

Periodontium: Arena of Orthodontics

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Introduction

With the advent of new treatment modalities and increased patient awareness of their facial esthetics, dental treatment requires a interdisciplinary approach in fulfilling the goals of esthetics and optimizing the functional outcome. Orthodontic treatment aims at establishing functional efficiency, structural balance and esthetic harmony. The results of orthodontic therapy are largely dependent on the patient's periodontal status. Orthodontic biomechanics and treatment planning are largely governed by the state of health of periodontium. Furthermore, orthodontic tooth movement can improve the periodontal prognosis of the dentition in a deteriorated case. Orthodontic treatment acts as a two edged sword as it may improve the periodontal prognosis of a patient, restorative prognosis of a tooth but at the same time can impede hygiene maintenance leading to periodontal loss and in turn hampering the outcome of orthodontic treatment[1].

Effects of Orthodontics on Periodontium

Clinical studies have suggested that with adequate plaque control measures, orthodontic tooth movement does not initiate periodontal inflammation in a reduced periodontium. In presence of previous plaque accumulation, orthodontic tooth movement can aggravate gingival inflammation. The most important initiator of periodontal disease in reduced periodontium is the presence of plaque[2].

Pre-orthodontic periodontal treatment in generalized periodontitis case was carried out in a study conducted by Boyd (1989) and demonstrated that orthodontic movement is possible in a reduced healthy periodontium with no further clinical attachment loss[3]. Mechanical irritation caused by bands, brackets is the predisposing factor for gingival enlargement. Inability to perform mechanical

Abstract

Orthodontic treatment aims at providing an acceptable functional and aesthetic occlusion with appropriate tooth movements. In the present era, patients are aware of their esthetic appearance. The combined comprehensive knowledge of orthodontics and periodontics would lead to more astonishing esthetic outcomes. Many cases seeking orthodontic treatment present with uneven gingival margins, bone loss, recession which requires collaboration with the other dentist. The purpose of this systematic review is to highlight the relationship between orthodontics and periodontics in clinical practice and to improve the level of cooperation between dental practitioners.

Keywords: Orthodontics, Periodontics, Esthetics

adequate plaque control measures is responsible for gingival inflammation. Banded molars as compared to bonded molars present with more gingival inflammation[4].

The teeth have shown increased counts of spirochaetes, motile rods, filaments and a reduction in cocci count which in turn leading to increased bleeding scores. There exists a controversy in which short clinical studies have shown changes in microbiota but no loss of attachment[5].

Modification in orthodontic treatment such as avoiding loops in design and minimizing excessive use of resins which serve as plaque retaining area can be taken to avoid or reduce gingival inflammation[6].

Intrusive orthodontic force can force supra-gingival plaque in sub-gingival environment leading to increase in periodontal inflammation and progressing to formation of intra bony defects[7]. Unwanted effects of intrusive forces on the prognosis of a tooth may lead to root resorption, pulpal inflammation, and alveolar bone defects.

Guidelines for orthodontic treatment[8]

Periodontal Findings	Action required
PD>5mm with no bone loss	Oral hygiene reinforcement. Shorten intervals in between maintenance appointments
PD>5mm with bone loss	Pause ortho treatment. Resume treatment only after resolution of periodontal disease
Gingival recession > 2mm	Avoid facial tooth movements
Root resorption > 3mm on radiographs	Apply lighter forces

Orthodontic therapy in improving periodontal prognosis

Resective osseous surgery for elimination of osseous defects leads to reduction in valuable supportive bone from adjacent teeth. Forced eruption in these cases can be very useful in which one wall bony defects can be converted to a fair prognosis category of two or three wall

infrabony defects[9].

