Review Article

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Beauty of Orthodontic: Periodontic Symbiosis

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ABSTRACT

Background: The scope of orthodontics has widened with growing esthetic conscience among the society for esthetic reasons. Our objective in adult patients should be realistic and it should take consideration of all the factor before treatment. They undergo comprehensive orthodontic treatment involving major occlusal changes to get the utmost esthetically pleasing face. The older adults with poor dental conditions requiring perio-restorative treatment undergo adjunctive orthodontic treatment to attain a long-term prognosis. The orthodontist faces challenges to practice adult orthodontics due to various issues being under considerations, which are quite different than routine orthodontic treatment oriented to children and adolescents. Oral hygiene is of paramount importance during orthodontic treatment. The role of dental plaque accumulation in the development of periodontal diseases is well documented. Maintaining good oral hygiene is difficult since bands, brackets, ligature wires, and elastics encourage accumulation of microbial flora and food residues. Various toothbrush devices, chemotherapeutic rinses and other home care products are available to help the patient achieve the desired level of oral hygiene. The ultimate aim of periodontal management is to make the patient better fit for orthodontic treatment. Though not all periodontal problems can be completely eliminated, significant progress has been made towards prevention of any adverse responses. The pre requisite of effective orthodontic treatment will be orthodontists possession of periodontal knowledge base sufficient to prevent periodontal injury.This article highlights the need for symbiotic relation and periodontal aspect of orthodontic treatment.

Keywords: Orthodontics, Periodontics, Gingival Recession. Bone Resorption, Adult Orthodontics.

INTRODUCTION

The goal of orthodontic treatment is not only to improve facial esthetics and function but also to address to the health of supporting structures and how teeth are placed in them. Both the short and long term successful outcomes of orthodontic treatment are influenced by the patient's periodontal status before, during and after active orthodontic therapy, which also includes post treatment maintenance by the patient. The interrelationship between orthodontics and periodontics often resembles symbiosis. In many cases, periodontal health is improved by orthodontic tooth movement, whereas orthodontic tooth movement is often facilitated by periodontal therapy[1-3]. Inter disciplinary co-operation with clinical excellency in both disciplines may transform patients with unattractive dentitions showing spaced, extruded, or otherwise migrated teeth in inflamed and reduced periodontium in to persons with attractive, esthetic dentitions and smiles. Teamwork is also important in monitoring the periodontal health of patients throughout the course of orthodontic therapy[4-5].

A moderate increase in mobility is an expected response to orthodontic treatment. Excessive force

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during orthodontic treatment increases the risk of root resorption particularly if heavy continuous forces are used. Research has made it evident that when orthodontic forces are applied, it resorbs similar to bone. Repair becomes impossible only in cases where islands of cementum or debris have been cut totally free from the root surface. This is primarily observed at the apex. Maxillary central incisor and lateral incisors, mandibular, incisors and Ist molars are more prone for root resorption.Excessive loss of crestal bone height is also seen as a complication of orthodontic treatment. The reason is that the position of the teeth determines the position of the alveolar bone. When teeth erupt or are moved, they bring alveolar bone with them. The only exception is tooth movement in the presence of active periodontal disease and even adults who have had bone loss from periodontal disease can have orthodontic treatment with good bone responses, if the periodontal disease is well controlled[6-9].

ORTHODONTIC TOOTH MOVEMENT IN ADULTS WITH PERIODONTAL TISSUE BREAKDOWN

Orthodontic treatment may be adjunctive to periodontal therapy[9]. The loss of periodontal support or teeth may result in elongation, spacing and proclination of incisors, rotation and tipping of premolars and molars with collapse of the posterior occlusion, and decreasing vertical dimension. Poorly executed orthodontic treatment in periodontal patients can certainly contribute to further periodontal tissue breakdown. In particular, the combination of inflammation, orthodontic forces and occlusal trauma may produce a more rapid destruction than would occur with inflammation alone. With properly performed treatment, extensive orthodontic tooth movement can be made in adults with a reduced but healthy periodontium without further periodontal deterioration. More recent studies have confirmed that pre-treatment evidence of periodontal tissue destruction is no contraindication for orthodontics[1,5]. Orthodontic therapy improves the possibilities of saving and restoring a deteriorated dentition and the risk of recurrence of an active disease process is not increased during appliance therapy[10-11].

