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Original Research

A comparative study of the effect of the intrusion arch and straight wire mechanics on incisor root resorption: A randomized, controlled trial

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ABSTRACT:

Aim: to assess this external apical root resorption caused by mechanical intrusion of the maxillary incisors using intrusion arches and to compare it with the resorption caused by conventional orthodontics. **Method and material**: 40 patients were divided into two groups. group 1 received intrusion arches while group 2 received straight wires. The external root resorption was evaluated in both the groups before start of the treatment and 6 month after the treatment using CBCT. **Results**: The results showed significant difference between resorption of root prior to commencement and 6 months after treatment while using archwire whereas while using straight wire no such change was observed. It was noteworthy that no difference on comparing both the groups. **Conclusion**: No significant changes were seen on comparing both the groups however in orthodontic treatments, it is strongly advised to use light forces and to leave longer gaps between activations. Serial radiographs should be taken every 6–12 months may assist detect early root resorption, and if resorption is detected, a two–three month break from treatment with a passive arch wire may assist prevent further resorption.

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INTRODUCTION

Deep bite is a malocclusion which occurs when on bringing mandible into habitual or centric occlusion leads to excessive vertical overlapping of mandibular incisors by maxillary incisors. It results in incisor wear, gingival recession , compromised esthetics and palatal impingement.[1] There are various methods to correct deep bite which includes uprighting of posteriors or flaring of anterior teeth , intrusion of incisors, extrusion of posteriors or combination of both, proclination of incisors and orthognathic surgical modality. Intrusion is a commonly employed orthodontic method for correction of deep bite. In this the anteriors are intruded for correction, or in anterior open bite where posteriors are intruded to close the bite for correction. [2]

There are many intrusion methods used some of them includes Ricketts utility arch, RCS, K-SIR, J-headgear, Connecticut intrusion arch, implant, Burstone arch, vertical loops three piece arch etc.

Connecticut intrusion arch (C.I.A) introduced by Ravindra Nanda is fabricated from Nickel – Titanium alloys as it is the material of choice for delivering continuous forces under large activation. C.I.A incorporates the characteristics of utility arch as well as those of conventional intrusion arch.[2]

There have been many side effects observed while intruding teeth by using these methods these includes incisal flaring, Lingual crown tip on molars and external root resorption. The tooth apex and associated periodontium can absorb relatively high compression stresses during intrusion. These high stress levels logically could increase the risk of apical root resorption.[3] Thus it is noteworthy to assess this external apical root resorption caused by mechanical intrusion of the maxillary incisors using intrusion arches and to compare it with the resorption caused by conventional orthodontics.

METHODOLOGY

The study was carried after approval from the institutional ethical committee. 40 patients were selected and divided into two groups. Informed consent was taken from all the subjects. Patients with no previous Orthodontic treatment, complete incisor root formation, without any history trauma to maxillary incisors and without any history of root resorption prior to commencement of orthodontic treatment and were selected. Other than that patients with 2.0 to 4.0 mm of overbite correction were selected for the study. Age and sex matched patients were included in the control groups. Study group received intrusion base arch while control group patients were those patients who were receiving full-arch fixed appliance therapy without use of an intrusion base arch. In the present study the resorption was calculated using CBCT as it is difficult to standardise the 2 dimensional scans.

All the patients were treated with full fixed appliances [3M Unitek Victory Series Low Profile Brackets Mbt - 0.022 (024-122)] Patients of G2 were orthodontically treated for levelling and alignment with nickel-titanium archwire beginning with 0.013-inch, 0.014-inch, and 0.016-inch, each arch-wire remained in place for 2 months. Patients from G1 followed a protocol with a heat-activated nickel-titanium segmented anterior archwire (0.014 × 0.025-inch. For the intrusion protocol, a long, preformed nickel-titanium 0.017 × 0.025-inch intrusion arch was used, activated with a previously calibrated V-bend effecting an intrusive vertical force of 40–60 g. The arch-wire was adapted to an accessory tube attached to the triple tube bonded to the maxillary first molar and cinched back and secured by a metal ligature over the lateral incisors on the same day the maxillary fixed appliances were bonded. Both arches remained until overbite was fully corrected.

