

**Beautiful smile crafted on backdrop of healthy gingiva (periodontal considerations in restorative therapy) – A review**

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**Abstract**

The primary goal of an effective restorative therapy is to establish a physiologic periodontal environment that simplifies the maintenance of periodontal well-being. A sound periodontium provides a framework for a functional prosthesis. This involves integrating a wide-ranging treatment plan, governing both soft and hard tissues around teeth and implants before, during, and after restorative procedure. The restoration and partial denture design that have an unswerving effect on the periodontium include restoration contour, margin adaptation, margin placement, prosthetic and restorative materials, design of fixed and removable partial dentures, restorative

procedures and occlusal function. This article reports the crosstalk relationship between significance of health of periodontal tissues and restorative procedures.

**Keywords:** Restorative therapy, periodontal health, biological width, restoration margin.

**Introduction**

Periodontal disease is a chronic inflammatory disease of the tissues surrounding and supporting the teeth. If left untouched, periodontal disease can lead to tooth loss. The relationship between periodontal health and the restoration of teeth is close and devoted [1]. For the long-term endurance of prostheses, it is compulsory that periodontium should be healthy, prostheses should be in

congruence with their adjacent periodontal tissues. Often, we overhear the notion that restorative dentistry is as virtuous as its foundation, the periodontium. Bryan specified that, “We must keep constantly in mind that the dental restorations we make have a twofold purpose; the restoration of the, tooth or teeth to function and the protection of the supporting tissues from injury.” It is clear that restorative procedures must fulfill both mechanical and biological specifications [2]. The reason for periodontal disease is directly related to the inability to meet periodontal specifications. Therefore, it is essential that

1. A detailed periodontal evaluation before construction of the prosthesis.
2. Definitive periodontal therapy should be accomplished
3. Periodontal maintenance during treatment and interim periods.

The considerations for successful and harmonious periodontal-prosthetic interrelationship can be divided under the following headings:

- a. Biologic parameters.
- b. Esthetic parameters.
- c. Occlusal parameters.
- d. Others.

#### **Biologic parameters:[3]**

#### **Biologic width [4]**

Dentist must understand the role of the biologic width in preserving healthy gingival tissues and regulating the gingival form around the restorations. The dimension of dentogingival complex, called “biologic width,” is present surrounding the teeth in the form of a defensive cuff-like barrier. It has a tendency of self-restoration and adapts dynamically. This biologic width includes junctional epithelium and connective tissue apparatus. The epithelial and connective tissue components are separated by an average distance of 0.97 mm and 1.07 mm, respectively.

The preservation of periodontal health is dependent on the biologic width [5]. During the placement of the restorative margin the sulcus depth can be used as a guidance.

#### **Sulcus depth - Restorative margins**

#### **Guidelines [6]**

1. The restoration margins should be placed 0.5 mm below the gingival margin if the sulcus probing depth is 1.5 mm or less.
2. The margin should be placed half the depth of the sulcus below the margin if the sulcus probing depth is more than 1.5 mm
3. If sulcus more than 2 mm is observed, gingivectomy procedure can be performed and create sulcus of 1.5 mm.

#### **Evaluation of biologic width**

Biologic width can be evaluated by means of clinical inspection, radiographs, and probing depth. Clinically, tissue discomfort may be observed when the restoration margin levels are being assessed with a probe. Probing depth may vary at locations around the teeth. Probing under anesthesia referred as sounding to bone. Radiographs are also be used in assessing biologic width, except that only interproximal biologic width measurements can be established.

#### **Biologic width violations [7,8]**

Violation of biological width area can result in gingival inflammation, loss of periodontal tissues, and erratic bone loss. Clinically, it can be detected as gingival bleeding, pocket formation, and gingival recession.

#### **Correcting biologic width violations [9,10]**

Biologic width violation is modified either by unravelling the bone surgically away from locality to the margins of restorations or by orthodontic approach of tooth extrusion and thereby changing of the margin away from the bone. Gingival recession and black triangle formation following the bone subtraction is an inadvertent drawback.