ORTHODONTIC TREATMENT CONSIDERATIONS

The key element in the orthodontic management of adult patients with periodontal disease is to eliminate or reduce plaque accumulation and gingival inflammation. This implies much emphasis on oral hygiene instruction, appliance construction, and periodical check-ups throughout treatment). The orthodontic appliance has to be properly designed To counteract the tendency of orthodontic appliances to increase the accumulation of plaque on the teeth, attempts should be made to keep the appliances and mechanics simple, avoid hooks, elastomeric rings and excess bonding resin outside the bracket bases[10,12].

The use of steel ligatures is recommended on all brackets since elastomeric rings have been shown to be significantly more plaque attractive than steel ties. Bonds are preferable to bands. Bonded molars show less plaque accumulation, gingivitis and loss of attachment interproximally than banded molars during orthodontic treatment of adults. During the treatment period professional tooth cleaning by dental hygienist or periodontist may be performed at 3 month intervals, or after regular examination up- dates at 6 and 12 month intervals, depending on the situation.The re-examinations should include recordings of probing depths, mobility, bleeding on probing, suppuration, gingival recessions, bone levels, etc[13-14].

Professional scaling may be indicated during *active intrusion* of elongated maxillary incisors, sinceorthodontic intrusion may shift supragingival plaque to a sub- gingival location. If efforts at maintaining excellent-to-good oral hygiene are unsuccessful, orthodontic treatment should be terminated. After appliance removal, reinstruction in oral hygiene measures should be given. Otherwise, subsequent labial gingival recession may be risked due to overzealous tooth-brushing, since cleaning is now easier to perform[15-17].

Adults with a reduced periodontium represent different challenges for orthodontists than adolescents. Worn or abraded teeth, missing papillae, uneven crown lengths are common problems and it is therefore more difficult to obtain an esthetically optimal appearance of the teeth and gingiva after bracket removal. Most incisor teeth in adults with malocclusions have more or less worn incisal edges, which represent an adaptation to the

functional demands. When the axial inclinations and rotations of such incisors are corrected, there is frequently need for incisal grinding towards a more normal contour. When the abrasion is more significant, however, co-operation with a restorative dentist is generally indicated.The presence of papillae between the maxillary incisors is a key esthetic factor after orthodontic treatment. Normally, when a long-standing crowding with incisor overlap is corrected orthodontically in adults, it is generally not possible to have an intact papilla.This is because the contact point becomes located too far incisally on the triangular crowns that have not had a normal interdental wear pattern. Similarly, in patients with advanced periodontal disease and destruction of the crestal bone between the incisors, the papillae may be absent. This produces unaesthetic gaps between the teeth after orthodontics. The best method of correcting this problem is to recontour the mesiodistal surfaces of the incisors during the orthodontic finishing stage [11,17,18]. When the diastema thus created is closed, the roots of the teeth can come closer together. The contact point is lengthened and moved apically, and the papilla can fill out the interdental space more easily[3,17].

In patients with high or normal smile lines, the relationship of the gingival margins of the maxillary anterior teeth may be another important factor in the esthetic appearance of the crowns. When adult patients have gingival margin discrepancies between adjacent teeth, the orthodontist must determine the proper solution for the problem: orthodontic movement to reposition the gingival margin or surgical correction (gingivectomy) to increase the crown length of single or several teeth[18-19].

RETENTION - PROBLEMS AND SOLUTIONS; LONG-TERM FOLLOW-UP

Due to the anatomic and biologic differences in tissue reaction between adults and children (Melsen), adults undergoing extensive orthodontic treatment will generally need, at least, a longer period of retention than would an adolescent patient. Also, growth and development no longer take place and cannot aid in changing occlusal levels or in space closure by the eruption of posterior teeth with mesial drift The space reopening tendency of closed extraction sites in adults can be mitigated by use of lingually bonded retainers. According to Proffit, two major primary factors are involved in the equilibrium which determines the final position of teeth. These are the resting pressures of lip or cheek and tongue, and forces produced by metabolic activity within the periodontal membrane[16-19]. The optimal long-term retainer for adults with reduced periodontium is the flexible spiral wire (FSW) retainer bonded lingually on each tooth in a segment. The bonded retainer in the anterior region is generally used together with a maxillary removable plate. At the same time as the FSW retainer works as a reliable, invisible orthodontic retainer, it concomitantly acts as a periodontal splint, which allows the individual teeth within the splint to exert physiological mobility[20-23]. Long-term follow-up of patients who have received combined periodontal and orthodontic treatment, and have used bonded retainers for several years, demonstrates excellent stability and apparently unchanged, or even improved, periodontal condition[24-27].

