

## **Case report**

### **Atypical Orthodontic induced external apical root resorption: A Case report**

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#### **Abstract**

Orthodontic induced external apical root resorption is one of the idiopathic phenomenon's as an effect, force generated through mechanotherapy as one of the cause and the biological tissues with their diversified variations as witness. It is also sub classified into iatrogenic as a result of indeterminate application of orthodontic forces with subconscious appreciation of the existing conditions. Numerous factors were identified to be related to this irreversible pathologic condition, but none were proven scientifically. Genetics and salivary markers proved the reliability with time. Different assessment methods were also identified to clinically diagnose it both subjectively and objectively. Mostly it is identified through routine radiographic stage records or certain prediction radiographs for root resorption probability assessment. This case report discusses one such encounter which was experienced after stage 2 mechanics involving quite a few teeth. Considering the biotype of the individual and tooth morphology the treatment was terminated and recovery measures were briefed to uplift the self-esteem of the individual.

**KEY WORDS:** Genetics, Malocclusion, Open bite, Orthodontics, Root resorption.

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## **INTRODUCTION**

External apical root resorption (EARR) is one of the complications of orthodontic treatment besides other idiopathic causes and conditions, leading to permanent shortening of tooth root structure involving one or more teeth, generally maxillary central and lateral incisors being affected.<sup>1</sup> The degree of severity can be manifested proportionally with the type of force and magnitude generated by orthodontic appliances and classified as pathological in nature.<sup>2,3</sup> More than a third of individuals treated with fixed appliances evidenced greater than 3 mm of root length resorption, whereas 2% to 5% witnessed up to 5 mm whereby compromising the function and lifespan of the tooth involved.<sup>4,5</sup>

Its numerous ways of occurrence and its clinical manifestations also remained highly variable suggesting new insights for additional diagnostic tools and markers. Routine pretreatment radiographic assessment, random intraoral periapical radiographs (IOPAR) proved efficient in that they were prospective by ruling out the contribution of different root anomalies as well as identification of EARR during the course of treatment with minimal compromise.<sup>6-8</sup>

The present case report discusses one such unconditional occurrence in a class II malocclusion out of exemplary precautions thereby compromising the objective fulfillment and leading to discharge of treatment.

## **CASE REPORT**

### **Clinical examination**

A 19-year-old female patient presented with inability to bite with her front teeth and some speech difficulty. She had unremarkable medical history. Clinically, she was thin biotype with symmetrical extraoral face, convex profile and increased vertical proportions. Her lips were potentially incompetent with acute nasolabial angle; shallow mentolabial sulcus and simple

tongue thrust habit on swallow. This was further complicated by increased overjet of 11mm, hyperdivergent jaw bases with anterior openbite by 1 mm, narrow arches, palatally erupted 14, upper midline shift towards right, cuspal class II relation on right and full tooth class II on left side, class II division 1 incisor relation and circum-oral muscular hyperactivity on swallow (Figure 1: a-d). The Temporomandibular joints function was asymptomatic with evident jaw deviation on maximum opening and spontaneous reduction to normal on closure.

### **Radiographic examination**

Orthopantomogram (OPG) revealed certain teeth with pipette-shaped, pointed apical third root contours with others dilacerated and also rectangular morphology (Figure 2a). The skeletal relation was class II contributed by severe prognathic maxilla and mild retrognathic mandible. The maxillary dentition had a neutral compensation with protrusion while mandibular teeth had unfavorable compensation with both inclination and protrusion (Figure 2b).

