

# Review Article

## Current outlook and perception of orthodontic treatment in mutilated dentition: A review

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### ABSTRACT:

We all are well aware that Orthodontic therapy for patients who have mutilated dentition can be clinically challenging. Commonly, an interdisciplinary treatment plan is needed to allow restoration of function and aesthetics in the "mutilated dentition". Tooth movement of periodontally involved teeth has to be done with a minimum of jiggling indicating an upper hand of segmented appliances where the forces are better controlled in all three dimensions. Orthodontists play a vital role in interdisciplinary treatment approach by preventing excessive periodontal surgery by establishing a physiologic alveolar crestal topography of a localized bony defect, up righting of mesially tipped molar, forced eruption of a fractured tooth avoiding extraction, leveling the gingival margins, correcting biological width violations and improving implant sites. This review is an attempt to assess the current outlook and perception of orthodontic treatment in mutilated dentition.

**Key words:** Mutilated Dentition, Orthodontic treatment, Interdisciplinary Orthodontics, Ortho- perio, compromised dentition

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### INTRODUCTION

Mutilated dentition is a dentition which is damaged or disfigured or is been compromised either in function or in appearance or in both because of periodontal disease, caries, congenitally missing teeth, trauma (dento-alveolar segment, TMJ, etc) or any iatrogenic reason. With the rise in number of adults seeking orthodontic treatment, the skills required of the orthodontist have changed. The pre-existing conditions that are present in the adult patient interfere with the achievement of orthodontist's general idealized goals. The adult orthodontic patient may be at a greater risk of attachment loss after teeth have become mobile because of tooth movement. The orthodontist must recognize and control clinical signs of inflammation and tooth mobility during treatment and be aware of higher risk patients who can of develop periodontal disease during orthodontic therapy.<sup>1</sup> The restoration of a periodontal health is a prerequisite to all other dental therapies. Dental procedures performed in the presence of periodontal

disease are often destined to fail, due to loss of supporting structures. Under normal conditions, chewing and phonetics forces act on tooth surfaces, but no dental movement results, since teeth are placed in so called "neutral zone". Moreover, this equilibrium is also maintained by means of active stabilization, mediated by metabolic activity of periodontal ligament. To overcome this equilibrium and move a tooth, minimal forces of 5-10 g/cm<sup>2</sup> is required.<sup>2</sup> In presence of unhealthy periodontium this equilibrium is lost. The resulting changes in tooth position compromise the esthetics and function of the dentition, resulting in "mutilated dentition." This review is an attempt to assess the current outlook and perception of orthodontic treatment in mutilated dentition.

### ORTHODONTIC CONSIDERATIONS IN PERIODONTALLY COMPROMISED PATIENT

Elimination or reduction of plaque accumulation and gingival inflammation is the key element in the