SPECIFIC FACTORS ASSOCIATED WITH ORTHODONTIC TOOTH MOVEMENT IN ADULTS

Tooth movement into infra-bony pockets

Orthodontic forces *per se* are unlikely to convert gingivitis into destructive periodontitis. The angular bony defect can be eliminated by the orthodontic treatment, but no coronal gain of attachment can be achieved.Since orthodontic movement of teeth into inflamed infrabony pockets may create a high risk for additional periodontal destruction, and because infrabony pockets are frequently found at teeth that have been tipped and/or elongated as a result of periodontal disease, it is clinically essential that periodontal treatment with elimination of the plaque-induced lesion is performed before orthodontic therapy is begun.It is equally important that excellent oral hygiene is maintained throughout the course of the orthodontic treatment[1-5].

Tooth movement into compromised bone areas

Orthodontic tooth movement may sometimes be performed in adults with partially edentulous dentitions (due to agenesis or previous extractions of teeth) and such patients may have a more or less

compromised alveolar process. Histologic observations in animal experiments have confirmed that when light forces were applied to move teeth bodily into an area with reduced bone height, a thin bone plate was recreated ahead of the moving tooth.. The key to moving teeth with bone is direct resorption in the direction of tooth movement, and avoiding hyalinization. Marked gingival invaginations are sometimes seen in such areas and computer tomography analysis and human histological findings indicate that buccal or lingual bone dehiscences may occur. For orthodontic tooth movement into markedly atrophied alveolar ridges, the possibility to acquire new bone by, for example, GBR procedures should be considered[7-9].

Tooth movement through cortical bone

Experimental studies in animals have demonstrated that when a tooth is moved bodily in a labial direction towards and through the cortical plate of the alveolar bone, no bone formation will take place in front of the tooth. After initial thinning of the bone plate, a labial bone dehiscence is therefore created. Such perforation of the cortical plate can occur during orthodontic treatment either accidentally or because it was considered unavoidable. Interestingly, however, there is potential for repair when mal-positioned teeth are moved back toward their original positions, and bone apposition may take place. Evidently, the soft tissue facial to an orthodontically produced bone dehiscence may contain soft tissue components (vital osteogenic cells) with a capacity for forming bone following repositioning of the tooth into the alveolar process.Bone dehiscence which may occur due to uncontrolled expansion of teeth through the cortical plate may be repaired when the teeth are brought back, or relapse, towards a proper position within the alveolar process, even if this occurs several months later. Similar repair mechanisms may be expected to occur when marked jiggling of teeth is brought under control and stabilized. In the case of buccal cross-bites, the initial discrepancy can apparently be overcorrected with both slow and rapid expansion treatment approaches without causing permanent periodontal injury to the settled occlusion[4-6].

EXTRUSION

Orthodontic extrusion of teeth, or so-called "forced eruption", may be indicated for shallowing out intraosseous defects andfor increasing clinical crown length of single teeth. The extrusive tooth movement leads to a coronal positioning of intact connective tissue attachment, and the bony defect is shallowed out. During the elimination of an intraosseous pocket by means of orthodontic extrusion, the relationship between the CEJ and the bone crest is maintained. This means that the bone follows the tooth during the extrusive movement[2-3]. Orthodontic extrusion of a single tooth that needs to be extracted is an excellent method for improvement of the marginal bone level before the surgical placement of single implants. Not only the bone, but also the soft supporting tissues will move vertically with the teeth during orthodontic extrusion. Orthodontic extrusion of a "hopeless" incisor is therefore a useful method also for esthetic improvement of the marginal gingival level associated with the placement of implants [1,5,9].