### **Treatment plan**

Establishing her treatment prognosis with average outcome, camouflage treatment was planned with patient's consent and disobedience for surgical approach in achieving optimal structural balance and functional efficiency with esthetic harmony. Damon MBT self-ligating 0.022X0.028" prescription was bonded from second molar to second molar in both the arches. Damon system was elected for her by assuming its passive self-ligation with low friction will reduce the resistance between the root surface and bone thereby minimizing the incidence of root resorption. Symmetric extractions of 14 and 24 were done to restore overjet with some compromise by 2-3mm along with non-extraction in the opposing arch. Subsequently, little more space generation was planned by widening of arches as well as molar distalization of the upper left molars to establish cuspal class II molar relation and simultaneously correcting the midline, and

also for bilateral intrusion of posterior teeth to restore optimal vertical proportion. For this, 18 and 28 were also included into therapeutic extractions alongside the premolars. Infra zygomatic cortical mini screw assistance was considered to reinforce the anchorage.

Stage I treatment of aligning and leveling was done for 13 months with Critical type A anchorage over 0.014", 0.016 and 0.014X0.025" thermal Nickel Titanium (T-NiTi) archwires followed by 0.017X0.025", 0.019X0.025" thermal T-NiTi ending with 0.019X0.025" stainless steel (SS) arch wires. The duration between the appointments was also delayed due to multiple times bracket and buccal tube displacements along with archwire changes to maintain optimal conditions to avoid any root resorption. Stage II objective of space closure was carried out for 11 months on a gentle reverse curve of Spee with active-tie backs, reinforced with intermaxillary class II elastics of 2 ounce force to control the vertical relation of incisors. Overjet was effectively addressed and a stage II OPG taken to proceed further with molar distalization, Intrusion of posterior teeth and midline correction with infra zygomatic cortical mini-implants assistance. The OPG and certain periapical radiographs revealed multiple teeth EARR both in the maxillary anterior and posterior teeth as well as in certain mandibular teeth (Figure 3) compromising further treatment execution and discharge all other procedures. The most affected being maxillary incisors and premolars followed by canines, molars (Figure 4) and least mandibular, as no major mechanics was involved. Seventy percent of the objectives were fulfilled by the end of radiographic root resorption encounter. Clinically the intraoral picture was health and absolute without any signs of EARR (Figure 5) which was occurring within the socket. The appliance was debonded on patient's request and education given on for further maintenance and support over managing of the incidence.

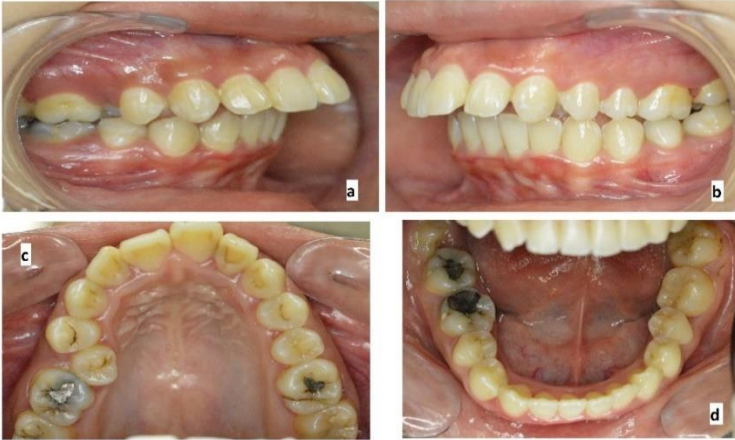
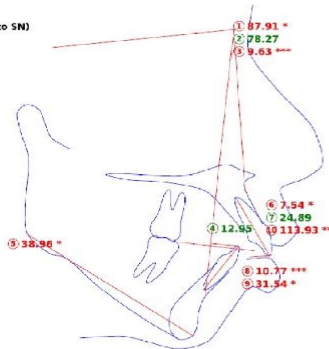


Figure 1: Pretreatment Intraoral photographs (a-d).