Orthodontic extrusion of the teeth is envisioned when the biologic width violation involves interproximal side or crossways the facial surface.

#### **Surgical [11]**

#### **Crown Lengthening Surgery Using External Bevel Gingivectomy**

This technique is generally performed when there is adequate sulcular depth and keratinized tissue so that the incision does not violate the biologic width or cause exposure of the bone. It can be performed with the help of scalpel or a Kirkland knife (conventional), lasers or electrocautery.

The incisions are started apical to the point of tissue that is desired to be removed. The incisions are directed coronally. Discontinuous or continuous incisions may be used. The incision should be beveled approximately 45 degrees to the tooth surface and should recreate, as far as possible, the normal festooned pattern of the gingiva. Then the excised tissue should be removed. Carefully granulation tissue should be curetted out and any remaining calculus or necrotic cementum should be removed so as to leave a smooth clean surface. Finally, the area should be covered with a periodontal pack.

#### **Crown Lengthening Surgery Using Internal Bevel Gingivectomy with or without Ostectomy (Undisplaced Flap) [12]**

It can also be referred as flap surgery with or without osseous surgery.

#### **Flap Surgery Without Osseous Surgery:**

To perform this technique without creating a mucogingival problem, the clinician should determine that enough attached gingival will remain after the incisions are made. The initial or inverse bevel incision is made depending upon that how much crown exposure is required. Then the second or the crevicular incision is made from the bottom of the sulcus to the bone to detach

the connective tissue from the bone. The flap is then raised and third incision is given to remove the tissue tags. After complete scaling and root planning flap is then sutured back in position –

**Flap surgery with osseous surgery:** It is the most common procedure used for clinical crown lengthening. A mucoperiosteal flap is designed and raised as described above. The alveolar bone is reduced by ostectomy and osteoplasty, using a combination of rotary instruments and chisels to expose the required tooth length in a scalloped fashion to follow the desired contour of the overlying gingiva. Either a high speed or low speed handpiece with carbide or diamond burs may be used to provide the initial reduction of bone. The bone is reduced close to the tooth, leaving the final removal of bone adjacent to the tooth to hand instruments. The ochsenbein chisel is useful in removing the greatest portion of the thinned bone. The process then is completed with curettes directed against the bone. The final bone level should be measured carefully in all locations around the tooth to be certain that the minimal dimension of 3 to 5 mm of tooth height has been achieved throughout the entire circumference of the tooth. Following flap surgery, a periodontal dressing may be placed to aid in maintaining flap adaptation. Gentle brushing and flossing may begin at 4 to 7 days post-surgery or following dressing removal at 7 days post-surgery. Chlorhexidine mouth rinse should be used for 4 to 6 weeks to aid in plaque control. Restorative procedures should be delayed until 3 to 6 months post-surgery. The longer period reduces the risk for gingival margin shrinkage in areas requiring maintenance of subgingival restoration margin. Provisional restorations may be reshaped at 3 to 4 weeks post-surgery but the margins should be placed supragingivally.

### **Apically Positioned Flap with or without Osteotomy**

One of the first authors to describe a technique for the preservation of the gingiva following surgery was Nabers (1954). The surgical technique developed by Nabers was originally denoted "repositioning of attached gingiva" and was later modified by Ariaudo & Tyrrell (1957). In 1962 Friedman<sup>18</sup> proposed the term apically repositioned flap to more appropriately describe the surgical technique introduced by Nabers. The apically positioned flap technique with bone recontouring (resection) may be used to expose sound tooth structure. As a general rule, at least 4 mm of sound tooth structure must be exposed at time of surgery. During healing the supracrestal soft tissues will proliferate coronally to cover 2-3 mm of the root thereby leaving only 1-2 mm of supragingivally located sound tooth structure.

