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Review Article

Periodontal Restorative Inter-Relationship: A Review

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ABSTRACT

The interrelationship between dental restoration and periodontal health is a dynamic and hence should always be considered. Various guidelines have been given and reviewed here to evaluate compatibility of periodontium while performing dental restoration. Using these basic clinical parameters and guidelines, careful and successful restorative procedure can be performed for longer stability. Judiciously performed periodontal treatment before oral restoration and /or prosthesis provides an aesthetically acceptable, functionally comfortable and stable dentition. This review article addresses the inter-relationship between significance of health of periodontal tissues and dental restorative procedures.

Introduction

Periodontal disease is a chronic inflammatory disease of the tissues that surround and support the teeth. If left untreated, periodontal disease can lead to tooth loss. Periodontal diseases are generally divided into two groups; Gingivitis, which causes inflammation that affect the gingival and Periodontitis, which damages the bone and connective tissue that support the teeth. Periodontal disease is caused by bacteria. Periodontal health is the pre-requisite of successful comprehensive Dentistry[1]. To achieve the long term therapeutic targets of, optimum function, treatment predictability, longevity and maintenance; acute periodontal infection must be treated and controlled. This has to be done before the initiation of restorative or aesthetic dentistry. More recently, this phase of treatment includes Crown lengthening, Covering denuded roots, Alveolar ridge augmentation, Implant site development and Endodontic treatment. An adequate understanding of the relationship between periodontal tissues form and function with restorative dentistry is paramount to ensure adequate rehabilitation of the dentition. Even though most clinicians are aware of this important relationship uncertainty remains regarding specific concepts such as biologic width, its maintenance and applications of crown lengthening in cases of Biologic width violation.[2] In fact, a most common complication to periodontitis and periodontal therapy is root dentin hypersensitivity, a condition associated with the direct exposure of root dentin to the oral environment (Gillam&Orchardson 2006)[3]**.** Hence, Maintenance of gingival health constitutes one of the keys for oral health. Bender, I.B. & Seltzer, S. (1972) [4] observed 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. Caries and/or restorative procedures can affect the pulps of periodontally involved teeth, and, vice-versa periodontal disease can affect pulps of teeth with caries or restorations. New Comb 1974, Tal et al 1989[5] detected evidence from different studies and a recent review also suggested that a breach of biologic width have an impact on Periodontal health and restoration longevity.[6] Kipioti A, Nakou M, Legakis N, Mitsis F. (1984) [7] examined the flora from the root canals and periodontal pockets of teeth with advanced periodontal disease in order to compare the predominant

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cultivable microflora from the canals with those found in the adjacent periodontal pockets. The study demonstrated 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. Torabinejad M, Kiger RD. (1985)[8] performed clinical and histological examination of twenty-five teeth of a patient with varying degrees of attachment loss resulting from periodontal disease and showed no correlation between the severity of periodontal disease and morphologic changes of the pulp tissue.

D. A. felton et al (1991) studied Effect of crown margin discrepancies on periodontal health and observed that a strong correlation exists between marginal discrepancies and gingival index and gingival crevicular fluid volume. So a significant quantitative relationships has been well established between the marginal discrepancy and periodontal tissue inflammation for subgingivally located crown margins.[9]

Kosyfaki et al (2010) analysed in a systemic review, the interactions between dental crowns and the marginal periodontal tissues and concluded that the recognition of the biologic width, in terms of crown margin placement, is utmost important for periodontal health. Therefore, knowledge of dimensions of Junctional epithelium and connective tissue attachment is of high clinical relevance.[10]

Rationale for therapy

The relationship between periodontal health and the restoration of teeth is inseparable. For the periodontium to remain healthy, restoration must be critically managed in several areas so that they are in harmony with their surrounding periodontal tissues. Reasons for establishing periodontal health before performing restoration are:

1) Periodontal treatment should be undertaken to ensure the establishment of stable gingival margins before tooth preparation for restoration.[11,12] In addition, tissues that do not bleed during restorative manipulation allow for a more accessibility and aesthetic result.[13,14]
2) Certain periodontal procedure are designed to enhance adequate tooth length for retention, impression making, tooth preparation and finishing of restorative margin.[13,15] Failure to complete these procedure before restoration can add to the complexity of treatment along with unnecessary risk of failure.[13]
3) Periodontal therapy should follow restorative procedure because the resolution of inflammation may result in the repositioning of teeth or in soft tissue and mucosal changes.[16]
4) Orthodontic tooth movement and restorations completed without considering the importance of periodontal treatment designed for this purpose may be subject to complicate construction and future maintenance .[17]