orthodontic management of adult patient with periodontal complications. An observation period of 4 to 6 months before appliances are bonded will give full benefit of subgingival instrumentation, allow the initial tooth movements to take place in healthy tissues, and provide a reliable check up of the patient's hygiene efficiency and motivation.<sup>3</sup> Hooks, elastomeric rings and excess flash around the bracket base must be avoided. The use of steel ligatures is recommended on all brackets including the tooth colored brackets because elastomeric rings have been shown to attract significantly more plaque than steel ties.<sup>4</sup> Molars are preferred to be bonded rather than being banded, as bonded molars show less plaque accumulation, gingivitis and loss of attachment interproximally than do banded molars during the orthodontic treatment of adults.<sup>5</sup> Self ligating brackets promote less plaque retention when compared to the conventional ones making them a choice of preference in suspected periodontally compromised patient.<sup>6</sup> Self ligating brackets may also be capable of exerting lower force levels, providing more favorable periodontal reactions in patients with previous bone loss.<sup>7</sup> The position of the bracket is usually determined by the anatomy of the crown of the tooth in a periodontally healthy individual. However, using the anatomy of the crown to determine bracket placement would be inappropriate in a patient with underlying periodontal problems and significant alveolar bone loss around certain teeth. Decision to place the bracket in adult patients having marginal ridge and cusp discrepancies is based on radiographs and not on the basis of marginal ridge or cusp tips.<sup>8</sup> Radiographic bone level that is the inter proximal bone suggests where to place the bracket. If the bone level is oriented in same direction as the marginal ridge discrepancy, leveling the marginal ridge would level the bone. If bone is flat between adjacent teeth and a marginal ridge discrepancy is present, patient is not treated orthodontically for ridge discrepancy as this can create a hemiseptal defect in the bone resulting in a periodontal pocket between the two teeth. In such a situation, it may be necessary to equilibrate the crown of the tooth. Depending on the amount of reduction of the length of the crown that is required, equilibration may require endodontic therapy and restoration of the tooth. This procedure results in a more favourable bony contour between the teeth. If Discrepancy is present in both the bone levels and marginal ridges between two teeth and the discrepancy is not of equal magnitude, orthodontic leveling of the bone level leads to discrepancy in marginal ridge level which needs to be equilibrated.<sup>9</sup>

#### **ORTHODONTIC TOOTH MOVEMENT INTO COMPROMISED BONE AREAS**

With the rise in number of adults seeking orthodontic treatment, it is not uncommon to encounter a patient with partially edentulous dentition having compromised alveolar process. Experimental reports

(Lindskog Stokland *et al.*, 1993) and clinical studies have shown that a reduction in vertical bone height is not a contraindication for orthodontic tooth movement towards, or into, the constricted area.<sup>10-14</sup> Lindskog Stokland *et al* 2013 revealed an increase in the bucco-lingual width of the edentulous ridge following tooth movement into an area of reduced ridge dimensions. The orthodontic movement of a tooth in edentulous area in most individuals resulted in only minor alterations in the periodontal tissues. Histological 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.<sup>10</sup> The key to moving teeth with bone is direct frontal resorption in the direction of tooth movement, and avoiding hyalinization.<sup>15</sup> Vardimon *et al* revealed that the total bony apposition was 6.5 fold larger with the orthodontic tooth movement into the surgical bony defects in rats. They concluded that orthodontic tooth movement is a stimulating factor for bone apposition.<sup>16</sup> The concept of combining orthodontic tooth movement with regenerative periodontal therapy is based on the assumption that regenerative procedures could be enhanced by orthodontic tooth movement. Other authors revealed through their clinical study that defects in which immediate orthodontic tooth movement was applied demonstrated superior results than defects in which delayed orthodontic tooth movement was applied following periodontal regenerative surgery. Both groups showed more favourable results than group where defects were treated with regenerative surgery alone.<sup>17</sup> Mandibular second molars can be moved mesially through remodeled edentulous first molar areas in adults, with only a limited reduction in vertical bone height/ crestal bone loss averaging -1.3 mm. Space closure is possible also in edentulous maxillary first molar areas, although vertical bone loss and some space re-opening can be a complication.<sup>18</sup>

#### **ORTHODONTIC TOOTH MOVEMENT THROUGH CORTICAL BONE**

When the alveolar width between the buccal and lingual cortical plates is not appropriate, orthodontic tooth movement into these areas may cause complications. Tooth movement through cortical bone may retard the rate of the movement and buccal and/or lingual bone dehiscence may develop. 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 and dehiscence defect occurs. In contrast, lingual movements of labially displaced teeth showing dehiscence defects will show new bone formation in the buccal aspect of the root, as well as soft tissue augmentation.<sup>19</sup> Such perforation of the cortical plate can occur during orthodontic treatment either

accidentally or because it was considered unavoidable. It may happen for example.<sup>15</sup>

- 1) In the mandibular anterior region due to flaring of incisors.
- 2) In the maxillary posterior region during expansion in cross-bite cases
- 3) Lingually in the maxilla associated with retraction and lingual root torque of maxillary incisors in patients with large overjets
- 4) By pronounced traumatic jiggling of teeth.