### **Indication**

- 1- In sites where there is insufficient gingiva for reduction, the initial incision is placed intrasulcularly and a mucoperiosteal flap is raised and apically positioned to gain the needed crown length.
- 2- Crown lengthening of multiple teeth in a quadrant or sextant of the dentition.

**Contraindication:** Surgical crown lengthening of single teeth in the esthetic zone.

### **Combined (Surgical and Non-Surgical Orthodontic) [13]**

In this technique, orthodontic therapy is done along with surgical technique. Increasing the clinical crown length by orthodontic extrusion is useful when the amount of surgical bone reduction around the affected tooth and adjacent teeth would be excessive. The major advantage of this procedure is the reduced hazard to the adjacent teeth with very little change in crown/root ratio occurs. Orthodontic extrusion for crown lengthening is of prime importance in esthetic zone, because it results in better

crown root ratio and improved esthetics than surgical procedure alone as shown in the picture below. The procedure may be contraindicated, however, because of short root length ratio and poor root form, which result in inadequate crown/ root ratio following extrusion.

### **Margin placement**

A clinician is presented with three choices for margin placement: Supragingival, equigingival, and subgingival.

### **Supragingival margins**

- Least impact on periodontium.
- Chosen for non-esthetic areas due to marked contrast in color and opacity traditional restorative materials against the tooth margins.

### **Equigingival margins**

- Well tolerated.
- Can be used in esthetic areas as the prosthetic margin can be merged and polished to provide smooth interface at the gingival margin.

Both supra and equigingival margins are acceptable from periodontal perspective as they are easily accessible for plaque removal.

The greatest biologic hazard occurs when placing subgingival margins. In this type of margin, there is higher risk of biologic width invasion, increasing further periodontal destruction.

### **Gingival retraction and impressions**

- a. A momentary trauma is seen in the region of junctional epithelium and connective tissue of gingival sulcus with all retraction methods. Retraction cord: It creates minimal gingival recession and also preserves the sulcular tissues while tooth preparation. If the retraction cord is used with negligence or when inadequate attached gingiva is present, gingival fiber injury takes place. This leads to the impression material infuse into the gingival connective tissue and bone generating foreign body reaction.

b. Electrosurgery: This procedure comes with a few constraints. Electrosurgery when done correctly, the cellular healing is comparable to a scalpel cut. Cutting electrode tips with controlled depth are used to prevent bone trauma, but the gingival fibers injure if the tip is not adequately angled in the sulcus. To enhance healing, Oringer's solution or surgical pack is used.

Electrosurgery is contraindicated in patients with thin covering of gingiva and alveolar bone over the root as gingival recession can occur by the loss of tissue from the internal or crevicular surface. Retraction cords are preferred in these patients to retract the gingiva. Apart from these, numerous methods of gingival displacement including mechanical and surgical, chemo mechanical, and surgical methods are available.

As a substitute to displacement cord methods, cordless techniques are introduced with the advantages of time saving, ease of use, low-pressure generation, and high patient comfort along with being less invasive.

#### **Guidelines**

1. When the sulcus depth is 1.5 mm or less, the cord is to be positioned in the sulcus at the height of final margin, i.e., 0.5 mm lower to the previously prepared margins. As the interproximal sulcus is 2.5–3 mm in depth, the cord is to be placed 1–1.5 mm below the tissue height.
2. In the case of deeper sulcus, two cords with larger diameter are used for the deflection of the tissue before the extension of the margins apically. For the identification of final margin position, the top of the second cord is positioned at the proper distance inferior to previously prepared margin that was at the gingival crest level. The margin is brought in level with the top of the second cord. During the impression making, the third cord is placed in the preparation.

Electrosurgery is indicated in the patients with a deep sulcus where margin may be 1.5–2.0 mm below the tissue crest to remove the overhanging tissue.

