

## Evaluation of Apical Root Resorption after Intrusion

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### ABSTRACT

**Aim:** To evaluate the frequency of various degrees of apical root resorption of premolar teeth after intrusion with heavy forces for their clinical significance.

**Study design:** It was a descriptive case series.

**Duration:** January 2010 to June 2010.

**Place of study:** Orthodontic Department of de'Montmorency College of Dentistry/Punjab, Dental Hospital Lahore in collaboration with Pakistan Council of scientific and industrial research laboratories.

**Material and method:** 70 premolars of (35 patients) meeting the inclusion and exclusion criteria was included in the study visiting the outpatient department of Orthodontics.

**Results:** Majority of the patients i.e., 18(51.43%) were between 16-20 years, mean age was found as 19.34±3.217, 22(62.86%) were found female and 13(37.14%) were male, frequency of degree of root resorption shows 42(60%) cases with grade I and the rest of 28(40%) were found with the complaint of grade II.

**Conclusion:** Controlled and measurable intrusive forces should be given and unnecessarily prolonged applications should be avoided for undesirable root resorption.

**Keywords:** Premolar teeth, intrusion with heavy forces, degrees of apical root resorption,

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### INTRODUCTION

Root resorption exists in different forms, physiological resorption of primary teeth as well as internal and external inflammatory resorption often associated with dental trauma and pulpal inflammation. The loss of the tooth substance has been referred by many names, root resorption, external apical resorption; external resorption and simply root resorption. Although apical root resorption occurs in individuals who have never experienced orthodontic tooth movements, the incidence among treated individuals is significantly higher<sup>1</sup>.

Root resorption is a common sequelae of orthodontic treatment. Consequences range from slight mobility resulting from mild amounts of root resorption to complete loss of teeth due to excessive root resorption. The type and the magnitude of the root resorption vary from mild apical root blunting in a large number of cases to lateral resorption and infrequently to excessive root loss. Because of the potential for significant clinical and legal implications of root resorption assessment of the biological and mechanical basis of root resorption has been the subject of excessive research and discussion for almost a century. Yet because of multiple factors contributing to this process, the research findings are inconclusive and remain a highly debatable topic in literature<sup>2,3</sup>.

Since then numerous potential causes, relationships and contributing factors have been proposed and studied but definite explanations of why root resorption occurs and what factors contribute to its occurrence have remained controversial<sup>6</sup>.

There is a relationship of root resorption with magnitude of force applied, duration of that force, root morphology especially abnormally shaped dilacerated roots, long conical roots appear to influence the severity of root resorption<sup>7</sup>. Previous trauma to the teeth treated orthodontically may be a significant risk factor for root resorption. Trabecular bone density may be associated with root resorption. It has been assumed that bone and roots with similar level of calcification are likely to undergo comparable amount of degradation when exogenous forces are applied. A hereditary component of orthodontic root resorption has been suggested by showing a significantly higher co-occurrence of root resorption among siblings and non siblings. In recent context of genetic predisposition to root resorption there is an association of 1L-1α and TNF-α polymorph and root resorption<sup>8,9</sup>. Types of tooth movement cause more root resorption e.g., jiggling movement torque, intrusion and bodily movements<sup>7,8,10</sup>. Factors like metabolic disorders, systemic diseases all play role in root resorption. The type of the tooth movement which is most effective in apical root resorption is intrusive movement which might be expressed by very light intrusive forces<sup>8</sup>.

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Intrusive movement is important when we are dealing with deep bite orthodontic cases especially those who are not growing. These deep bite cases have low mandibular planes and strong musculature, so the chances of relapsed are there if we extrude the posterior segment in order to correct the deep bite. In such cases, we intrude the anterior teeth. On the other hand if we are dealing with high angle cases then we have to intrude the posterior teeth. So, intrusive movement has its significant role in orthodontic field<sup>11</sup>.

As orthodontics is in developing stage in Pakistan, most of the new learners of orthodontics and even the general dentist community, they all are delivering the forces to the teeth without measuring them properly. As a result the teeth are at the risk of root resorption which can range from mild mobility to the total loss of root. Our study is going to show the orthodontists that intrusion can affect the integrity of teeth if heavy forces are given. So it is very important for them to measure the forces by measuring gauges before applying them on to the teeth. Previously radiographic methods were used to measure root resorption and the most authentic of them was periapical long cone technique. Later microscopes were used to evaluate the root resorption<sup>12</sup>. Histological studies were also done. Now a days CT scans and CBCT are used for three dimensional view of root resorption<sup>13</sup>. As in our country great expenditures are required to have the research of this standard so to make it more economical, it was decided that root resorption after intrusion should be studied on electron microscope. This study is done for the first time in our country in collaboration with Pakistan Council of Scientific and Industrial Research.

**MATERIAL AND METHODS**

Seventy premolars of (35 patients) meeting the inclusion and exclusion criteria was included in the study visiting the outpatient department of Orthodontics, de'Montmorency College of Dentistry/Punjab, Dental Hospital, Lahore. Their demographic information (name, age, gender, occupation and address) was recorded. An informed consent was obtained to use their data in the study. No ethical issues of risk were involved to patients.

Passive utility arch fabricated in S.S 017x25 were used for intrusion. Sliding hooks were attached to the lateral arms of utility arch. A heavy controlled orthodontic force of (200)gms were applied on maxillary 1<sup>st</sup> premolars. The intrusive force was applied between the attachment on premolar tooth and sliding hook on the lateral arm of utility arch via intraoral elastics after measuring them properly. The

patients were wearing elastics for 24 hours per day. After every week the patients were given new measured elastic of same force to wear on apically moved teeth. This procedure was continued for eight weeks. Preintrusion root length was determined from cemento-enamel junction to apex of the root on periapical radiograph taken by long cone parallel technique. Radiographic were scanned at 300 dpi and root lengths were measured by electronic ruler on software CoralDraw Graphic suit x4. After atraumatic extraction analysis of root resorption was done by scanning electron microscope (Ittachi, Japan model s-3700 N). Root resorption severity is scored on index for evaluating the degree of root resorption.

