

Iatrogenic dentistry and the periodontium

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The health of the surrounding hard and soft tissues is important for the optimal functioning of the natural dentition. The dentist plays a positive role in maintaining the health of the diseased oral tissues if a careful and meticulous diagnosis, treatment planning and treatment procedures are carried out. On the other hand, the dentist may be incriminated in perpetuating damage to the tissues as a result of injudicious / careless dental therapy. This article is a review on the implications of common dental procedures for the periodontium.

Key words: Biologic width, iatrogenic dentistry, periodontium

Natural dentition can function optimally when the surrounding hard and soft tissues are in a state of good health. An existing oral disease may be aggravated by therapeutic dental procedures. The dentist may be incriminated in perpetuating periodontal disease as a result of injudicious / careless dental therapy, which further aggravates the periodontal disease. Such damage caused by the dentist is called iatrogenic damage^[1] and the factors responsible for such aggravation are termed as iatrogenic factors. This article is a review on the implications of common prosthodontic procedures for the periodontium.

PHYSIOLOGIC DIMENSIONS OF THE PERIODONTIUM

To comprehend restorative procedures and their impact on the periodontium, clinicians must understand the role of the biologic width in preserving healthy gingival tissues and controlling the gingival form around the restorations.

BIOLOGIC WIDTH

The dimension of the space that the healthy gingival tissue occupies above the alveolar bone is called the "Biologic width".^[2] This comprises of 1.07 mm of connective tissue attachment and 0.97 mm of junctional epithelium. The biologic width should not be violated in any restorative procedure [Figure 1].

RESTORATIVE DENTAL PROCEDURES AND PERIODONTAL HEALTH

It has been shown clinically and experimentally that

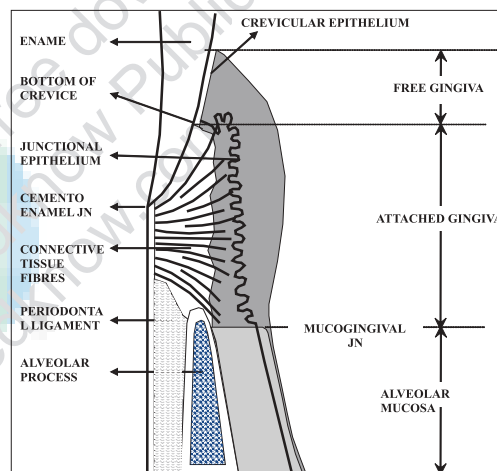


Figure 1: Schematic diagram illustrating 3 zones of Dento-gingival junction that are significant to the restorative dentist

dental restorations induce periodontal changes ranging from minor gingival alterations to pocket formation with bone loss and increased tooth mobility.

Application of rubber dam

A rubber dam is extremely useful in protecting surrounding gingival tissues. While placing the rubber dam clamp, ensure that it is firmly seated on the hard tissues of the tooth. The clamp should not be forced subgingivally so as to violate the biologic width. It should not be kept for long time as ischemia will cause tissue sloughing and subsequent recession. A mobile clamp must be stabilized with compound to prevent apical migration. Forceful packing of the gingival cord into the sulcus to prepare subgingival margins on a tooth or for the purpose of obtaining an impression may mechanically injure the periodontium and leave

behind impacted debris capable of causing a foreign body reaction.^[1]

CROWN PREPARATION

Periodontal tissues should be in a state of health of state prior to preparation of a tooth. It is impossible to prepare the tooth accurately when inflammation is present. During the preparation, great care should be exercised to prevent laceration of soft tissues to reduce risk of postoperative iatrogenic recession.

The location of margins is a matter of controversy.^[3] Some studies indicate that a restoration should end above the gingival margin or in level with the gingiva. More important are factors such as accuracy of fit, the surface finish, type of material used and gingival contour of the restoration. Subgingival extension of restoration creates an unfavorable environment for the gingival tissues even if it is adequately performed. Furthermore; it is impossible to place the cervical margin of a restoration two to three mm deep without irritating gingiva due to the manipulative procedures associated with tooth preparation. This may lead to violation of the biologic width. With subgingival margins, the impression, carving, verification of adaptation and sealing after cementation are difficult. A subgingival finish line may be required to create adequate retention and resistance form in cervical caries and in subgingival restoration. The alleged increased retention will not justify the risk of periodontal problems; instead pins and grooves can increase retention.