#### **The provisional restoration**

To maintain the health and position of the gingival tissues till the final restorations are delivered, it is necessary that the marginal fit, crown contour, and surface finish line of the interim restorations are to be appropriate. Inaccurate provisional restorations with poor adaptation at the margins being over or under contoured with rough or porous surfaces result in inflammation, overgrowth, or recession of gingival tissues.

#### **Marginal fit**

Inflammatory response in the periodontium is directly proportional to gap at the tooth-restoration interface. Ideally, there should not be any gap at the tooth restoration interface. Studies have suggested that gap of 50 µm is clinically acceptable.

#### **Crown contour [14]**

Restoration contour is extremely important to the maintenance of periodontal health. Properly designed contours provide access for hygiene, have the fullness to create the desired gingival form, and have a pleasing visual tooth contour in esthetic areas. There seems to be an association between over contouring and gingival inflammation according to evidence from human and animal studies, although no periodontal effect is noticed with under contouring. Inadequate tooth preparation by the dentist is the most common reason for the production of over contoured restorations, resulting from the fabrication of bulky restoration to provide space for the restorative material.

#### **Theory of access for oral hygiene**

According to this theory, plaque is the chief etiologic factor in caries and gingivitis. Hence, plaque removal

should not be hampered but facilitated by contouring of crown.

#### **Guidelines to contour the crowns**

1. Facial and palatal contouring - Flat not rounded. Facial and palatal surfaces are the primary plaque retentive areas, especially at the infrabulge of the tooth. Reduction in plaque retention is noticed by the reducing the infrabulge area.
2. Unobstructed embrasures - The interproximal areas should allow effortless and easy access for plaque control. Over contouring of the embrasures should be avoided as it reduces intended area for the gingival papilla.
3. Contact location - With maxillary first and second molars as exception, all the contacts are to be designed and constructed incisally or occlusally and buccally in relation to the central fossa. This measure establishes a large lingual embrasure space to maintain the optimum health of lingual papilla.
4. Furcation involvement - Based on the approach of discarding plaque traps, the furcation exposed due to loss of periodontal attachments should be fluted or barreled out.

#### **Subgingival Deposits**

Leaving the debris below the tissue during restorative procedures creates an adverse periodontal response. The cause can be retraction cord, impression material, provisional material, or either temporary or permanent luting agents. Care must be taken not to any residue by examination and gentle passage of an explorer around the restorations.

Hypersensitivity to dental materials - Inflammatory gingival responses have been reported related to the use of non-precious alloys, auto polymerizing resins along with roughness used to fabricate provisional and definitive restorations.

#### **Esthetical Parameters:**

#### **Embrasure**

##### **Interproximal**

The ideal interproximal embrasure should house the gingival papilla without impinging on it and also extend the tooth contact interproximally to the top of the papilla so that no excess space exists to trap food and appear esthetically pleasing.

##### **Gingival**

From a periodontal viewpoint, the gingival embrasure is the most significant.

Periodontal diseases cause tissue destruction, which reduces the level of alveolar bone, increases the size of the gingival embrasure, and creates an open interdental space. Restorations may be constructed to preserve the morphologic features of the crown and root and retain the enlarged embrasure space or when esthetic situations dictate, the teeth may be reshaped by the restorations so that the gingival embrasures are relocated close to the new level of the gingiva.

##### **Pontic design**

The following are the ideal characteristics of a pontic:

1. Should provide satisfactory esthetics.
2. Should help to maintain sufficient occlusal relationship with the abutment teeth.
3. Masticatory performance should be reestablished.
4. Should be designed to diminish dental plaque and food debris accumulation.
5. Should provide acceptable embrasures for easy passage of food.

The patient's oral hygiene plays a crucial role in maintaining the health of the tissues around the fixed prosthesis. Very little difference occurs with the pontic material and the pontic design. These are necessary only to enable the patients to keep the area clean.

Glazed and unglazed porcelain, polished gold, and polished acrylic resin are subjected to same degree of

plaque accumulation. Pontics follow the same principles of crown contour but with increased concern regarding the tissue contours toward the tissue.

