The purpose of this literature review is to improve the level of understanding, communication and vision in these important areas of restorative dentistry, orthodontics and periodontics.

For any patient with orthodontic and periodontal problems, teamwork involving the restorative dentist, the orthodontist and the periodontist is essential to determine the patient’s periodontal condition and to plan the appropriate interdisciplinary treatment before orthodontic tooth movement is initiated. It is essential to identify patients who have periodontal disease or are at risk of developing it, and to know what treatment approaches should be avoided to prevent negative sequelae. Teamwork is also important in monitoring the periodontal health of patients throughout the course of orthodontic therapy.

ABSTRACT

Background. In this article, the author reviews the evidence-based literature in the fields of periodontics and orthodontics to clarify the relationship between orthodontic tooth movement and various types of common periodontal disorders.

Types of Studies Reviewed. The first section is a review of the literature on common periodontal disorders. The second is a review of evidence-based studies in the combined fields of orthodontics and periodontics, with a focus on orthodontic treatment possibilities, limitations and risks inherent in patients with periodontal disorders, particularly active periodontal disease.

Results. The literature on orthodontic tooth movement as it relates to periodontal disease shows that proper orthodontic treatment in patients with excellent oral hygiene and the absence of significant periodontal disorders should not pose any significant periodontal risk. In the presence of poor oral hygiene, however, and under circumstances of certain types of periodontal disorders, fixed orthodontic appliances and tooth movement can contribute to significant deleterious periodontal consequences.

Clinical Implications. This review provides a clear understanding of what is known about orthodontic treatment possibilities, limitations and inherent risks in patients who may have certain types of periodontal disorders. It also underscores the importance of teamwork among the restorative dentist, periodontist and orthodontist when planning treatment for these patients. The author also offers a specific patient management protocol for this interdisciplinary dental team to follow.

PERIODONTAL DISORDERS

This review of the literature on common forms of periodontal disorders is intended to help members of the dental team identify patients who may have periodontal disorders or may be at high risk of developing these disorders, and to underscore the significance of this risk when contemplating orthodontic treatment.

Periodontal disease. Brägger and Lang defined periodontal disease as an inflammatory disease triggered by bacteria that subgingivally affect the gingiva (gingivitis) and subgingivally affect the supporting connective tissue and alveolar bone (periodontitis).

The two main characteristics of periodontitis in contrast to gingivitis are connective-tissue attachment loss and alveolar bone loss, which follows various patterns around the teeth.
Incidence. Epidemiologic studies have shown that even though the world-wide prevalence of gingival inflammation is high, advanced periodontal disease affects only a small portion of the population (2 to 8 percent of people younger than 45 years of age and about 30 percent of people aged 65 to 75 years). In addition to the age factor, there is a greater incidence of periodontal disease in patients who have a history of the disease, as well as a greater incidence in certain teeth (especially maxillary and mandibular molars in adult periodontitis).1-7

Etiology. Most researchers agree that bacterial plaque is the main etiologic factor in periodontal disease. Specific bacterial pathogens (at least 15 have been identified) are linked to the presence of adult periodontitis. Most studies of localized juvenile periodontitis have found an association between Actinobacillus actinomycetemcomitans and presence of the disease.8-22 Depending on host and environmental factors, these pathogens are believed to be responsible for the loss of periodontal attachment (possibly by triggering the production of biochemical mediators such as interleukin and prostaglandin E2). Progression of the disease leads to an imbalance in the steady state between resorption of bone and apposition of osteoid, resulting in alveolar bone loss.1

Nature of progression. Most researchers now believe that periodontitis progresses via infrequent, recurrent, acute episodes; the commonly held theory up to about 10 to 15 years ago was that it is a slow, continuous, destructive process.6,21 In fact, evidence suggests that even in areas of deep periodontal pockets, the great majority of these pockets are probably not undergoing breakdown at any given time.24

Risk factors. The microbial ecology (which varies from patient to patient and can vary from tooth to tooth in a given patient) and the patient's immune system appear to be the main elements that differentiate diseased patients from others with similar plaque levels.1,23 Risk factors affecting our microbial ecology and/or immune system have been shown to alter the chances of occurrence of periodontal disease and its rate of progression.1 These risk factors include the following:

- psychosocial stress23;
- lifestyle factors such as diet, alcohol use and especially smoking25,26;
- deficiencies in the immune system26;
- the presence of specific bacteria27,28;
- sex (disease is more common in women than in men)29;
- age30;
- diabetes mellitus31;
- osteoporosis32;
- polymorphonuclear leukocyte disorders33-36

Treatment goals for periodontal disease sites. The goals of periodontal treatment are to minimize or eliminate subgingival plaque and calculus, prevent recolonization of subgingival microorganisms and restore the tissue to a healthy state (that is, converting an active disease site to a passive state).41

Many researchers and clinicians believe that deep pockets can be successfully treated with plaque control and one or more sessions of subgingival débridement.42,43 It is important to note, however, that the full effect of subgingival débridement may not be achieved until at least two to three months after the start of therapy.42,43,47-49

