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Assessment and correction of gingival dimensions-Highlighting the role of a Periodontist in interdisciplinary treatment approach

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ABSTRACT

There are several factors which play an important role in the occurrence of a disease in an individual as well as in determining the result of a treatment procedure. Variable gingival dimensions is one such factor which has been highlighted in the recent ongoing researches. It is now believed that the assessment of gingival parameters; width, thickness, papilla height, must be done on a routine basis as determining these various components play an important role in the treatment planning for orthodontics, root coverage, extractions, implant placement and other restorative and periodontal procedures. Therefore, it is important to take into consideration the differences in dimensions and forms of gingival tissues during treatment planning.

Introduction

The dental profession is on a continuous quest to replicate the ideal natural dentition.[1] In order to obtain the best treatment outcome, the clinician must consider not just the individual features of each tooth but also the effect that different tooth forms generate when arranged next to each other. In addition, the relationship between teeth, soft tissue, and the patient's facial characteristics must be in harmony with each other. Tooth size, tooth shape, tooth-to-tooth relation/alignment, and symmetry influence the gingival architecture.[2]

Gingival dimensions, like width and thickness show great intra- and inter-individual variation, which are associated with tooth type and shape, and are certainly also genetically determined.[3] Recently, distinct gingival phenotypes have been identified on a subject level, and their existence later confirmed in an independent, periodontally healthy population of young adults by using cluster analysis.[4]

Tissue biotypes are associated with the host response against periodontal diseases, the outcomes of periodontal therapy, root coverage procedures, and the remodeling process after tooth extraction.[5] Gingival thickness affects the treatment outcome possibly because of a difference in the amount of blood supply to the underlying bone and susceptibility to resorption.[5, 6] Gingival or periodontal diseases are more likely to occur in patients with a thin gingival phenotype, and the remodeling process after tooth extraction reportedly results in more dramatic alveolar bone resorption in the apical and lingual directions for ridges associated with thin biotypes.[5] Fu et al.[6] also showed a positive correlation between thickness of the gingival phenotype and its underlying bone.

The presence or absence of the interproximal papilla is again of great concern to periodontists, restorative dentists, and to patients. Preserving papilla in the gingival embrasure of the esthetic zone is a key consideration in restorative and orthodontic treatment. Today, with an increase in aging adult population with a history of periodontal disease, open gingival embrasures are a common occurrence. Black triangles occur in more than one-third of adults and therefore, should be discussed with the patient prior to initiating dental treatment.[7] Not only are black triangles unesthetic, but they also contribute to retention of food debris; and plaque formation and can adversely affect the health of the periodontium.

Periodontal bestowal in orthodontic treatment is now widely acceptable and popular because of which, today, orthodontic treatment is applied even on adult population. A healthy periodontal tissue is an essential factor to be considered prior to any orthodontic treatment. The application of orthodontic forces without careful planning may lead to significant damage to periodontium. The results of a study concerning the width of the attached gingiva on facially positioned teeth support Ochsenbein's[8] contention that during orthodontic movement, teeth are displaced in the bone and their soft tissue attachments move with them during therapy. This is the basis for his contention that areas of actual or potential mucogingival stress should be corrected prior to orthodontic treatment.[9]

Several factors may play a critical role in the incidence of dehiscence and fenestration during orthodontic treatment, such as the direction of movement, frequency, magnitude of orthodontic forces and the volume and anatomic integrity of the periodontal supporting tissues.[10] During orthodontic tooth movement, there are changes in the mucogingival complex with respect to the position of the gingival margin which might result change in gingival dimensions. Therefore, it is imperative to carefully estimate the direction of tooth movement. Moreover, determining the thickness of the gingival tissue plays an important role in treatment planning process for orthodontic therapy.[11] Gingival recession associated with orthodontic treatment is a controversial issue. It was shown that when thickness of the attached gingivae was more than 0.5mm, the risk of gingival recession is reduced.[12] Accordingly, for patients with a thin attached gingiva, a correct estimation of bone support in the periodontal evaluation deemed necessary.

