

To Determine Correlation between Magnitude Of Overbite And Type Of Orthodontic Intrusive Technique Followed For Carrying Out Maxillary Anterior Tooth Intrusion

Research Article

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Abstract

Intrusion of maxillary anteriors is a critical aspect in resolving deep bite for patients with unfavourable growth patterns. It is essential to carry out appropriate treatment methods to obtain the required changes respectively. The aim of this retrospective prevalence study was to determine the most commonly used orthodontic techniques for anterior intrusion and correlate the intrusive option selected with respect to the depth of the overbite. Patient records were analysed from March 2019 to June 2020 and patients visiting the Department of Orthodontics were identified for classification. The results were tabulated and grouped into figures using SPSS Software Version 20.0. Pearson's correlation coefficient was done to determine correlation between depth of overbite and type of intrusive mechanics used. Following that, a chi-square test was carried out to determine association between different mechanics employed within the subgroups themselves. From the patients who underwent orthodontic treatment, 32 patients were treated with segmental mechanics and 15 were treated with miniscrews. Out of 32, 5 cases were treated with Burstone's intrusion arch, 11 with Connecticut intrusion arch, 16 with Ricketts utility arch. Out of 15 miniscrews, 2 cases were treated with 2 mini-implants, 4 cases with 3 mini-implants, 5 cases with 4 mini-implants and 4 cases with 5 mini-implants. Utility arches were used in greater numbers for anterior intrusion than miniscrews. Ricketts utility arch is a more commonly used segmental utility arch. Segmental intrusive arches are used when the magnitude of deep bite is from 7.2-9mm in most instances and implant mechanics are carried out when the magnitude of deep bite is from 6.5-8mm in most instances. Both intrusion arches and implant-aided mechanics were statistically insignificant when compared to the overbite depth. Hence, both type of mechanics can be used for successful treatment.

Keywords: Intrusion; Utility Arches; Mini-Implants; Segmental Mechanics.

Introduction

Correction of a deep overbite with incisor intrusion is an important stage during orthodontic treatment. Nonsurgical correction of deep bite involves either extrusion of posterior teeth, intrusion of incisors or both [1]. The treatment of choice depends on a variety of factors such as smile line, incisor display and vertical dimension. The treatment for patients with normal vertical development and gummy smiles involve maxillary incisor intrusion. Conventional methods of incisor intrusion usually include 2x4 appliances such as utility arches, 3-piece intrusion arches, or re-

verse curved arches [2]. Labial tipping of the anterior teeth is commonly the outcome of these arches and gives the impression of deep bite correction from the change in the vertical incisal edge portions [3]. However incisor protrusion is not the desired effect in patients with normal axial inclinations and in extraction patients who will need incisor retraction [4]. The introduction of skeletal anchorage as a source of stationary anchorage to orthodontic forces has made complex tooth movements simpler [5]. Because of their relatively small dimensions, miniscrews offer the advantages of immediate loading, multiple placement sites, relatively simple placement and removal, placement in interdental

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areas where traditional implants cannot be placed and minimal expenses for patients [6].

Miniscrews can be loaded to forces upto 500g and yet stay intact until the end of treatment. Two case reports have been published showing miniscrew-supported incisor intrusion [7]. Moreover in a clinical study that incorporated the records of some patients, it was shown that true incisor intrusion can be achieved with simple mechanics via miniscrews with minimal protrusion of the anterior teeth [8]. However, orthodontic literature lacks comparative clinical studies on the effects of miniscrew-supported incisor intrusion and conventional methods. In this prevalence study, the aim was to compare the usage of utility arches or miniscrews for anterior intrusion in patients visiting Saveetha Dental College and wanted to assess the more commonly used intrusion technique in growing patients.

Materials and Methods

This was a prevalence study conducted retrospectively in Saveetha Dental College, Chennai. The samples for the study were obtained from the patient records that were taken from the Department of Orthodontics. The number of patients undergoing orthodontic treatment specific to the study need. The obtained samples under orthodontic intrusion were divided into two groups as : miniscrew-assisted intrusion and segmental mechanics for intrusion. The samples were chosen from June 2019 to the end of March 2020.

