

Apical Gingival Margin Movement in Response to Maxillary Incisor Intrusion with Fixed Orthodontic Therapy

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Abstracts

Objective: To determine the proportion of apical gingival margin movement in response to maxillary incisor intrusion, with fixed orthodontic therapy, in patients requiring maxillary incisor intrusion.

Methods: Descriptive study was carried out in the Orthodontics department of Alvi Dental Hospital, Karachi, from June to December 2009. Forty five subjects requiring maxillary incisor intrusion were included in the study, who received 2x2 segmental 17x25 stainless steel archwire therapy, for 3 months. Maxillary incisor intrusion measured on cephalogram, and crown length, measured on cast and clinically, were used to compute the proportion of apical gingival margin movement in response to maxillary incisor intrusion.

Results: Out of 45 patients, 20 subjects showed proportion of gingival margin movement in apical direction to be 71 to 80% in response to maxillary incisor intrusion, 18 subjects showed 61 to 70% and 12 patients demonstrated 81 to 90%. The mean reduction in clinical crown length was found to be 0.45 ± 0.21 mm which was statistically significant ($p < 0.05$).

Conclusion: With maxillary incisor intrusion, the gingiva moves in the same direction as the tooth, yet considerably less. Hence incisor clinical crown reduces in length, resulting in unsatisfactory appearance of anterior teeth. This may indicate the need for gingival correction after intrusion therapy.

Keywords: Maxillary incisor intrusion, gingival margin movement and clinical crown length. (AASH & KMDC 18(1):1;2013)

Introduction

A great advantage in moving teeth orthodontically is that the entire attachment apparatus, incorporating the osseous structure, periodontal ligaments and the soft tissue components, moves together with the tooth¹. Smile is formed by the upper and lower lips framing the display zone of the smile, bordering the dentition, the gingival scaffold, and the space in oral cavity². The relationship among 3 primary components i.e. teeth, lip framework and gingival scaffold plays a vital role in the overall beauty of smile and has a significant impact on the aesthetic presentation^{3,4,5}.

A healthy but asymmetric gingival arrangement reflects a disagreeable appearance, and it may become desirable to establish a certain harmony of

the free gingival margin¹. Free gingiva is the portion of the gingiva that surrounds the tooth but is not directly attached to the tooth surface. The free gingival margin of the anterior teeth has a certain natural contour which is accepted as aesthetic. Generally, the central incisor has the highest gingival level, the lateral incisor is approximately 1.5 mm lower and the gingival margin of canine is again at the same level as central incisor⁶. In orthodontics, the vertical reorientation of the teeth is as important as horizontal movements.

The gingivae around all orthodontically intruded, extruded and rotated teeth move in the same direction as orthodontic movement. However, the effect of orthodontic tooth movement on gingiva has been investigated to a lesser extent, especially the effect of intrusion on periodontal structures⁷. Intrusion is a translational type of tooth movement parallel to long axis of the tooth in an apical direction⁸. In other words, it is the apical movement of the geometric centre of the tooth root (centroid) with respect to the occlusal plane or a plane based on the long

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axis of the tooth⁹. Intrusion moves the dentogingival complex apically^{10,11}.

The ability to change the gingival position via the intrusion of teeth using orthodontics gives clinicians the ability to enhance smile and facial aesthetics. The functional evaluation of the upper gingival line in relation to the upper lip, and the incisor stomion indicate whether the maxillary or mandibular anterior teeth should be intruded¹².

Broadly speaking, maxillary incisor intrusion is indicated for gummy smile, pathologic extrusion of maxillary incisors, excessive incisor display, short upper lip, deep bite and patients with Class II division 1 malocclusion, in which they have increased overjet and lower facial height, a simultaneous gummy smile and incisor exposure at lip rest^{13,14}.

Etiologic factors of gummy smile can be skeletal, gingival, muscular (hyperfunctional upper lip muscle), iatrogenic, or some combination of these¹⁵. On average young adult female with gummy smile displays 5.3 mm of upper incisor crown when upper lip is relaxed, while an adult male will display 4.7 mm of the central incisors¹⁶. Maxillary incisor intrusion may improve the gingival show on smiling in patients with gummy smile¹⁷.

The accompanying movement of the gingiva with incisor intrusion and extrusion has been studied in some detail in monkeys^{7,18,19}. The intrusion study finding demonstrated that the gingival margin moved in the same direction as the teeth were intruded, but only about 60% as far¹⁸. A recent study in humans has shown that the gingival margin moved in the same direction along with the tooth by 79% of the actual vertical movement after intrusion of mandibular incisors⁷, resulting in a reduced tooth's crown length. There's paucity of data regarding accompanying gingival margin movement with orthodontic intrusion of maxillary incisors.