Biologic considerations

The importance of the periodontal tissue is often underestimated. In order to avoid pathological changes, to predict treatment results more precisely, it is necessary to keep gingival biological width unaltered during restorative procedures. If there are less than 2 mm from restoration's margin to marginal bone clinical crown lengthening should be considered in treatment plan. The line of treatment depends on relationship of crown-root-alveolar bone and patient's esthetical expectations. In order to keep margins of restoration supra-gingivally the

distance from marginal bone to margins of restoration should not be less than atleast 3 mm. The margins of restoration ideally considered either supra or equi-gingival. When the margins of restoration are prepared sub-gingivally, the distance from marginal gingiva to margins of restoration should not be more than 0.7 mm. To continue treatment in operated area is recommended not before 4 weeks, and making restorations not before 6 weeks.[18]

Biological width

The dimension of space that the healthy gingival tissue occupies coronal to the alveolar bone is defined as the biologic width.[19] This term was based on the work of Gargiulo et al; who described the dimensions and relationship of the dento-gingival junctions in humans. The biologic width (Figure 1) is essential for preservation of periodontal health. Gargiulo et al (1961), reported the following mean dimensions: a sulcus depth of 0.69mm, an epithelial attachment of 0.97mm, and a connective tissue attachment of 1.07mm. Based on this work, the biologic width is commonly stated to be 2.04mm, which represents the sum of the epithelial and connective tissue measurements. Radiographic interpretations can identify interproximal violations of biologic width. However, with the more common locations on the mesio-facial and disto-facial line angle of teeth, radiographs are not diagnostic because of tooth superimposition.

Biologic Width Violations

Direct or indirect restorations of tooth crown defects with margins located in the gingival biological width area can potentially induce gingival inflammation, loss of periodontal tissue attachment and unpredictable bone loss. Clinically it could be manifested as:

– Gingival bleeding,

– Periodontal pocket formation,

– Gingival recession.

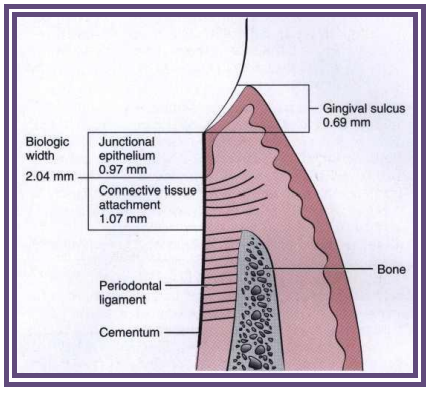

Figure 1: Biological width

Correcting Biologic Width Violations

Surgical removal of bone

To remove alveolar bone the modified widman technique is applied. The bone should be moved away from the margin by the measured distance of the ideal biologic width for that particular individual with an additional 0.5 mm of bone removed for a safety zone. **Orthodontic Extrusion**

If the biologic width violation has occurred across the facial surface and the gingival tissue level is correct. By applying low orthodontic extrusion force, the tooth will erupt slowly, bringing the alveolar bone and gingival tissue along with it. [20] The tooth is extruded until the bone level has been carried coronal to the ideal level as recommended in that individual. Another option is to perform rapid orthodontic extrusion where the tooth is erupted to the desired amount within several weeks. During this period, a super-crestal fibrotomy is performed weekly in an effort to prevent the tissue and bone from following the tooth during its orthodontic eruption. The tooth is then stabilised for at least 12 week to confirm the position of the tissue and bone so that it does not return to previous undesired position.[21]

Margin Placement and Biologic Width

Role of biologic width in preserving healthy gingival tissues and controlling the gingival form around restorations is very important. Practitioner must also apply this information in the positioning of restoration margins, especially in the anterior esthetic zone, where a primary treatment is to mask the junction of the margin with the tooth.[19]

Margin placement guidelines

When determining regarding the placement of restorative margins relative to the periodontal tissue attachment, it is recommended that the patient's existing sulcus depth can be used as a guideline in assessing the biologic width requirement for that patient. The base of the sulcus can be considered as the top of the attachment, and therefore variations in attachment height are accounted for by assuring that the margin should be placed in the sulcus and not in the attachment.[22,23,24,25] The extension of any restorative margin into the gingival sulcus should be considered a compromise,[26,27,28,29] but esthetic or retentive condition and so often make it necessary. Hence, sub-gingival margins can lead to a compromised periodontal status[30,31,32,33,34,35,36], so supra-gingival margins are preferred.[37,38]. The marginal fit should be optimal because rough restorations or open margins lead to an accumulation of periodontal pathogens that are associated with inflammatory periodontal conditions and can compromise function and form.[39] Intra-crevicular margins are defined as those confined within the gingival crevice and plays a very significant role as periodontal health indicator.[40,41] Different studies have demonstrated conclusively that periodontal tissues show more signs of inflammation around crown margin with intra-crevicular or sub-gingival margins than those with supra-gingival margins.[42].Orkin et al [43] demonstrated that sub-gingival restorations had a greater chance of bleeding and exhibiting gingival recession in comparison to supra-gingivally placed restoration margin.