The internal validity of the study can be done by the same sample examination to assess for error and external validity to check by examiner and guide. Data collection was done for orthodontic patients and this data was verified by two examiners. The records were tabulated in an excel sheet. Statistics were carried out for the collected samples using SPSS Software Version 20.0 and the prev-

alence variables were checked appropriately. Pearson’s correlation test was done to determine the correlation between overbite and type of intrusion mechanics employed. Chi-square test was done to determine the association between different intrusive arches and different numbers of implants used with relation to the overbite. The independent variables for this study was the amount of intrusion obtained and the dependent variables for this study was the method employed for intrusion (miniscrews or segmental mechanics). The mean value for statistical significance was fixed at $p < 0.05$ for both the groups in the study.

Results and Discussion

A total of 47 cases were obtained of which 32 were treated with segmental mechanics and 15 were treated with miniscrews. No gender discrimination was made in the two groups. All the population was taken for Dravidian Population. The various intrusion arches employed in the study while utilizing segmental mechanics were Burstone’s three-piece intrusion arch, Connecticut intrusion arch and Ricketts utility arch. At the same time, a varying number of implants were used for intrusion. These were the confounding factors in the study. Out of the 32, 5 cases were treated with Burstone’s intrusion arch, 11 with Connecticut intrusion arch and 16 with Ricketts utility arch. Out of the 15 miniscrew cases, 2 patients were treated with 2 mini-implants, 4 patients with 3 mini-implants, 5 patients with 4 mini-implants and 4 patients with 5 implants. The results were analysed statistically using SPSS Software (Version 20.0) using figures and pie charts and prevalence rates were obtained. Both intrusion arches and implants were statistically insignificant in comparison with the magnitude of overbite (0.564 and 0.598 respectively). Pearson’s correlation test was done to determine correlation between overbite and segmental mechanics used (Table 1). The correlation was 0.137 indicating greater positive correlation than when implant mechanics were used 0.125 (Table 2). Chi-square test was done to determine as-

Table 1. Pearson’s correlation test to determine correlation between overbite and type of intrusive mechanics used (Intrusion arches).

		INTRUSION ARCH	OVERBITE
INTRUSION ARCH	Pearson Correlation	1	0.137
	Sig. (2-tailed)		0.564
	N	20	20
OVERBITE	Pearson Correlation	0.137	1
	Sig. (2-tailed)	0.564	
	N	20	20

Mean values are significant at $p < 0.05$
The correlation between intrusion arch used and overbite is 0.137

Table 2. Pearson’s correlation test to determine correlation between overbite and type of intrusive mechanics used (Implants used).

		IMPLANT MECHANICS	OVERBITE
IMPLANT MECHANICS	Pearson Correlation	1	0.125
	Sig. (2-tailed)		0.598
	N	20	20
OVERBITE	Pearson Correlation	0.125	1
	Sig. (2-tailed)	0.598	
	N	20	20

Mean values are significant at $p < 0.05$
The correlation between implant mechanics used and overbite is 0.125

sociation between individual appliances used within the groups for treating deep bite. A linear line-by-line association was used to determine the variable values. The association was greater with implants (0.584) (Table 3) than with segmental mechanics (0.550) (Table 4) indicating a greater number of implants needed. Within the groups, the type of subgroups employed was statistically insignificant for the implant group (0.749) with respect to the likelihood ratio than for the intrusive arch group (0.450). There is a

very negligible correlation between depth of overbite and type of mechanics used (Figure 1&2).

Deep Bite is a complex orthodontic problem that needs to be corrected at the beginning of treatment [9]. The position of the maxillary incisors, especially with the upper lip is a key factor in determining the type of treatment, since overbite correction with maxillary incisor intrusion in patients with insufficient incisor

Table 3. Chi-square test to determine association between deep bite and type of intrusion arch used.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.167 ^a	26	0.566
Likelihood Ratio	26.241	26	0.45
Linear-by-Linear Association	0.357	1	0.55
N of Valid Cases	20		