Studies suggest that the critical pocket depth is 5 to 6 millimeters, beyond which surgical reduction may be necessary.41,47 An overview of current concepts of periodontal disease and treatment modalities may be found in the synopsis by Socransky and Haffajee.50

Gingival recession. Gingival recession is frequently seen in teeth that are positioned labially relative to the supporting alveolus. One of the most important etiologic factors in gingival recession is thinnness of the soft tissue and bone, especially on the labial surface of labially prominent teeth.51-55 This thin soft tissue and/or bone is a predisposing factor for gingival recession.52 In fact, vertical loss of buccal or labial bone (dehisence) is a prerequisite for recession.52

Other common factors in the development of recession are trauma (caused by improper toothbrushing or gingival lesions associated with bacterial plaque), tooth position relative to the alveolus and age.53,54 Several authors have confirmed that bacterial plaque control is an important factor in preventing gingival recession.55-58

There seems to be little importance to the “zone” or apical-coronal height of keratinized
tissue. In fact, one long-term study of a nonorthodontic population has shown that the incidence of recession in areas without keratinized tissue is no greater than that in areas with a wide expanse of keratinized tissue.59

Gingival hyperplasia. Dental professionals frequently see gingival hyperplasia in patients who chronically breathe through their mouths and in those with delayed apical migration of the gingival margins of the teeth.60-62 Gingival hyperplasia is also a common side effect of some antiseizure medications such as phenytoin and, more rarely, some calcium channel blocker medications such as nifedipine.

Although hyperplasia is frequently reversible, severe cases may lead to loss of periodontal attachment.63

INTERRELATIONSHIP OF ORTHODONTIC TOOTH MOVEMENT WITH PERIODONTAL HEALTH

The primary focus of this section is to help members of the dental team understand the special periodontal benefits and risks that are posed by orthodontic treatment, especially in adults. This literature review is also intended to dispel some widely held misconceptions about adverse periodontal effects caused by various orthodontic procedures.

Loss of periodontal attachment and bone relative to orthodontic therapy. In the absence of periodontal disease and in the presence of excellent oral hygiene (including adults with reduced, but healthy, periodontium), proper orthodontic treatment causes no significant long-term effects on periodontal attachment and bone levels.64-70 Conversely, in patients (mostly adults) with active periodontitis (that is, plaque-infected deep pockets evidenced by bleeding on probing), orthodontic tooth movement may accelerate the disease process, even when good oral hygiene is practiced.64-70,73

In this review of the literature, I also examined various types of orthodontic tooth movement as it relates to loss or gain of periodontal attachment. Orthodontic bodily tooth movement into plaque-induced infrabony defects can be successfully performed, provided that the periodontal lesion is eliminated before tooth movement is begun, and that excellent oral hygiene is maintained. Although there is no unfavorable effect on the level of connective-tissue attachment under these optimal conditions, neither does there appear to be a gain in soft-tissue attachment.65 On the other hand, if subgingival plaque and periodontal disease are not controlled before and during orthodontic treatment, an accelerated loss of attachment may result.70,74-76

Tooth movement into areas of remodeled edentulous spaces (that is, constricted bone areas) with slow, light orthodontic forces is often possible, depending on the width ratio of tooth to bone, but alveolar bone loss and posttreatment space opening can be common sequelae, even under optimal conditions.75,77-81

My review of the literature uncovered no compelling evidence that new attachment gain can be predictably achieved with intrusive tooth movement unless the intrusion is done in conjunction with a barrier/new attachment procedure.68,76,82-84

Extrusive tooth movement in areas of one- and two-wall bony pockets leads to a coronal (favorable) positioning of intact connective-tissue attachment and a shallowing of the bony defect.70,75,76 These changes in attachment and bone levels are a key factor in uprighting tipped molars.76 If there is furcation involvement in the tooth to be uprighted, however, orthodontic tooth movement may exacerbate the periodontal problem.76,85,86

Gingival recession relative to orthodontic therapy. Orthodontic tooth movement per se does not cause gingival recession.87 In areas of thin labial tissue, however, labial orthodontic tooth movement can result in bone dehiscence, creating an environment in which plaque and/or toothbrush trauma may cause sudden recession.82,87-92 If, on the other hand, thick gingival tissue is present in these areas, gingival recession is less likely to occur.82,87-92
In cases in which the labial tissue is thin, however, especially if the orthodontist plans to move the tooth labially, periodontists seem to be uniformly concerned. Many researchers and clinicians agree that this thin labial tissue should be augmented before labial orthodontic tooth movement is begun.82,87,90,92 It is interesting to note that in areas of a labially positioned tooth with dehiscence, bone may re-form and gingival thickness may increase when the tooth is moved linguually.93-95

In regard to the relationship between rapid maxillary expansion procedures and gingival recession, Graber and Vanarsdall82 stated that if the
maxillary expansion is performed after the midpalatine suture begins to fuse (after approximately 14 to 16 years of age), there is a greater risk of recession of the buccal gingival tissue of the maxillary premolars and molars later in life.