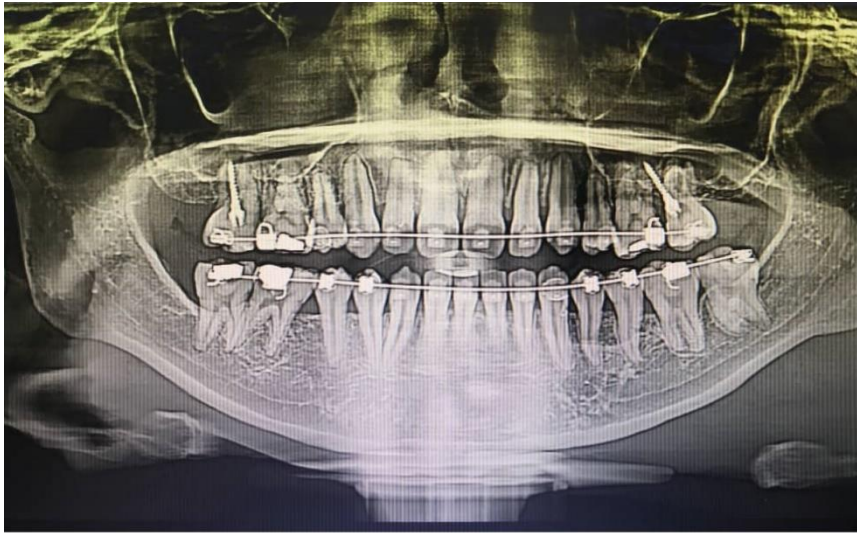


- ① SHNA
- ② SNB
- ③ ANS
- ④ Occlusal plane to SN angle
- ⑤ Mandibular plane angle(Go-Gn to SN)
- ⑥ U3 to NA(mm)
- ⑦ U3 to NA(deg)
- ⑧ LI to NB(mm)
- ⑨ LI to NB(deg)
- ⑩ Interincisal angle

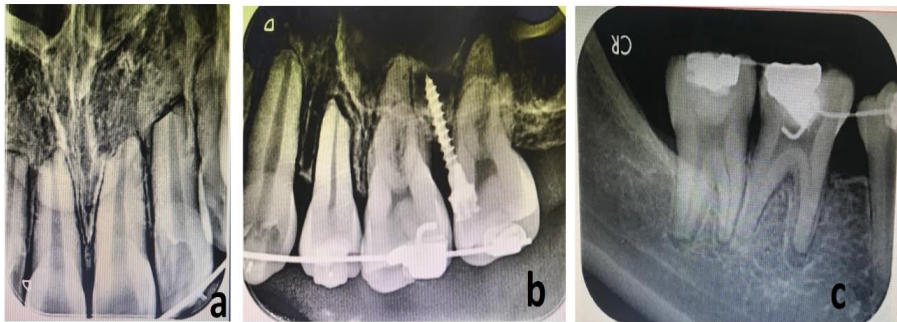


**b**

Figure 2: Pretreatment opg (a) and lateral cephalogram (b).



**Figure 3: Mid treatment OPG**



**Figure 4: Intraoral periapical radiographs of maxillary incisors (a), maxillary left posterior teeth (b), and mandibular right posterior teeth (c).**