MEASUREMENT OF ROOT RESORPTION

CBCT scans were performed on all patients at two intervals i.e. prior to the commencement of the study (T-1) and 6 months after treatment began (T-2). The central and lateral incisors of the same quadrant were examined on the CBCT scan. The radiographs were examined on view box where the cement-enamel junctions at the mesial or distal aspects of the tooth in the pre and post treatment CBCT scans were marked and projected perpendicularly on the tooth axis. Total tooth length, crown length (defined as cement-enamel junction to incisal edge) and root length (defined as cement-enamel junction to apex of root) were measured with good illumination. Intrusion arches were removed for tomographic examination at T2. All the scans were assessed by same observer[1].

RESULTS

The results showed significant difference between resorption of root prior to commencement and 6 months after treatment while using archwire whereas while using straight wire no such change was observed (table 1and 2). It was noteworthy that no difference on comparing both the groups (table 3)

Table 1: Tooth measurements for group 1

Tooth measurements	I- 1	I-2	Difference (resorption)	P value
11	23.5±1.7	22.5±1.7	-.93	.04
21	23.28±1.8	22.22±1.74	-.94	.05
12	24.6±.93	23.7±1.08	-.97	.005
22	24.67±.77	23.66±.97	-1.05	.0006

Tooth measurements for group 2

Tooth measurements	I- 1	I-2	Difference (resorption)	P value
11	23.2±1.64	22.6±1.7	-.5	.056
21	23.06±1.76	22.60±1.73	-.46	.19
12	24.4±1.04	23.8±0.97	-0.6	.06
22	24.5±1.2	23.9±1.14	-0.6	.08

	Tooth number	Group 1 (tooth measurements in mm)	Group 2 (tooth measurements in mm)	P value
Interval 1	11	**23.5±1.7**	23.2±1.64	>.05
	21	23.28±1.8	23.06±1.76	>.05
	12	24.6±.93	24.4±1.04	>.05
	22	24.67±.77	24.5±1.2	>.05
Interval 1	11	22.5±**1.7**	22.6±1.7	>.05
	21	22.22±1.74	22.60±1.73	>.05
	12	23.7±1.08	23.8±0.97	>.05
	22	23.66±.97	23.9±1.14	>.05

DISCUSSION

External apical root resorption (ARR) is an unfavourable orthodontic condition that causes permanent tooth structure loss at the root apex.[4]According to Remington et al the maxillary incisors were the most frequently severely affected then rest of the dentition. Radiographs alone cannot adequately assess the severity of root resorption. Thus Heimisdottir et al recommended the use of CBCT in case to rule out the possibity of root resorption. The CBCT images of this patient show more clearly the degree of severity of ARR and the geometry of the resorption as the severity of ARR and the geometry of the resorption are more clearly visible in this patient's CBCT scans.[5]

Castro et al in their study concluded that that CBCT was effective for detecting in vivo even minimal degrees of ARR due to orthodontic treatment and allowed three-dimensional evaluation of dental roots and visualization of palatine roots of maxillary molars. The highest frequencies and the most significant ARR occurred in incisors and distal roots of first maxillary and mandibular molars.[6]

The present prospective study was conducted to compare the difference in the external resorption in the maxillary incisors in deep bite patients by using CIA and continuous archwires by using CBCT. Our study showed that on comparing both the groups no significant difference was observed and were comparable however significant difference was observed at different time intervals while using intrution wires.

The results of the present study were similar to that of de Almeida et al who compared the effect of the intrusion arch and straight wire mechanics on incisor root resorption and observed that both the groups were comparable on basis the degree of root resorption .[7]

Costopoulos and Nanda in their study evaluated the root resorption was during intrusion by means of periapical radiographs. in their study they used Burstone intrusion arch in 17 patients and compared it with compared with 17 patients treated with continuous archwires. A mean resorption value of 0.6 mm was found among patients using the intrusion arch, but only 0.2 mm among those with continuous archwires. Their study showed that Burstone intrusion arch used for intrusion was found to be effective in reducing overbite, while causing only a small amount of root resorption.[8]

Aras et al [9] in their study used CBCT to compare the the root resorption and treatment efficiency of two different mini-implant-assisted modalities in intruding the maxillary incisorsthey found that , the central incisor were more prone to root resorption than lateral incisors whereas Dermaut and De Munch found no difference between them. [10]

CONCLUSION

Many previous studies also shows that comprehensive orthodontic treatment using heavy forces can lead to increased root resorption.[11] In present study although no significant changes were seen on comparing both the groups however in orthodontic treatments, it is strongly advised to use light forces and to leave longer gaps between activations. Serial radiographs taken every 6–12 months may assist detect early root resorption, and if resorption is detected, a two–three month break from treatment with a passive arch wire may assist prevent further resorption.

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