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Periodontal problems associated with orthodontic treatment

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Abstract

Many periodontal factors should be considered in the orthodontic treatment of children and adolescents. These factors include a careful assessment of the periodontal susceptibility using criteria such as bleeding, type of soft tissue, gingival, inflammation, bone loss, as well as other factors such as mucogingival deformities, frenum attachments, gingival hyperplasia, mouth breathing, etc. Other areas such as appliance trauma, ectopically positioned and impacted teeth, special patients, extraction sites, and soft tissue lesions are also important. A keener periodontal awareness should reduce or eliminate damage from orthodontic treatment and increase the longevity of the dentition.

Introduction

One of the common problems in recognizing periodontal problems in children and adolescents is that orthodontists assume that the supporting tissues have a great ability to resist stress from full-banded orthodontic treatment.[1] However, periodontists, believe, " . . . the opposite is true — that there is some penalty in longevity to be paid for orthodontic therapy."[2] They do agree that there is change following treatment. The critical aspect, then, is the determination of common factors among patients whose response is unfavorable change. It would be most advantageous for the clinician to have some basis for predicting which patients are going to have problems during orthodontic therapy before beginning treatment.

This paper will discuss some of the common problems of the periodontium associated with orthodontic treatment.

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Prevalence of Gingivitis in Children

Parfitt[3] found gingivitis in more than 5% of three-year-olds, in more than 50% of six-year-olds, and in greater than 90% of eleven-year-old British children. Several reports indicated the presence of gingivitis in 100% in several groups of Swedish school children.[4,5] In a group of 15- to 19-year-old British young adults, approximately 50% were found to exhibit bone loss.[6] Childhood gingivitis appears to reach a peak in 80% of the 11- to 13-year-old age group.[7,8,9] And it has been hypothesized that the transition from gingivitis to periodontitis occurs during the adolescent years.[10-13]

Orthodontic therapy, then, is performed in the age group experiencing the most severe gingival disease. This treatment adds further complications: appliances obstruct the ability to perform adequate oral physiotherapy and contribute to plaque accumulation. Matsumoto et al.,[14] showed that the milder the gingival inflammation before orthodontic treatment, the greater the tendency for improvement of gingival health during treatment. It is therefore important that there be a minimal amount of inflammation prior to therapy.

Determination of Periodontal Susceptibility

Bleeding Upon Probing

Gingival bleeding is possibly the best clinical index to determine gingivitis. Healthy tissue will not bleed as a thin Michigan probe is gently moved along the crevicular area. Healthy gingival tissues will appear firm, exhibit stippling and will not bleed upon careful probing; tissue damaged by gingivitis will appear erythematous, edematous, and may hemorrhage upon delicate probing. In the highly susceptible patient it is critical to perform scaling and currettage pre-orthodontically. Other local factors may also be indicative of the periodontally susceptible patient.

Type of Soft Tissue

The first simple assessment is the observation of

the periodontal tissue characteristics of the patient. The presence of thin friable tissue is definitely more prone to recession during orthodontic treatment than is normal or thick. Patients with such thin periodontal tissues must establish exemplary oral hygiene measures before appliance placement. Preferably, bonded apppliances should be placed rather than metal bands.

Gingival Response to Tooth Emergence and Local Factors

Gingivitis is seen so routinely at the time of eruption of the permanent teeth that it has been called "eruptive gingivitis" and is considered to be normal. Instead of being normal, this reaction to eruption may well be an indicator of susceptibility. No study has suggested that tooth eruption causes gingivitis. This inflammation could be the first sign that the patient may be losing the battle against the microbial plaque.

Tissue located above the cervical height of contour favors accumulation, retention, and growth of subgingival bacteria. During the eruption of the permanent teeth it is not uncommon to see depth[15] of the gingival cuff up to 6-7 mm, particularly in the incisor area. Therefore, dependent upon the patient's ability to overcome the insult, we see the periodontium's defensive reaction in the form of gingivitis. *(Early* and *Initial* lesions are not detectible clinically — only the *Established*[16] gingival lesion can be observed as clinical gingivitis.) Therefore, though most children seem affected by the disease, the degree of clinical manifestation is the variable.