In the mandibular posterior region, esthetics is not a major consideration, so the spheroidal pontic is the design of choice because of its contour. In the maxillary posterior area, the modified ridge lap satisfies both esthetics and hygiene.

Mandibular anterior area also requires a ridge lap design. When using a spheroidal design, the pontic contacts without pressure the tip of the ridge or the buccal surface. When there is excessive bone loss and the rigidity of the connector is suitable (non-esthetic posterior areas), the pontic is not required to touch the ridge. There should be at least 3 mm of space so that the patient can maintain hygiene.

#### **Occlusal Parameters**

The effect of occlusal forces on the periodontium is prejudiced by their severity, direction, duration, and frequency. When severity increases, the periodontal fibers condense and increase with the alveolar bone becoming denser.

Occlusal therapy should be performed as a part of periodontal treatment - whenever there is a functional indication for it.

- a. A diagnosis of trauma from occlusion fully justifies occlusal therapy.
- b. When malocclusion interferes with achievement of stable intermaxillary relationship, for example, migrating teeth, diastemas, and flaring of anterior teeth.
- c. Bruxism may require treatment since it is the basis for every type of dysfunctional manifestation and often is the first evidence of lack of adaptation to occlusion.

Occlusal therapy is also indicated when missing teeth need to be replaced or food impaction needs to be corrected. Occlusal therapy should not be initiated unless there is

evidence to indicate that the system is no longer adapting to the occlusal scheme of the individual.

#### **Occlusal Alterations**

1. Removing occlusal pre-maturities in centric relation and centric occlusion. A “long-centric” or “freedom in centric” when cusp tips contact horizontal stops in the fossae.
2. Eliminating balancing interferences which will allow the mandible to move freely laterally and protrusively.
3. Adjusting working contacts in lateral movements and anterior contacts in protrusion. Depending on the occlusal pattern of the individual, no single tooth should be overloaded during excursions with either group function or a cuspid protected occlusion.

#### **Others**

Root resection is generally done in cases of furcation involvements. Restorations must be provided with suitable contours for maintenance of oral hygiene. Gingival areas may be fluted into the resected tooth. Complete coverage of root resected teeth is optional, specifically over resection site.

#### **Discussion**

Alterations in biological width, the finish lines, especially subgingival preparation, marginal seal, crown contour, embrasures, residual cement, host factors as well as easy oral hygienic maintenance are all determining factors conducive to the health or disease of the gingiva and the periodontal supporting tissue.

The most common impediment to periodontitis and periodontal therapy is root dentin hypersensitivity [15]. Bender, I.B. & Seltzer detected during endodontic treatment that teeth with chronic inflammation in the root canal space also shows areas of chronic inflammation in the periodontal space adjacent to lateral canals [16].

New Comb 1974, Tal et al 1985 detected evidence from diverse studies and a current review also suggested that a

break of biologic width has an influence on periodontal health and restorative endurance [17,18].

Kipiotti A, Nakou M, Legakis N, Mitsis F (1984) scrutinized in a study that the micro-organisms present in the root canals of caries-free teeth with advanced periodontitis generally resembled those found in the adjacent periodontal pocket and the pocket could be the source of the root canal infections [19].

D. A. felton et al (1991) studied the consequence of crown margin inconsistencies on periodontal health. A significant quantitative relationship has been well established between the marginal discrepancy and periodontal tissue inflammation for sub gingivally located crown margins [20].

Kosyfaki et al (2010) analyzed in a systemic review, the interactions between dental crowns and the marginal periodontal tissues and clinched that the recognition of the biologic width, in terms of crown margin placement, is imperative for periodontal health [21].

### Conclusion

An interdisciplinary approach requiring synchronized efforts by the restorative dentist and periodontist is an essential factor. Governing both soft and hard tissues around teeth and implants before, during, and after restorative trials harvests a successful outcome. It also gives the patient the profit of comprehensive treatment with accurate and long-lasting restorations.

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