The following three rules can be used to place intracrevicular margins:^[1]

1. If sulcus depth is ≤ 1.5 mm, place margin 0.5 mm below crest of gingiva.
2. If the sulcus depth is >1.5 mm, place margin one half the depth of the sulcus below the crest of gingiva.
3. If a sulcus >2 mm especially on the facial aspect, then evaluate to see whether a gingivectomy could be performed to lengthen the teeth and create a 1.5 mm sulcus. Then use the same rule as 1.

IMPRESSIONS, RETRACTION AND ELECTROSURGERY

When making impressions, injudicious use of gingival retraction techniques can injure the biologic width and cause recession. Excessive digital force should not be used during impression-making so that the biologic width of the attachment is not stripped. Precautions must be taken to avoid using too much cord or using a cord of excessive diameter for prolonged periods of time in the crevicular space. Care must be exercised in retracting thin and delicate, free gingival tissue especially when

the attached gingiva is inadequate. Studies have shown that even with careful use, there is a risk of attachment loss especially in the anterior region if the end point of the electrosurgical loop accidentally contacts the tooth apical to the epithelial attachment.^[4]

Temporary Restorations

Temporary restorations will aid in healing after tooth preparation. Careless use of disks, burs and stones may destroy connective tissue fibres. If this is followed by inadequate temporary coverage with unadapted, unpolished and imperfect margins, marginal inflammation and apical migration of the junctional epithelium ensues. Thus, marginal fit, contour and surface finish of the temporary restoration are critical in maintaining health and position of gingiva during placement of the temporary restoration.^[5]

Cavity preparation and placing the matrix

Care must be exercised not to injure gingival tissues during cavity preparation, especially in those areas where attached gingiva is minimum.

Class II restorations necessitate the placement of a properly designed, well-contoured rigid matrix along with interdental wedges. Improperly contoured interdental contacts and gingival overhangs account for food impaction and retention of plaque, causing recurrent caries or periodontal breakdown. Injudicious separation can cause similar injury and should be kept minimal, without exceeding the width of the periodontal ligament.

If the margins of the prepared cavity must be placed within the crevice, this procedure must be executed cautiously to avoid disturbing the biologic width. This structure is the most vulnerable of all the supporting structures to periodontal disease and procedural trauma can initiate its apical migration and result in periodontitis or recession.^[6]

Placement, finishing and cementation

Restoration should be sealed close to the tooth preparation as it minimizes the cement line, which enhances plaque accumulation. The subgingival junctional zone comprising of the crown and the restoration margin, the luting material and the prepared tooth, has been considered responsible for the tissue changes adjacent to the restoration. Subgingival roughness is favorable to subgingival plaque formation and retention. Several sources of roughness include stripes and scratches seen on carefully polished acrylic resin, porcelain and exposed surface of the luting material. To reduce the possible effects of subgingival roughness, the cervical part of the preparation should be smoothed by curettage. When the luting material has set, excess material should be removed with dental floss and wood points avoiding the use of steel probes,

since metals can scratch the surface further.

OVERHANGS AND SUBGINGIVAL DEBRIS

Overhanging margins contribute to the development of periodontal disease by:^[6]

1. Changing the ecological balance of the gingival sulcus to an area that favors the growth of disease-associated organisms (predominantly gram-negative anaerobic species) at the expense of health-associated organisms predominantly gram-positive facultative species.!
2. Inhibiting access to remove accumulated plaque. Leaving debris below the tissue during restorative procedures can create an adverse periodontal response. The cause can be the retraction cord, impression material, provisional material or permanent material.^[7]

Morphologic Characteristics Of Restoration And Periodontal Health

Overcontoured restorations tend to accumulate plaque and possibly prevent the self-cleaning mechanisms of the adjacent cheeks, lips and tongue.^[5,8,9] Failure to establish adequate interproximal embrasures lead to papillary inflammation. The contours of the occlusal surfaces as established by the marginal ridges and the related developmental grooves, normally serve to deflect food away from the interproximal spaces. The integrity and location of the proximal contacts along with occlusal morphology typically prevent food impaction. The interproximal plunger cusp effect may be observed when the missing teeth are not replaced and the contact relationships between adjacent teeth are altered.