Periapical and Bite Wing Radiographs

To evaluate the patient before, during, and after treatment, parallel technique periapical radiographs are imperative. In the susceptible patient, this is the area (between the second primary molar and the first permanent molar in all four quandrants) that requires flossing by the parent or patient. The angular crest areas will usually have greater pocket depth and exhibit bleeding upon careful probing.

By understanding the periodontium before treatment begins, it is possible to prevent, minimize, or at least not aggravate an existing condition. There is no substitute for critical periodontal observation, recognition of susceptibility, judicious probing, and radiographic examination to determine the periodontal status of the patient. Some areas deserve special emphasis, such as the mucogingival deformities, frenum considerations, and gingival hyperplasia.

Mucogingival Deformities

During normal dental eruption, the lower permanent central incisor is located and erupts in more labial version than the permanent lateral incisor in the average arch form. Differences in axial alignment, and labiolingual position or root prominence will exhibit a correspondingly different gingival picture on adjacent teeth. The tooth in labial version also has a much thinner and more apically positioned tissue than the tooth in more lingual version. It is difficult to identify keratinized tissue on the tooth in severe labial version. When the underlying connective tissue becomes very thin between the outer gingival epithelium and the underlying periostium, it is difficult to recognize the keratinizing potential of the overlying epithelial tissues.

In addition to local eruptive patterns of teeth, certain types of mandibular growth have been shown to demonstrate distinctly different quantities of keratinized gingiva in the lower anterior area.[17] As the lower anterior teeth erupt, substantially greater keratinized gingiva is found in the lower incisor area in the open-bite patterns than is seen in deep-bite skeletal patterns. In addition, this is readily seen in lower incisors that have supraerupted. Recognition of normal periodontal tissues with various growth patterns is quite significant to orthodontic treatment planning as well as stability of the posttreated case.

Effects of Orthodontics on the Gingiva[18]

Significant tissue changes will occur during orthodontic treatment. Parfitt and Mjor found localized gingival recession in the lower incisor area in 54 (8.1%) of 668 untreated 9- to 12-year-olds.[3]

It has been stated that orthodontic movement has not been shown to result in an increase in the amount of attached gingiva.[19] It has also been pointed out that if a tooth has alveolar mucosa as its marginal tissue, proper orthodontic alignment will not create any attached gingiva.[20] One hypothesis suggests that if a tooth erupts in facial or lingual version so that it penetrates the oral tissues at the mucogingival junction area, it may have an inadequate amount of attached gingiva. For the patient who will undergo orthodontic treatment, this hypothesis may not be valid. The orthodontist must make the decision regarding utilization of hazardous types of mechanics.

Anticipated Tooth Movement and Profile Consideration

Extrusion is generally considered to be the most hazardous type of tooth movement. Slight extrusion is necessary during retraction of the lower anterior segment to increase the amount of gingiva. Torquing the teeth to achieve proper axial position may allow the keratinized tissue present on a tooth to reveal itself, but more attached gingiva will usually not be created.

In orthodontic therapy, it is frequently necessary to advance the lower anterior teeth because of profile considerations, mechanical requirements (C-II elastics), poor patient cooperation (headgear wear), and other factors. The presence of a large chin and nose limits the retraction possibilities on the anterior teeth. A retrognathic or posterior divergent face may

necessitate a more procumbent lower incisor. In these cases, it may be necessary to augment the lower anterior area with a free gingival graft to prevent recession that can occur in the precarious lower incisor segment.