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Thin periodontium is frequently characterized by osseous defects and dehiscence; moreover, it exhibits pathological changes like gingival recession when subjected to traumatic surgical insults or orthodontic forces more than thick periodontium. Therefore, bio-modification of thin periodontium becomes essential before an orthodontic treatment and has shown to have a positive clinical effect. Moreover, transforming the case from thin periodontium to thick periodontium also reduces the possibility of future breakdown of the periodontium during the orthodontic therapy.[13]

The orthodontists usually deal with variable cases having different periodontal situations in which the periodontal health is crucial for the orthodontic therapy. They use different appliances with variable force magnitudes in different directions.[14] Experimental studies demonstrate that when a tooth is moved bodily in a labial direction towards the cortical plate of the alveolar bone, no bone formation will occur. In addition, bone thinning and dehiscence might take place. Such cortical plate perforations can occur during an orthodontic treatment in situations especially with thin periodontium which may lead to gingival recession and root exposure as documented by various scientific reports.[15, 16]

Therefore, periodontal therapy is needed to prevent periodontal tissue breakdown during an orthodontic treatment.[17] The periodontal treatment includes non-surgical periodontal therapy and/or surgical correction of any soft tissue or bone defects. Surgical corrective therapy includes different interventions like frenectomy, soft tissue augmentation and bone augmentation.[18, 19, 20] It is possible to modify the thin periodontal tissues by using these surgical techniques before or during an orthodontic therapy to avoid tissue collapse. One of the key factors for the successful treatment of patients with orthodontic problems is the interdisciplinary intervention, which involves teamwork approach to achieve an optimal result.

Kurth and Kokich[21] studied the causes of central papilla recession in adults who received orthodontic treatment on the upper central incisors and found an association with the crown form. Recession of the central papillae was more likely found in teeth with triangular-shaped crown forms.

It has also been suggested that a wide zone of keratinized and attached gingiva is more desirable than a narrow zone or a total lack of such a zone, because a wide zone as compared to narrow zone would better withstand gingival inflammation, trauma from mastication, toothbrushing and forces from muscle pull and orthodontic procedures.[22]

Anterior teeth with narrow zones of attached gingiva are frequently encountered in children.[23] Maynard and Ochsenbein[24] suggested that newly erupted permanent teeth with narrow attached gingiva have a greater risk of gingival recession. They recommended that gingival grafting procedures should be considered for such teeth, particularly where orthodontic therapy was anticipated.[24]

Width of attached gingiva also played a significant role in placement of subgingival restorations. Restorations in a subgingival position in sites with a narrow zone of or insufficient keratinized gingiva may, in the presence of subgingival plaque, favor the apical displacement of the soft tissue margin, i.e. gingival recession. It has been observed that the narrow keratinized gingiva on the lingual aspect of the mandibular anteriors may pose a problem in prosthodontic and periodontal treatment. For example, if mandibular partial removable appliances are to be equipped with a lingual bar, the lingual area should have a minimum of 4mm keratinized gingiva.[25, 26] This requirement may be difficult to be satisfied in the average patient since the mean width of the lingual gingiva adjacent to the mandibular anterior teeth is usually less than 3mm.

Kois[27] suggested a classification system related to gingival biotype involving the relationship between the CEJ and the crest of the bone. The three categories included:

1. Normal crest: alveolar crest is 3mm apical to CEJ (85% of the population),
2. High crest: alveolar crest is <3mm apical to the CEJ (2% of the population), and
3. Low crest: alveolar crest is >3mm apical to the CEJ (13% of the population).

Kois[27] described treatment outcomes in each of the three crest positions and suggested that clinical outcomes were strongly related to the gingival/alveolar crest form. He discussed the importance of alveolar crest position in tooth preparation. For example, preparing intracrevicular finish lines in a patient with a high alveolar crest position may increase the susceptibility of biologic width impingement since the bony crest is positioned close to the CEJ. In a patient with a low alveolar crest position, an increased propensity for gingival recession may result in exposure of restorative margins when finish lines are placed intracrevicularly.

Conclusion

Healthy periodontium is necessary throughout the therapy, right from planning to performing a treatment and then maintenance, in order to get the optimum desired results. To achieve this, periodontal intervention becomes necessary thereby highlighting the role of a periodontist in various interdisciplinary treatment approaches.

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