Length and shape of the roots
2. Location and dimension of the defect(s)
3. Width of supporting bone
4. Root prominence
5. Relationship of the intraosseous defects to adjacent teeth and other anatomic structures, e.g. palatal exostoses.

The major determinant of the extent of bone resected is the relationship between the configuration and depth of the osseous defect to the root morphology and adjacent teeth. Osseous defects are classified according to their configuration and number of osseous walls containing the defect[13]. Osteoplastly and ostectomy could effectively be used to treat 1 or 2-walled osseous defects around teeth with early-moderate bone loss and moderate-length root trunks, and create a positive osseous architecture[14,15]. Patients with severe bone loss and deep intra-osseous defects were not considered suitable candidates for osseous resection as the amount of bone which would have to be removed to attain positive architecture would further compromise the attachment, and consequently, survival of the tooth.Two-walled defects (craters) are the most common bony defects found in patients with periodontitis[16,17]. If the facial and lingual plates of this bone are resected, the resultant interproximal contour would become more flattened or ovate. However, confining resection only to ledges and the interproximal lesion results in a facial and lingual bone form in which the interproximal bone is located more apically than the bone on the facial or lingual aspects of the tooth. This resulting anatomic form is reversed, or negative, architecture[18,19,20].

The extent of attachment loss during resection to a positive architecture has been measured. When the technique is properly applied to appropriate patients, the mean reduction in attachment circumferentially around the tooth has been determined to be 0.6 mm at six probing sites.[20] In practical terms, this means that the technique is best applied to interproximal lesions 1 to 3 mm deep in patients with moderate to long root trunks.[18] Patients with deep, multiwalled defects are not candidates for resective osseous surgery. They are better treated with regenerative therapies or by combining osteoplasty to reduce bony ledges and to facilitate flap closure with new attachment and regeneration procedures.

IX. Examination and Treatment Planning Associated with Osseous Resective Surgery

A comprehensive periodontal examination is necessary to determine whether osseous resective surgery can be used as a potential treatment modality. Periodontal probing is an essential component of this examination. Thorough and careful periodontal probing can confirm the presence of:

1. Periodontal probing depth in excess of that of normal gingival sulcular probing depth (0-4 mm).
2. Relationship of the base of the pockets to the mucogingival junction and attachment levels on adjacentteeth
3. Number of osseous walls
4. Furcation involvement.

Transgingival probing or Bone sounding, under local anesthesia, allows one to better appreciate the osseous topography of intraosseous or furcation defects[21,22]. The sounding procedure involves inserting the probe into the sulcus and "walking" it along the tissue-tooth interface for the clinician to feel the osseous topography. It is also useful to sound horizontally through the overlying tissues as this gives three-dimensional information about the underlying osseous contours.

Dental radiographs can also be used adjunctively to provide further information pertaining to the extent of interproximal bone loss, the presence of angular bone loss, caries, root trunk length, and root morphology. Radiographs also provide a means to evaluate therapeutic success and longitudinal stability of the patient.

Radiographs do not, however, accurately determine the extent of osseous defects or the number of osseous walls present on the facial or palatal/lingual walls[23].

X. Technique for Osseous Resective Surgery

Instruments: combination of hand and rotary instruments can be used for osseous resective surgery. Piezoelectric surgical techniques have also been used with success for osseous surgical resective techniques[24,25].
Technique: the following steps are recommended in sequence to perform osseous resective surgery:

1. Vertical grooving
2. Radicular blending
3. Flattening interproximal bone
4. Gradualizing marginal bone

1. **Vertical grooving** – This is the first step of the resective process and is a purely osteoplastic technique. The purpose of vertical grooving is to reduce the thickness of the alveolar bone while at the same time providing relative prominence to the tooth roots (also known as "festooning"). Rotary instruments (carbide or diamond) are generally used to accomplish this critical first step. Vertical grooving is contra-indicated in areas with close root proximity or thin alveolar bone.
2. **Radicular blending** – This is the second step of the resective process and is a continuation of the vertical grooving process. Like vertical grooving, radicular blending is also a purely osteoplastic technique. The purpose of this procedure is to provide a smooth, gradualized bone contour over the entire radicular surface. Gradualize bone over the entire radicular surface.

Both vertical grooving and radicular blending comprise the bulk of the osseous resective process. These first two steps can be almost entirely used to treat shallow crater defects, thick osseous ledging on the radicular surface, incipient and early Class II furcation involvements.

3. **Flattening of the Interproximal Bone** – This step is indicated when interproximal bone levels vary horizontally and requires the removal of minimal supporting bone. This step requires some degree of ostectomy. Indications for this step include one-walled interproximal defects or hemiseptal defects. However, this step is contra-indicated for large defects whose ideal correction would require significant bone removal thereby compromising the periodontal support of the tooth; thus, compromised osseous architecture is acceptable is such situations.
4. **Gradualizing Marginal Bone** – This is the final step of the osseous resective process and is necessary for providing a well-contoured base for the gingival tissue to follow. It is a process requiring ostectomy and thus caution must be exercised in order not to remove excess bone. Consequently, various hand instruments such as bone chisels and curettes can be used in conjunction with rotary instrumentation. In certain situations, where conventional bone removal may lead to compromised support of the tooth or exposure of a furcation, "ramping" the bone to the palatal or lingual has been advocated to avoid or reduce the risk of furcation involvement[14,15].

XI. Flap Replacement, Closure & Post-operative maintenance

Following osseous resective surgery, the elevated mucoperiosteal flaps may be replaced to their initial positions, to cover the bone at its new level, or they may be apically repositioned to expose marginal bone.Closure of flaps can be attained with either resorbable or non-resorbable sutures. The recommended suturing technique involves a continuous vertical mattress sling pattern as this allows the operator to achieve close approximation between the flaps and the underlying bone.

Patient should be seen no more than 2 weeks following surgery for a post-operative visit and suture removal (if necessary). Optimal plaque control is critical for long-term stability of the surgical result.

XII. Long Term Healing Following Osseous Resective Surgery

Osteoblastic activity was still present at 1year post-operatively[26]. Bone remodeling following osseous surgery was characterized by an initial crestal bone loss of 1.2 mm followed by 0.4 mm of new bone apposition – resulting in an average crestal height reduction of 0.8 mm. A key determinant of the amount of post-operative bone loss was bone thickness; thicker bone exhibited less resorption than thin bone.A 5-year study demonstrated that osseous surgery for 75 patients with advanced periodontal disease is highly effective and that maintenance of optimal oral hygiene and frequent recalls are particularly important for long-term stability. Sixty-one of 75 patients were examined 9 years later and found that the results obtained at 5 years post-operatively were maintained at the 14-year mark in most patients[27].

XIII. Conclusion

Using strict guidelines and protocols it demonstrated that when properly used; osseous surgery can eliminate and modify defects. Osseous resective surgery has been and remains one of the principal periodontal treatment modalities because of its proven clinical success.

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