In independent investigations, Boyd and colleagues56 and Hamp and colleagues56 found no differences in the postorthodontic development of mucogingival problems between groups of patients who had undergone tooth extraction and those who had not undergone extraction.

**Gingival hyperplasia relative to orthodontic therapy.** In the presence of excellent oral hygiene (provided that the appliances are properly placed, without excessive adhesive flash), no significant hyperplasia should develop as a result of orthodontic tooth movement in adolescents64,65,96-98 or adults.66

However, fixed orthodontic appliances in the presence of consistently poor oral hygiene can lead to moderate-to-severe hyperplasia, especially in the lower incisor region. Severe cases of gingival hyperplasia may lead to attachment loss. Several authors on the topic of risk management have recommended that orthodontic treatment be terminated if patients are at great risk of developing periodontal breakdown and attachment loss.63,67,99

Depending on home care and the relationship between the gingival tissue and the crown of the tooth, gingival hyperplasia is frequently reversible, especially after the orthodontic appliances have been removed. However, Graber and Vanarsdall102 suggested that some patients may benefit from removal of excessive gingival tissue from the crowns of the teeth, which may add to the stability of the orthodontic correction.

**Risk management implications.** Evidence-based care literature (discussed above) and risk management literature advise dentists of the importance of detecting active periodontal disease before and during orthodontic treatment. Because adult patients, in particular, may be at risk of having active sites of periodontal disease, and because we know that orthodontic tooth movement in this environment can accelerate the destructive process, the interdisciplinary dental team consisting of the restorative dentist, periodontist and orthodontist must be sure that the periodontium is healthy before and during the course of orthodontic therapy. For the benefit of the patient and dental team members, dentists are advised of the importance of a well-defined protocol for careful clinical examination, internal documentation and communication among team members.63,67,99

**Clinical assessment of the periodontal condition.** Dentists and hygienists can assess a patient’s periodontal condition by evaluating the appearance of the tissue (color, texture, degree of plasticity), severity of inflammation (bleeding on probing—immediate or delayed, copious or minimal—or suppuration on probing) and changes in the level of soft-tissue attachments (that is, recession, pocket depth and attachment level).1,63,99

Radiographic evaluations can indirectly assess the severity of periodontal destruction or the progression rate, but it is important to note that significant radiographic underestimation of the severity of periodontal defects has been reported in the literature.1,100-103

**PATIENT MANAGEMENT PROTOCOL FOR DENTAL TEAM MEMBERS**

For patients being considered for orthodontic treatment (especially adults), it is important to establish a careful team protocol for periodontal examination, internal documentation and correspondence as well as for regular progress evaluations, to guard against accelerated deterioration of periodontal health during orthodontic treatment. This approach is supported by risk management experts, who stress that patients with periodontal destruction pose potential liability problems.67,99

The interdisciplinary dental team members should carefully educate patients who are not maintaining acceptable levels of oral hygiene, and inform them that orthodontic treatment might be terminated if their chronic poor hygiene poses a significant risk of periodontal breakdown.

**Suggested protocol before orthodontic therapy.** Before orthodontic treatment is begun, each member of the dental team must be sure that the patient is practicing excellent oral hygiene and is free of active periodontal disease. Ideally, the restorative dentist or periodontist should, at the time of orthodontic referral, provide the orthodontist with the following:

- a copy of the patient’s recent periodontal charting;
- recent anterior periapical radiographs and bitewing radiographs;
- a written periodontal clearance statement that the patient may safely begin orthodontic
If the patient in juvenile periodontitis is able to indicate progress in maintaining adequate oral hygiene and has no evidence of periodontal disease, it is safe to begin orthodontic treatment. If there is evidence of periodontal disease, it is safe to begin orthodontic treatment before orthodontic treatment begins, the orthodontist is obliged to either refer the patient to a periodontist to evaluate his or her periodontal condition or perform the evaluation (including pocket probing) himself or herself. Patients with excellent oral hygiene and no evidence of periodontal disease, especially those with a history of periodontal disease, for any signs of recurrence. Depending on a number of circumstances, including any of the risk factors described above, this reevaluation should be performed at six-week to six-month intervals.

Suggested protocol after orthodontic therapy. Boyd9 has observed that many patients (mostly adults) adopt a more aggressive brushing technique during orthodontic treatment. When the orthodontic appliances are removed, these patients may benefit from oral hygiene instruction to guard against possible gingival recession resulting from toothbrush trauma.

CONCLUSION

The purpose of this literature review is to clarify the relationship between various types of orthodontic tooth movement and common periodontal disorders. The evidence-based literature offers dental professionals a good understanding of the orthodontic treatment possibilities, limitations and risks inherent in patients with periodontal disorders. Using this information, along with a well-defined patient management protocol (and a home care commitment from the patient), the interdisciplinary team of restorative dentist and periodontist can manage the majority of interrelated orthodontic-periodontal problems with minimal risk and predictably successful outcomes.

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15. Dzină J, Socransky SS, Haffajee AD.