Relationship of pontic adaptation to the periodontal health

Regardless of the design, the pontic should provide occlusal surfaces that stabilize the opposing teeth, allow for normal mastication and do not overload the abutment teeth.^[1] Of prime concern are the degree of pressure, area of ridge contact and the embrasure space.

The ovate and sanitary pontics have convex undersurfaces that facilitate cleaning. The ridge lap and modified ridge lap designs have concave surfaces that are difficult to clean.

DESIGN OF THE REMOVABLE PARTIAL DENTURE

Partial dentures favor the accumulation of plaque particularly if they cover the gingival areas.^[10,11] Improperly designed clasps also cause damage to the abutment tooth by continuously causing excessive stresses with resulting occlusal trauma. During the

settling of a posterior partial denture, the arms of the clasp may impinge upon the marginal tissue of the abutment tooth, unless the denture is supported adequately on occlusal rests. Whenever possible, teeth rather than soft tissue should support the removable partial denture. Teeth that lack sufficient support must be splinted to the other teeth by means of soldered crowns. When strategic abutment teeth are missing or are in a weakened condition, one often must rely on tissue support as well as tooth support. In such cases, unless constructed carefully, the partial denture may exert a cantilevering effect on the abutment teeth thus resulting in occlusal trauma.!

Exodontic procedures that affect the periodontium

Numerous clinical studies have reported that extraction of third molars often results in the creation of vertical defects distal to second molars.^[12] This iatrogenic effect is unrelated to the flap design and appears to occur more often when third molars are extracted in individuals older than 25 years.^[13]

PERIODONTAL COMPLICATIONS ASSOCIATED WITH ORTHODONTIC THERAPY

Orthodontic therapy may affect the periodontium by favoring plaque retention, by directly injuring the gingiva as a result of overextended band and creating excessive unfavorable forces both on the tooth and supporting structures.

More recently, *Actinobacillus actinomycetemcomitans* was found in at least one site for 85% of children wearing orthodontic appliances compared with only 15% of the control subjects.^[14]

The uprighting of molars, extrusions and buccolingual movement place teeth into traumatic occlusion which must be controlled by selective grinding as the tooth movement progresses. Root resorption is seen in many patients, caused by excessive forces from the application of^[15,16] jiggling forces exerted during the tooth movement.

IMPLANTS

Ossointegration has had a dramatic influence on prosthodontic practice. Implants now serve as substitutes for tooth roots and help provide support and retention for overlying prostheses.^[17] Gingival tissues form a tightly adherent band around implants. The response of the peri implant tissues can lead to a hyperplasia of the soft tissues. It is important to check that no soft tissue is entrapped between the crown and the implant during the tightening of the attachment screw.!

OCCLUSAL TRAUMA AND THE PERIODONTIUM

The importance of occlusion and its role in dentistry is significant. Understanding occlusion is critical for restorative dentists wanting a high degree of predictability in their final result. The increase in the utilization of dental implants and nonmetallic cosmetic restorations has resulted in increased concern with force management.^[1] When restorations are fabricated, there should be simultaneous contact on all teeth during centric closure. Occlusion should be created at a stable vertical dimension.

Restorations that interfere with or alter the direction of occlusal forces on the teeth may produce acute trauma, pain, sensitivity and tooth mobility. Fillings that are high, prosthesis that create excessive forces on abutment teeth, disturbed proximal contact relationships and orthodontic movement of teeth to functionally unacceptable positions will cause or aggravate periodontal destruction. Reduction of periodontal support further leads to migration and mutilation of occlusion. The amount of mutilation is influenced by severity, direction, duration and frequency of occlusal forces.

CONCLUSION

Diseased pulp and missing tooth structures are replaced with inert materials, but at present, no material can substitute for a lost periodontium. As Muller de van, a prosthodontist, stated, "Our objective should be perpetual preservation of what remains, rather than meticulous reconstruction of what is lost."

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