In teeth with crown-root fracture, or other subgingival fractures, the goal of treatment may be to extrude the root out of the periodontium and then provide it with an artificial crown. When an increased distance between the CEJ and the alveolar bone crest is aimed at, the forced eruption should be combined with gingival fiberotomy[22,27].

INTRUSION

Similar to the indications for extrusion, the orthodontic intrusion of teeth has been recommended for teeth with horizontal bone loss or infrabony pockets, and for increasing the clinical crown length of single teeth. However, the benefits of intrusion for improvement of the periodontal condition around teeth are controversial.The intrusion of plaque-infected teeth may lead to the formation of angular bony defects and increased loss of attachment. When oral hygiene is inadequate, tipping and intrusion of the teeth may shift supragingivally located plaque into a subgingival position, resulting in periodontal destruction. This explains why professional subgingival scaling is particularly important during the phase of active intrusion of elongated, tipped and migrated maxillary incisors commonly occurring in association with advanced periodontal disease. Histologic studies indicate that new

attachment is possible associated with orthodontic intrusion of teeth. The increased activity of periodontal ligament cells and the approximation of formative cells to the tooth surface was suggested to contribute to the new attachment[24-28]. Furthermore, new techniques like the GTR and other regenerative procedures would appear to be more promising when it comes to creation of new attachment.

Regenerative procedures and orthodontic tooth movement

New supracrestal and periodontal ligament collagen fibers may be gained on the tension side, which can transfer the orthodontic force stimulus to the alveolar bone. In theory, the regenerative techniques would be advantageous associated with both extrusion and intrusion of teeth with infrabony defects, and for uprighting of tipped molars with mesial angular lesions. Moreover, if the epithelium can be prevented from proliferating apically, a bodily tooth movement into or through an intraosseous defect could eliminate the bony pocket more effectively than in the past. The patient's oral hygiene during the healing phase is critical, and inflammation around the membrane, particularly if it becomes exposed and contaminated, may lead to discouraging clinical results with marked gingival retraction[3,22,27].

Traumatic occlusion (jiggling) and orthodontic treatment

The importance of reducing jiggling of teeth *after* orthodontic treatment of patients with moderate to advanced periodontitis may be significant: (1) Tooth mobility generally increases with loss of support for the teeth, (2) Animal experiments have shown that bone dehiscences produced by jiggling forces will regenerate after elimination of the jiggling trauma, and (3) Occlusal adjustment may be a factor in the healing of periodontal defects, especially bony defects, after periodontal treatment[5,27.28].

Molar uprighting, Furcation involvement

Tipped molars have been considered a causative or at least an aggravating factor for future periodontal tissue breakdown. Furcation defects generally remain the same or get worse during orthodontic treatment. For example, if tipped molars have furcation involvement before orthodontic up righting, simultaneous extrusion may increase the severity of the furcation defects, especially in the presence of inflammation. Hence, initial periodontal therapy and maintenance is essential. The mandibular molar can be split into two roots, one or both of which may be kept and moved orthodontically into new positions. The developments of regenerative techniques may make it possible in the future to obtain better outcomes in orthodontic therapy of periodontally compromised patients[20-24]

INTRUSION OF PERIODONTOLLY COMPROMISED TEETH

Orthodontic intrusion may be of substantial benefit to the adult restorative patient. Often the intrusion eliminates the need for resective osseous surgery. Orthodontic intrusion causes reduction in mobility of teeth. Intrusion also moves gingival margins apically, which is esthetically pleasant.Melsonshowed that new connective tissue attachment could be formed during intrusion of periodontally involved teeth if the gingival infection is eliminated, and the root surfaces are scaled to a degree that makes it possible for a new cementum layer to form on the former infected root surface. After two to three weeks the notch will partly be lined with epithelium that apparently will get replaced during intrusion by connective tissue attachment. However, some clinicians said that intrusion of anterior teeth to correct deep overbite can deepen infrabony defects. Intrusion has been reported to create altered cementoenamel junction and angular crest relationships along with only epithelial attachment to roots, therefore great risk for future periodontal breakdown. Tooth movement when properly executed, will improve periodontal conditions and be beneficial to periodontal health. The successful intrusion takes place only when the patients periodontal condition is under control i.e., apart from single localization with vertical bone loss, no pockets of more than 3mm should be there. This limitation should be selected because[17-21].