Selective extrusion may also be useful in cases of a poor prognosis of a tooth which would be replaced by an implant after its extraction. Extrusion can improve the esthetic value of implant prosthesis as the soft tissue and alveolar bone follows in the direction of the extrusion. Upon extruding a tooth, the periodontal fibres are pulled away from the bone inducing mechanical strain to cells in bone leading to bone formation. It improves the marginal bone level before the placement of surgical implants. Kajiyama stated that in a study conducted by him, free gingiva moved 90% and the attached gingiva 80% of the extruded distance and the width of attached gingiva was improved significantly[10].

Clinical studies have proved that orthodontic extrusion is useful in one wall or two wall defects by reducing the size of the defect.

Sometimes, the placement of implant is hampered by reduced bucco-lingual thickness of bone. Spear et al (1997) suggested that one option is to move a premolar into edentulous space and implant placement in a position which was previously occupied by a premolar[12].

Missing papilla

Interdental papillary loss may be due to various reasons such as periodontal inflammation, spacing between teeth, abnormal morphology of tooth such as divergent crown forms and defective interproximal contact point between teeth[13]. The interradicular distance between adjacent teeth and the distance from the base of the contact area to the bone crest affect the form and the shape of the interdental papilla[14]. Restorative modality involves reshaping of a faulty contact point and shifting it to a more apical location so that the embrasure is filled with papillary connective tissue. This involves proximal stripping and composite build up to establish contact point or a crown which establishes contact point in the laboratory settings. If there is spacing between teeth,

orthodontic closure of diastema is helpful in establishing proper contact point between teeth and gain of interproximal papillary height[15]. In case of divergent roots as seen on a radiograph, proper inclination of the roots will solve the problem of black triangle formation[16].

Gingival margin discrepancy:

The etiology of gingival margin discrepancy should be determined for the successful treatment outcome. Four criterias should be evaluated:[17]

- a) Gingival margin and lip line assessment: Discrepancy is present but the lip line does not show it then there is no need of treatment.
- b) Evaluation of labial sulcular depth: If the shorter tooth has a deeper sulcus, excisional gingivectomy may be appropriate. If not, gingivectomy might not help.
- c) Evaluation of adjacent teeth and tooth in concern relationship: If the tooth in concern is longer than its adjacent teeth, then extrusion of the longer tooth will eliminate the gingival marginal discrepancy
- d) Evaluation of incisal edges: If the incisal edge is abraded it means it is overerupted. In such cases, the short tooth may be intruded to resolve the marginal discrepancy.

Molar uprighting and furcation involvement

Mesially tipped molars are potential candidates for future periodontal breakdown. Molar uprighting in infra bony pocket formed cases may cause shallowing of those defects with new bone forming along the mesial border. Moreover there is improvement in clinical parameters[18].

Furcation defects may remain the same or worsen during orthodontic treatment. Extrusion component of mechanotherapy may increase the severity of furcation involvement in the presence of inflammation[19]. A clinical study conducted by Lang(1977) reported reduction in pocket depth and gain in clinical attachment on uprighted molars after completion of oral hygiene phase[20].

Mucogingival defects

An adequate attached gingiva is essential for carrying out oral hygiene procedures to allow orthodontic forces carry out their task without any periodontal complications[21]. Therefore, if the tooth movement is expected to result in a reduction of soft tissue thickness and an alveolar bone dehiscence may have occurred in the presence of inflammation, gingival recession is a risk. If the thin biotype of gingiva exists in combination with inadequate attached gingiva, then any labial orthodontic movement can cause gingival recession. Bony dehiscence will be corrected by itself if orthodontic force realigns the tooth in the arch that is the concept of 'alveolar envelope' and thus avoiding any surgical procedures such as gingival augmentation procedures[22,23,24].

Stauffer and Landmeser correlated the degree of crowding and the occurrence of gingival recession. They showed that chances of gingival recession occurring are 12 times more likely in crowding of more than 5mm[25].

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Prominent labial position of a tooth accompanied by thin labial thickness of gingiva is a predisposing factor for gingival recession. Gingival augmentation is not indicated in such cases, only lingual movement will suffice. If augmentation is indicated; it should be performed before the orthodontic tooth movement[26].