Renggli et al[44] showed that gingivitis and plaque accumulation were more pronounced in interdental areas even with well-adapted sub-gingival amalgam restorations compared to a sound tooth structure.

Flores-de-Jacoby et al[45] studied the effects of crown margin location on periodontal health and bacterial morphotypes in human 6-8 weeks and 1 year post insertion. Subgingival margins demonstrated increased in various clinical parameter such as plaque, gingival index score and probing depths. Furthermore, more spirochetes, fusiforms, rods and filamentous bacteria were found to be associated with subgingival margins.

Silness[46] evaluated the periodontal condition of the lingual surfaces of 385 fixed partial denture abutment teeth. He found that a supra-gingival position of the crown margin was the most favorable, whereas margins below the gingival margin significantly compromised gingival health.

Using sulcus depth as a guide in margin placement is necessary to manage gingival health. Once the tissue is healthy, the following three rules can be used to place intra-crevicular margins:-

1) If the sulcus probes 1.5 mm or less, place the restoration margin 0.5mm below the gingival tissue crest.
2) If the sulcus probes more than 1.5 mm, place the margin half the depth of the sulcus below the tissue crest.
3) If a sulcus greater than 2 mm is found, especially on the facial aspect of the tooth, evaluate to see if gingivectomy could be performed to lengthen the teeth and create a sulcus of 1.5mm.

Pontic design

Pontics should both esthetically and functionally replace lost teeth, and at the same time be non-irritating to the underlying mucosa and allow effective plaque control and periodontal health mantenance.[47,48,49,50,51].

Classically, four options should be considered in evaluating pontic design: Sanitary, ridge lap, modified ridge lap and ovate designs. The restorative material used for all four designs can be either glazed porcelain, polished gold or polished resin. There is no difference in biologic response of the tissue on contact with the restoration, regardless of the material chosen, as long as it has a smooth surface finish[52]**.** The sanitary and ovate pontics have convex under surfaces and considered better design because it facilitate cleaning of area beneath it. The ridge lap and modified ridge lap designs have concave surfaces that are more difficult to access for maintenance of periodontal tissue beneath it even with dental floss. A modified ridge lap design can be given where there is an inadequate ridge to place an ovate pontic design. Whereas the facial aspect of the undersurface has a concave shape, which facilitates an adequate access for oral hygiene by the more open lingual form.[53]

Crown Contour

When the gingiva contacts a non-contoured flat tooth surface, there is a tendency to develop a thick free gingival margin around the tooth. Over-contouring of restorations or faulty placement of contour is a much greater hazard to periodontal health than is lack of contour, since both supra- and sub-gingival plaque accumulation will be enhanced and retained by over-contoured margins. The greater the convexity, the more difficult it is to remove the plaque.[54]The facial or lingual surface of a restoration should not have more than 0.5 mm bulge adjacent to the gingival margin because this may interfere with adequate plaque removal.[55]It has been hence opinioned that buccal and lingual crown contours should be 'flat', not 'fat' usually less than 0.5 mm wider than the cement-enamel junction, and those furcation areas should be 'fluted' or 'barreled out' to accommodate oral hygiene aids in these areas.

Overhanging dental restoration and periodontal disease

An overhanging dental restoration is defined as an extension of restoration margin or restorative material beyond the confines of a cavity preparation. They have been strongly implicated as an aetiology factors in initiation and progression of periodontal diseases and are alarmingly prevalent. In addition to promoting plaque accumulation and provide retention for it. There is good documentation that bleeding on probing, gingivitis and alveolar bone loss has been found to be increased in tissues adjacent to overhanging dental restoration as compared to homologous teeth. Removal of overhanging dental restoration enhances the effectiveness of hygiene phase after periodontal therapy. Many overhanging dental restoration, however are not detected on radiographs and are evident only clinically by use of an explorer directed sub-gingivally. In the study of pathogenesis and causality of periodontal disease processes, lesions of endodontic origin are significant as they frequently extend and manifest themselves in the attachment apparatus. These lesions do not only produce signs and symptoms of inflammation in apical areas of teeth, but they may also induce periodontal tissue destruction along the lateral aspects of roots and in furcations of two- and multi-rooted teeth.

A highly significant reduction in alveolar bone height was reported relative to metal restoration with marginal excess equal to or greater than 0.2 mm .posterior teeth were associated with more sever periodontal disease than similar teeth without overhanging restoration. Michael A. Brunsvold, James J. Lane revealed that overhanging dental restoration is major dental health problem.

Conclusion

All phases of clinical dentistry are intimately related to a common objective: The preservation and maintenance of the natural dentition in health. In an integrated multidisciplinary approach to dental care, it is logical that periodontal treatment precede final restorative procedures.

Hence for successful oral rehabilitation of the patient the MULTIDISIPLINARY APPROACH is required where ideas can be exchanged for sake of sound oral health.

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