### **EXTRUSION OF TEETH IN PERIODONTALLY COMPROMISED PATIENT**

Orthodontic extrusion can be an effective means to treat soft tissue and osseous vertical deficiencies of the periodontium. Orthodontic extrusion, also known as forced eruption, was first identified as a treatment option to change the relative position of teeth within the alveolar housing through active vertical eruption of teeth in an occlusal direction. Few other workers described technique such a corrective procedure toward elimination of infrabony defects resulting from periodontal disease. Authors suggested that intra-osseous vertical defects could be improved and even eliminated by altering the osseous configuration through controlled tooth movement.<sup>20</sup> Forced eruption has also been considered as an alternative method in the management of root fractures in the region of alveolar crest. In 1976, Ingber described orthodontic extrusion as an effective means of treating teeth deemed non-restorable because of clinical crown fracture and/or subgingival dental caries.<sup>21</sup> He further described the use of orthodontic extrusion to resolve the restorative challenge of insufficient clinical crown length for proper restorative ferrule, which otherwise required either periodontal surgical crown lengthening or exodontia as the definitive form of treatment. However, surgical exposure in the anterior segment is bound to compromise esthetics.

In 2014 Tondelli and co-workers published a series of articles using orthodontic extrusion to augment bone and soft tissue of the recipient dental implant site. These authors stated the notion that a “hopeless tooth is not a useless tooth,” in which they advocated using periodontally compromised teeth to dramatically improve the esthetic-restorative implant outcome.<sup>22</sup> A good implant placement is facilitated by lengthening of the vertical buccal bone plate and alveolar bone crest, hence providing a more natural emergence profile in relation to the adjacent teeth. A more esthetically pleasing restoration is produced by an increase in keratinized gingival and bone tissue levels.<sup>23</sup> During orthodontic extrusion, the relationship between the Cemento-enamel junction and the bone crest is maintained. This means that the attachment apparatus (alveolar bone) and gingiva follows the tooth during the extrusive movement due to force transmitted by the gingival fibers and periodontal fibers<sup>24</sup> suggesting that the bone follows the tooth during the extrusive movement. This may or may not

be beneficial depending on the clinical situation. In other words, it is sometimes desirable to have the periodontium follow the tooth and in other situations, it is desirable to move a tooth out of the periodontal support. However, inflammation always should be controlled to ensure that the supra-crestal connective tissue remains healthy and that the crestal alveolar bone height remains at its original level.<sup>25</sup> Orthodontic extrusion is of two types:

### **EXTRUSION WITH PERIODONTIUM**

An excellent method for improvement of the marginal bone level before the surgical placement of single implant is orthodontic extrusion of a single tooth that needs to be extracted. During orthodontic extrusion, the tooth extrudes along with the periodontium ie with the bone and its soft tissue. Kajiyama et al. reported that the free gingiva moved about 90% and the attached gingiva about 80% of the extruded distance.<sup>24</sup> The width of the attached gingiva on the labial surface increased and the clinical crown length increased about 20%, whereas the position of the mucogingival junction was unchanged. Orthodontic extrusion of a “hopeless” incisor is therefore a useful method for esthetic improvement of the marginal gingiva level associated with the placement of implants.