Prior to the tooth movement a repair procedure would be indicated if there were gingival recession in the lower incisor area in the following cases: 1) Class II, Division 2 with retroinclined lower incisors which will be moved labially; 2) Class II, Division I in which the teeth must be kept prominent for profile considerations; and, 3) lingually in the C-III with a defect on the lingual aspect. In the presence of the very thin and friable tissue (in the labiolingual dimension) it may be advisable to place a free graft to change this type of soft tissue before treatment as well.

Frenum Considerations

When a frenum is associated with a mucogingival problem it most frequently relates to an inadequate zone of attached gingiva. The high frenum insertion contributes to movement of the marginal gingiva where the keratinzied tissue has been lost, is detached, or mechanical trauma is present. This problem is most prevalent in the lower anterior area.

It has been recommended that a frenectomy procedure be done in the maxillary midline for young children because of the belief that the midline diastema is caused by the maxillary labial frenum. Many believe that this frenum prevents mesial migration of the maxillary central incisors, and that removal should precede orthodontic therapy.[21] Others have suggested that if the frenum is removed the space can be orthodontically closed more easily. However, it must be remembered that a physiologic space will normally be present between the maxillary central incisors until eruption of the canines in the adolescent dentition.[22] In addition, a frenectomy procedure may cause scar tissue which could prevent orthodontic space closure. With extremely large diastemas in the early transitional dentition a frenectomy is usually recommended to facilitate space closure and prevent ectopic eruption of the lateral incisors and/or canines. These interceptive early treatment problems require complete orthodontic supervision, usually additional mechanotherapy, and several stages of treatment.

Generally, removal of a maxillary labial frenum should be delayed until after orthodontic treatment, unless the tissue prevents space closure or becomes painful and traumatized. Removal may be indicated following treatment to change irreversible hyperplastic tissue to normal gingival form and to enhance post-treatment stability.

Gingival Hyperplasia

Gingival changes associated with orthodontic appliances[23] seem to be transient and there is little permanent damage to the periodontal tissues. Usually this condition will resolve itself or will respond to plaque removal, and/or curettage. Should the gingival tissue or enlargement interfere with tooth movement, however, it must be surgically removed. Otherwise, it is preferable to wait until appliances are removed to surgically correct abnormal gingival form.

Mouth Breathing

A significant problem in the orthodontic patient is the added periodontal insult of mouth breathing. The drying effect on the exposed tissue in the susceptible patient is associated with enlarged, erythematous labial gingiva particularly in the maxillary and mandibular anterior regions. With a short upper lip, a demarcation line can usually be seen where the lip contacts the labial tissue. The mouth breather will usually exhibit dry, cracked lips as well. Though orthodontic retraction of anterior segments may help to provide a better lip seal, extraoral appliances, lip bumpers, etc., will exacerbate the problem or may even cause mouth breathing in the normal patient. The patient that exhibits symptoms of inability to breathe properly (tongue posture, enlarged adenoid tissue, narrow high palatal vault, allergies) should be referred for evaluation of nasal obstruction and adenoid tissue. Although the plaque index is not significantly higher in mouth breathers it has been reported that there is an increase in the gingival index.[24] This increased inflammation should be controlled prior to appliance placement. Good oral hygiene, scaling and curettage should be used to reduce inflammation to a minimum before bonded appliances are placed.

Dilantin Hyperplasia

Patients with gingival enlargements due to dilantin should have a rigorous plaque control scaling and/or gingivectomies prior to orthodontic treatment. Surgical removal is usually necessary to expose the anatomical crowns and allow eruption of the teeth. Appliances should be placed within 10 days to begin leveling and alignment of the arches. Weekly prophylaxis appointments should be scheduled to help prevent regrowth of the tissue. Tooth movement will usually proceed quite rapidly during this early healing period. Every effort must be made to complete the treatment as rapidly as possible. If surgical removal of fibrous tissue has to be repeated several times to control the exaggerated connective tissue response, it becomes less likely that the orthodontic problem will be successfully resolved.

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