Therefore, in this study we shall strive to evaluate the proportion of gingival margin movement in apical direction in response to maxillary incisor intrusion, and if the difference between intrusion and the gingival margin movement in apical direction is

substantial, then the length of clinical crown would reduce significantly, resulting in unsatisfactory appearance of anterior teeth. The data obtained can be utilized to adopt strategies like periodontal plastic procedures such as the basic gingivectomy or apically positioned flap to overcome the difference and regain actual crown length, and hence, obtain the perfect smile.

Patients and Methods

This descriptive study was carried out in the Orthodontics department of Alvi Dental Hospital from June to December 2009. Convenience sampling technique was used. Considering that proportion of gingival margin movement compared to intrusion was $p = 0.79$ in a previous study⁷, on 12% margin of error, with 95% confidence interval, the sample size estimated was 45. Forty five patients requiring orthodontic treatment, meeting the inclusion and exclusion criteria were selected from the patient pool being treated at Alvi Dental Hospital. Patients were diagnosed on the basis of clinical and radiologic examination.

The inclusion criteria were both male and female patients age range 8 to 25 years, patients requiring intrusion of 1-3 mm of maxillary incisors due to gummy smile, excessive incisor display, over-eruption of upper incisors and short upper lip, excellent oral hygiene (Loe and Silness's plaque index and gingival index²⁰ scores of 0, at pre-treatment and post-intrusion stages.), requiring intrusion of maxillary incisors. Those excluded from the study were patients with gingival hyperplasia or gingival recession, patients on drugs that have potential to cause gingival hyperplasia like Phenytoin, Nifedipine, Cyclosporine and Diltiazem, patients with periodontal disease (bleeding, calculus and pocketing), patients on NSAIDs as these can cause gingival bleeding and give false positive reading of periodontitis and patients with cardiovascular disease.

Procedure was explained to the patient and informed consent was taken. History of any previous orthodontic treatment or traumatic injuries was re-

corded through clinical and radiographic examination.

Patients were given strict oral hygiene instructions before the start of treatment and placed on chlorhexidine mouthwash twice weekly. All patients were treated with multibonded, preadjusted 22x25 bracket slot fixed orthodontic appliance. Maxillary incisor intrusion was carried out with 2x2 segmental wire technique using 17x25 stainless steel wire, cinched back, and it was performed by a senior consultant having post fellowship experience of 30 years. Buccal root torque of 45° for the molars and 15° labial root torque for the incisors was maintained.

Data, consisting of dental casts and cephalograms, was collected at pre-treatment (T1), and 3 months later at post-intrusion (T2), for each subject, by the chief researcher, under the supervision of the senior consultant. Cephalograms were oriented with facial profile to the right.

The variables measured were clinical crown length, on cast and maxillary incisor intrusion, on cephalogram; to compute apical gingival margin movement. Gingival margin movement is equal to Intrusion in mm minus difference in clinical crown length at T1 and T2, in mm.

Intrusion of maxillary right central incisor was measured with a millimetric ruler by superimposing pre-treatment and post intrusion cephalograms. On both T1 and T2 cephalograms, the distance from the root apex of maxillary central incisor to the incisal edge was measured and the midpoint designated as centroid on both the cephalograms. The template of T1 cephalogram was then placed on that of T2 cephalogram and the distance between the two centroid markings indicated intrusion in mm²¹.

Clinical crown length was measured clinically, and on cast with Sliding Caliper, at T1 and T2 stages. The mean score of clinical and cast readings were recorded at T1 and T2. (Maxillary right central incisor was considered in this study as it is the closest tooth to the midline and, so, least sub-

ject to roentgenographic magnification in lateral cephalograms⁷.)

Radiographs were traced on acetate tracing paper with a sharp 3HB drawing pencil and were assessed by supervisor for quality and resolution. All the cephalometric measurements were adjusted for the radiographic magnification error.

To determine the proportion of gingival margin movement in response to maxillary incisor intrusion, the following formula was applied:

$$\frac{\text{Apical Gingival margin movement in mm}}{\text{Intrusion in mm}} \times 100$$

For growing candidates in our study, measure of the increase with growth of the distance from anterior nasal spine (ANS) to suprapogonion (PM) was taken. This quantity represented the extrusive effects of growth on the teeth and was used to correct for the amount of alveolar and dental elongation which occurred during the treatment period²² (Fig.1). Total intrusion was then calculated for the growing patients.

Data was analyzed on SPSS software version 11. Mean and standard deviation were computed for continuous variables like age, clinical crown length and intrusion at pretreatment and post intrusion stages, and apical gingival margin movement at post intrusion stage. Frequency was computed for categorical variables like gender and apical gingival margin movement. Normality of the data was checked by with Shapiro- Wilk test. Dependent (Paired) sample t-test was applied to compare clinical crown length. P<0.05 was considered statistically significant.