### **EXTRUSION OUT OF PERIODONTIUM**

Extrusion of root out of periodontium may be the goal of treatment in teeth with crown-root fracture, or other subgingival fractures and then provide it with an artificial crown. Forced eruption should be combined with gingival fiberotomy when an increased distance between CEJ and the alveolar bone crest is aimed at. Thus, orthodontic extrusion is indicated for the treatment of subgingival lesions (e.g., caries, fractures, and perforations), restorations invading the biologic width, vertical or horizontal bone loss, reduction of angular bone defects or isolated periodontal pockets, treatment of trauma and impacted teeth, as well as gains in the bone and gingival regions for implant insertions.<sup>25</sup> During orthodontic extrusion to level hemiseptel defects, the periodontist must regularly monitor the patient. Initially the hemiseptal defect will have a greater sulcular depth and hence difficult for the patient to clean. Interproximal cleaning becomes easier as the defect is ameliorated through tooth extrusion. To control inflammation in the interproximal region, the periodontist must recall the patient every 2 to 3 months.<sup>26</sup>

### **INTRUSION MOVEMENT IN PERIODONTALLY COMPROMISED PATIENTS**

Intrusion of teeth has been recommended for correcting isolated horizontal bone loss defects. Orthodontic intrusion can change a horizontal bony defect into a deep and narrow defect that is more favourable for regeneration of the periodontium through grafting procedures. Intrusion of teeth has

been recommended for correcting isolated horizontal bone loss defect, not for generalized horizontal bone defects. Intrusion has remained a controversial topic in Orthodontics. Experimental and clinical studies reveal that when gingival status is healthy, forces kept to a minimum (5 to 15 gm per tooth) with the line of action of the force passing through or close to the center of resistance and there is no interference with periodontal function; intrusion of teeth does not result in decrease of the marginal bone level and that the periodontal condition can be improved by combination of periodontal therapy and orthodontic intrusion.<sup>27,28,29,30</sup> Through their studies they reported an overall gain in attachment/ re-attachment from 0.5 to 3mm and even more can be gained with GTR. Amiri-Jezeh M et al also concluded that orthodontic intrusion of maxillary front teeth in patients with a high level of oral hygiene maintains stable periodontal parameters and may even lead to a small clinical attachment gain.<sup>31</sup>

### **BODILY MOVEMENT OF TEETH INTO A PERIODONTAL DEFECT**

The effect of bodily tooth movement into and through the intra-bony defects has been evaluated experimentally in monkeys (Polson et al.) and in dogs (Wennstrom et al).<sup>32,33</sup> Through the experiments, it was revealed that provided elimination of the subgingival infection was performed before the orthodontic tooth movement was started, no detrimental effects on the connective tissue attachment level were observed. The angular bony defect adjacent to orthodontically moved teeth was eliminated, but no coronal gain of attachment was found and a thin epithelial lining covered the root surface corresponding to its pretreatment position. It was therefore concluded that orthodontic tooth movement into infra-bony periodontal defects had no favorable effects on the level of connective tissue attachment. Tooth movement builds up bone and movement through infra bony defect is absolutely possible.<sup>34</sup> Many pioneer researchers have shown the movement of teeth into defects, with the patients contra-lateral side serving as the control. Loss of attachment was revealed by the radiographs when a tooth was moved into a defect in an edentulous area. The tooth can move away from a defect and with sufficient eruption, a bony defect can be reduced or eliminated, this usually is the treatment of choice to improve osseous architecture. Other recent studies have also demonstrated certain very clinically imperative outcomes.<sup>35,36,37,38,39</sup>

### **CONCLUSION**

Literature has well evidenced that ultimate aim of any orthodontic treatment is to provide an acceptable aesthetic and functional occlusion with planned tooth movements. With the rise in the number of adults seeking treatment for esthetic problems like uneven gingival margins and functional problems due to

periodontal disease, it has become important to incorporate it in the overall treatment plan. Periodontal conditions have to be co-evaluated by the periodontist and the orthodontist to select the suitable orthodontic intervention. After orthodontic treatment is over, the patient should be put on a 3 month maintenance program for adequate bone remodeling after band removal, cessation of mobilities and narrowing of the periodontal ligament takes about 6 months. It may take up to a year to complete the final phase of periodontal therapy after orthodontic treatment. Once the patient is periodontally stable, the operator can proceed with any restorative treatment.

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