Data was analysed by using SPSS version 11, computer based software programme. Quantitative variables (age) was presented as mean and standard deviation. Gender and degree of root resorption (grades) were presented by calculating frequency and percentage.

**RESULTS**

A total of 70 patients fulfilling the inclusion/exclusion criteria were enrolled to evaluate the frequency of various degrees of apical root resorption of premolar teeth after intrusion with heavy forces for their clinical significance. While studying the distribution of cases by age it was found that majority of the patients i.e., 18(51.43%) were between 16-20 years, 12(34.29%) were found between 21-25 years, 4(11.43%) were between 12-15 years while 1(2.85%) was found between 26-30 years, mean age was found as 19.34±3.217. Gender distribution of the subjects was computed in Table 2, where 22(62.86%) were found female and 13(37.14%) were male. Frequency of degree of root resorption shows 42(60%) cases with grade I and the rest of 28(40%) were found with the complaint of grade II (Table 3).

Table 1: Age distribution of the subjects (n=35)

Age (in years)	=n	%age
12-15	04	11.43
16-20	18	51.43
21-25	12	34.29
26-30	01	2.85

Mean and S.D: 19.34±3.21

Table 2: Gender of the subjects (n=35)

Gender	=n	%age
Male	13	37.14
Female	22	62.86

Table 3: Degree of root resorption (n=70)

Grade	=n	%age
Grade I	42	60
Grade II	28	40

## DISCUSSION

It is recognized in orthodontic literature that long term intrusion causes external root resorption and decrease the root lengths<sup>14</sup>. Previous clinical studies that investigated the root resorption after intrusion were on radiographs and on histological pictures. In addition, there were different methodologies among the studies, making the results difficult to compare. Our study evaluated the effects of force magnitude during short term controlled intrusion, we also analyzed the lingual and the buccal surfaces of the tooth root after intrusion.

Orthodontically induced inflammatory root resorption is one of complications induced by orthodontic treatment; however sometimes it is diagnosed to patients that haven't undergone orthodontic treatment<sup>15</sup>.

Usually orthodontic treatment doesn't cause clinically significant root resorption; however microscopic changes appear on the teeth roots, which are difficult to detect in radiological images. Root resorption induces root shortening and weakening of teeth arch and this is very important for successful orthodontic treatment<sup>16</sup>. Root resorption is considered as clinically important when 1-2 mm (1/4) of the root length is lost<sup>17</sup>.

It is considered that occurrence of root resorption can be induced by the strong force through orthodontic treatment and hyalinisation of periodontal ligaments induced by increased activity of cementoclasts and osteoclasts<sup>18</sup>. During tooth movement, areas of compression (where osteoclasts are in action inducing bone resorption) and areas of tension (where osteoblasts are active inducing bone deposition) are formed. Thus a tooth moves towards the side of bone resorption. During remodeling process of hyalanised zone the necrotic hylanised tissue and alveolar bone wall are removed by phagocytic cells such as macrophages foreign body giant cells and osteoclasts. As a side effect of cellular activity, during the removal of necrotic PDL tissue, the cementoid layer of root and the bone are left with raw unprotected surfaces in certain area that are attacked by resorptive cells. Root resorption then occurs. Harry and Sims showed that distribution of root resorption craters is directly related to the amount of stress on root surface. Faltin et al showed that greater root resorption is observed intruded with heavy forces, which is in agreement with the inclusion criteria of our study i.e. heavy force of 200gms.

Comparing root resorption resulting from removable and fixed appliances, it was established that root resorption more often is induced by treating it with fixed appliances.

In our study, 40%(n=28 teeth) were found with grade II root resorption, and the results are in agreement with Stuteville. He further describes that the incidence of reported root resorption during orthodontic treatment varies widely among investigators. This resorption potential varies in persons and between different teeth in the same person. This throws doubt on the role of various factors as a primary cause of root resorption during orthodontic treatment. The extent of treatment duration and magnitude of the force definitely influence root resorption. Our study also agrees with the results of previous quantitative root resorption study that compare difference force magnitude. However, contradictory findings were reported in orthodontic literature regarding force magnitude and extent of root resorption. Some studies stated that an increase in force magnitude is not directly proportional to an increase in the resorption. On the other hand, Maltha et al concluded that incidence of root resorption increases with duration of force applications. As, in the current study, the duration of treatment was 8 weeks only which is comparatively of shorter duration, the grade II resorption might have increased with longer duration. Moreover, our study also revealed more root resorption on the lingual roots because buccal forces were applied, which were in accordance with Acer et al who also applied buccal forces with elastics from buccal button bounded to the sample tooth to passive intrusion arch.

In another study, it was established that duration of treatment with fixed orthodontic appliances was found to contribute to the degree of root resorption. Patients, whose orthodontic treatment with fixed appliances lasts longer, experience significantly more grade 2 root resorption. Average treatment length for patients without root resorption is 1.5 years and for the patients with severe root resorption – 2.3 years<sup>19</sup>. On the other hand, Segal GR reveal that several contemporary studies have found no relation between the length of orthodontic treatment and root resorption<sup>20</sup>. Considering the findings of Segal GR, further trials for long term treatment is required.

The findings of present study indicate that significant correlation exists between magnitude of force and degree of apical root resorption. It is also concluded that heavy intrusive forces cause more root resorption so orthodontists should give controlled measurable forces to avoid undesirable root resorption after orthodontic treatment.

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