Yard et al. in 2006 stated that in adults subjected to orthodontic treatment, the factors associated to the incidence and severity of gingival recession of mandibular central incisors are final inclination more than 95 degree and free gingival margin thickness less than or equal to 5mm, with thickness having greater relevance to recession than final inclination[27].

The cause and effect relationship has not been established between the orthodontic treatment and gingival recession. Machado et al (2014) hypothesized two mechanisms in spontaneous root coverage after grafting by two mechanisms- creeping attachment phenomenon and bridging mechanisms[28].

Periodontal treatment

There should not be any active gingival inflammation during orthodontic tooth movement. Periodontal lesions such as craters, furcation lesion, hemiseptal defects should be corrected prior to orthodontic treatment. Osseous craters can be managed by osteoplasty and by non-surgical means depending upon the size of the crater. The management of three wall bony defects can be done by placement of bone grafts and orthodontic treatment has to be initiated after 6 months of periodontal surgery[29].

CSF

Methods to reduce the occurrence of rotational relapse may include:

- 1) Overcorrection
- 2) Long term retention with bonded lingual retainers
- 3) Fiberotomy

Presence of oxytalan fibres in transseptal group is responsible for relapse. The slow remodeling of transseptal fibres during and after orthodontic tooth movement tends to pull the teeth into their original positions. Supra-alveolar fibres are non-elastic by nature and more stable with a slower rate of turnover.

Technique: Scalpel insertion into the gingival sulcus and severing the epithelial attachment surrounding the involved teeth. The blade also transects the transseptal fibres by interdentally entering the pdl space. It is not recommended during active tooth movement, or in the presence of gingival inflammation[30].

Long term effectiveness evaluated in a prospective follow up study over a period of 15 years by Edwards (1988). The degree of crowding was examined for CSF and control cases at 4-6 yrs and at 12-14 yrs after treatment. A significant effect of fiberotomy was observed[30].

Periodontally accelerated osteogenic orthodontics is a technique dependent on Rapid Accelerating Phenomenon which combines selective alveolar corticotomy, particulate bone

grafting and the application of orthodontic forces. Both buccal and lingual decortications in the inter-radicular space not extending beyond the root apices. Particulate bone grafting is done. The placement of orthodontic brackets and activation of arch wires are typically done the week before the surgical aspect of PAOO is performed. This procedure produces rapid tooth movement in turn reducing treatment time and the chances of periodontal complications such as root resorption and furcation involvement are also reduced[31,32].

High thick labial frenum is considered to be one of the causes for midline diastema. The abnormal frenum prevents mesial migration of the central incisor and the aberrant fiber increases the relapse tendency after orthodontic space closure. Frenectomy is advised in these situations and it should be performed during orthodontic treatment[33].

Crown lengthening:

Inadequate space for placement of bands and brackets for orthodontic treatment may require crown lengthening procedures in shorter clinical crown cases. Apical positioning of a flap may be useful in cases where there is inadequate width of attached gingiva which may impede mechanical plaque control measures.

Here is presence of alveolar bone dehiscence around the labially positioned tooth, graft surgery to increase the width of attached gingiva is useful to prevent gingival recession and future gingival inflammation.

Conclusion

Comprehensive knowledge of the problem and collaboration of the orthodontist and the periodontist can give us many solutions to improve the prognosis of the dentition and shorten the treatment time and enhance the esthetics of the patient. Undoubtedly, the application of oral hygiene maintenance measures both on patient's and the clinician's front are essential for excellent treatment outcome. The decision regarding the time of intervention and the sequence of periodontal and orthodontic procedures is sometimes inevitably based on clinical experience, published case reports or case series and subsequent arbitrary assumptions. Therefore, there is a strong need for further research in certain directions through well-designed studies to provide patients with evidence-based treatment.