Recession

Recession is exposure of the root surface by an apical shift in the position of the gingiva. The two types of recession are ;visible, which is clinically

observable and hidden, which is covered by gingiva and can be measured only by inserting a probe to the level of epithelial attachment.eg.in periodontal disease, the inflamed pocket wall covers part of the denuded root; thus some of the recession is hidden, and some may be visible. The total amount of recession is the sum of the two[21]. Alterations of mucogingival dimensions may occur during orthodontic treatment. Contrary to beliefs in the past, these changes are independent of the apicocoronal width of the keratinized and attached gingiva. Buccolingual thickness (volume), may be the determining factor for the development of gingival recession and attachment loss at sites with gingivitis during orthodontic treatment. In cases with a thin (delicate) gingiva caused by a prominent position of the teeth, there is no need for a pre-orthodontic gingival augmentation procedure. Neither in the case of labial gingival recessions should a mucogingival surgical procedure be performed before orthodontic therapy, when the position of the tooth is improved by the treatment. The recession, as well as the bone dehiscence, will decrease as a consequence of the lingual movement of the tooth into a more proper position within the alveolar bone. If still indicated at the end of orthodontic therapy, the surgical procedure will have a higher predictability of success than if it had been performed before the tooth movement[22-25].

From an esthetic view point it would appear that inter dental recession, manifesting as pronounced empty spares (dark triangles) between teeth would be equally or perhaps more important. It would be visible both in rest portion of the lips and upon smiling. Various theories have been advanced to account for open gingival embrasures following orthodontic treatment. One proposal implicates shortening of the interdental papillae due to stretching of the interdental gingival fibers as crowded incisors an aligned. However, the hypothesis fails to take into account possible contributions made by crown, alveolar bone loss, gingival fibers other than the interdental fibers and aging of the gingival tissues. Open gingival embrasure could be closed by torquing the central incisor roots mesially as the proximal contacts were maintained. Mesiodistal enamel reduction or "Proximal stripping " or "Slicing" 0.5 - 0.75 mm of enamel is removed and contact area lengthened[22,23].

MINOR SURGERY ASSOCIATED WITH ORTHODONTIC THERAPY

1. **Fiberotomy: A** major cause of rebound after orthodontic therapy is due to stretched gingival fibers. As teeth are moved to a new position, these fibers tend to stretch and remodel very slowly. If the pull of these elastic fibers could be eliminated, a major cause of relapse of previously irregular and rotated teeth should be eliminated. In fact, if the supracrestalfibers are sectioned and allowed to heal while the teeth are held in the proper position, relapse caused by gingival elasticity is greatly reduced. Circumferential supracrestalfiberotomy (CSF) technique was first developed by Edwards. After infiltration with a local anesthetic the procedure consists of inserting the sharp point of a time blade (No.11) into sulcular area and severing the epithelial attachment surrounding the involved tooth. No periodontal pack is necessary, and there is only minor discomfort after the procedure[1-5].

2. **Frenotomy:** It which represents a more gentle operation, with only partial removal of frenum and with the purpose of relocating the attachment in an apical direction. Procedure consists of V shaped incision along the frenal borders, removal of frenum tip, before cutting fibers and periosteum with some vertical and horizontal incisions[22-24].

Removal of gingival invagination (Clefts)

Edward suggested that simple removal of only the excess gingival in the buccal and lingual area of approximated teeth would be sufficient to alleviate the tendency for the teeth to separate after orthodontic movement.

Gingivectomy: If a gingival margin discrepancy is present, but the patients lip does not moves upward to expose the discrepancy upon smiling, it does not require correction. If the gingival discrepancy is apparent then this technique may be used[7.25.28].

CONCLUSION

Orthodontic tooth movement is brought about by prolonged application of force on the attachment apparatus. Using this information along with a well defined patient management protocol (and a home care commitment from the patient) the inter-disciplinary team of periodontist and orthodontist

can manage majority of inter related Ortho – Perio problem with predictably successful outcomes.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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