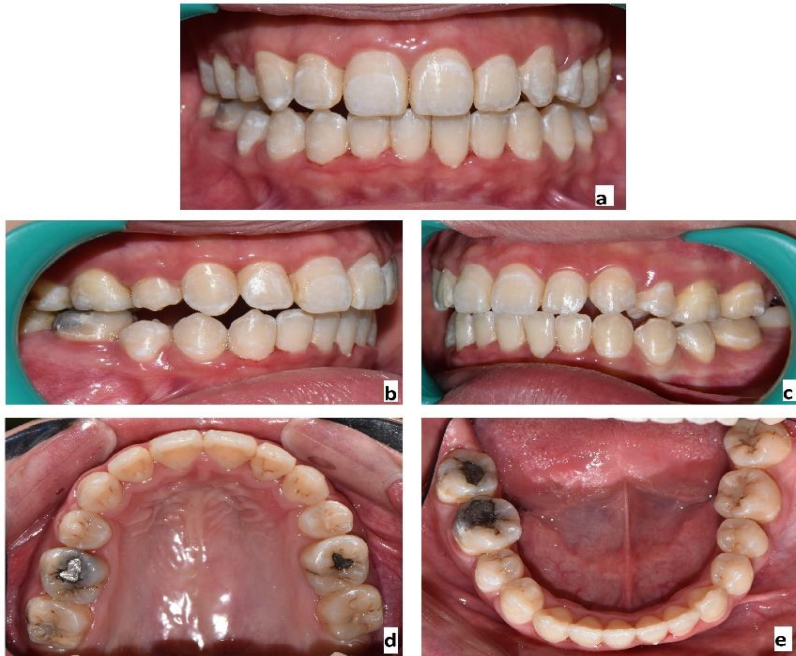


Figure 5: Mid treatment Intraoral photographs (a-e).

## DISCUSSION

Orthodontic induced external apical root resorption (OIERR) is a globally prevalent undesirable pathological condition without any discrimination even today, that is widely documented by researchers.<sup>9</sup> It's genetic predisposition, ever since published by Newman et al (1975) with family clustering of inexplicable inheritance pattern among its diversity, was later supported with one of such findings by Al-Qawasmi RA (2003)<sup>10</sup> relating to proinflammatory cytokines like IL-1A and IL-1B on IL-1 gene cluster on human chromosome 2q13 substantiating the clinical perception that there is more to root resorption than amount of force or type of appliance used. In accordance with the radiographic finding of thin, pointed, barrel shaped and dilacerated root morphology as a predisposing factor and radiographic marker in prediction of EARR in this individual, Katona TR (2006)<sup>8</sup> and Antônio Geraldo de O (2011)<sup>11</sup> also found

greater correlation of root resorption with similar findings after the orthodontic treatment.

Among the types of malocclusions, class II is mostly reported for orthodontic intervention alongside the complexity. As the growth spurt was completed camouflage treatment was elected by dental compensation of skeletal malrelation. Janson G (2016)<sup>12</sup> found incidence of OIERR in both nonextraction and extraction treatment approaches ranging from mild to severe with clinically insignificant difference in results which was correlating in this condition. Visible changes can be witnessed as early as within 6 months during aligning and leveling phase or by the end of space closure phase through stage radiographs. About 4.1% of patients had an average resorption of at least 1.5 mm of the 4 maxillary incisors, and about 15.5% had 1 maxillary incisor or more with resorption of at least 2.0 mm from 3 to 9 months after initiation of fixed appliance therapy in their study. Although teeth with long, narrow, and deviated roots are at increased risk of resorption during this early stage, the explained variance of these risk factors is less than 25%.<sup>13</sup>

Gingival crevicular fluid markers and salivary markers are the evolving areas in this field to act much earlier than the radiographic findings.<sup>14</sup> Over time many adjunctive therapies with devices were innovated to overcome such collateral encounters like acceleDent<sup>15</sup>, micro-osteoperforation<sup>16</sup> (Propel), low-level laser therapy<sup>17</sup> (LLLT), low-intensity pulsed ultrasound<sup>18</sup> (LIPUS), etc. to minimize the intensity of root resorption and hasten tooth movement by improving the bone remodeling. However root resorption even with these aids proved not promising with variable results in the literature review.<sup>19,20</sup> . In one of the study by El-Bialy et al. (2004)<sup>21</sup>, revealed the healing effects of LIPUS induced by OIEARR through ultrasound, suggesting more intervention studies in this area. Gay G et al.<sup>22</sup> in their study on Invisalign aligner therapy, being advanced in the field of orthodontic therapy, reported root resorption with an



average of less than 10 percent of their original root length in almost every individual.

## **CONCLUSION**

In spite of even considering majority of factors, the root resorption became inevitable in this condition, instituting that it is a consideration of fact beyond mechanical factors and variable tooth morphology. More emphasis should be shadowed on delivering the mechanical forces at optimal thresholds to rule out the inadvertent mechanotransduction as one of the major cause and invariable understanding the role of other factors in its occurrence.

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