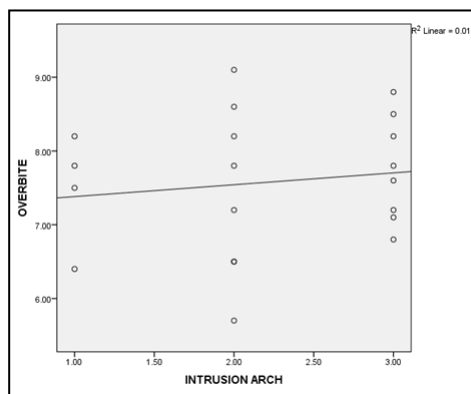
Line-by-line association between deep bite and intrusion arch used is 0.55

Table 4. Chi-square test to determine association between deep bite and number of implants used.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49.352 ^a	45	0.303
Likelihood Ratio	38.324	45	0.749
Linear-by-Linear Association	0.299	1	0.584
N of Valid Cases	20		

Line-by-line association between deep bite and number of implants used is 0.584

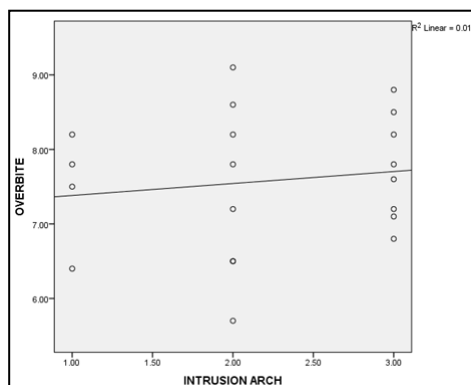
Figure 1. Scatter plot to determine the correlation between degree of overbite and intrusion arches used.



Mean values are significant at $p < 0.05$

There is a very negligible correlation between depth of overbite and intrusion arch used ($p = 0.564$)

Figure 2. Scatter plot to determine the correlation between degree of overbite and number of implants used.



Mean values are significant at $p < 0.05$

There is a very negligible correlation between depth of overbite and number of implants used ($p = 0.598$)

display leads to flattening of the smile arc and reduces smile attractiveness.

However, deep bite patients with at least a 4mm closure of the maxillary incisors with the lower lip and a gummy smile need to be treated with intrusion of the maxillary incisors. The groups in this study were selected according to this criteria [10]. Conventional intrusion arch mechanics frequently cause labial tipping of the incisors which does not always give favourable treatment outcomes. The counteracting moments in the molars are frequently inevitable. Reinforcement of posterior teeth by using rigid stainless steel arches was recommended to minimize the movement of the posterior anchorage unit by Burstone and was successful for this segment [11]. However, anterior protrusion during intrusion still can hardly be avoided [6]. The application of intrusion arches directly from miniscrews offers an efficient alternative to 2x4 arches and it has been shown that intrusion with minimal protrusion can be achieved [12]. However to date, no clinical studies have compared the effects of miniscrews and conventional intrusion arches for incisor intrusion.

Despite the advantages of miniscrews, its reliability in young children is still unknown. Stability is a very important issue and that significantly affects the treatment mechanics used. The potential difference in treatment response between these patients lies in the amount of vertical growth potential for the growing patients [13]. However, a look at the change in overbite during adolescence could enlighten this problem. Bjork showed decreases in overbite through adolescence [14]. Bergensen also found decreases in overbite between ages 12-18 years [15]. According to Sinclair and Little, overbite increases from 8-13 years and decreases from 13-20 years for untreated normal growing subjects [16]. The amount of overbite increase during the transition from mixed dentition to permanent dentition was 0.4mm and the reduction during maturation of permanent dentition from 13-20 years was 0.59mm. The decrease in overbite expected during growth would be beneficial for both overbite reduction and retention of patients in the intrusion arch group.

Packer et al., and Kinzel et al found similar amounts of protrusion during maxillary incisor intrusion with conventional mechanics [17]. The minimum amount of protrusion shown in the literature was by Weiland et al , who found 2.350 of protrusion using intrusion base arches [18]. Labial tipping was close to these values. However, Van steenberg et al found about 8 degrees of incisor protrusion using the same arch. The main difference lies in the resultant force vector in the miniscrew group. In vitro studies with different methods such as laser-reflection technique, holographic interferometry have been employed that have shown that intrusive force could be applied close to the centre of resistance of the 4 incisors by placing the screws laterally to the maxillary lateral incisors [19]. Differences in directions of force application and measurements could interfere with results obtained with previous studies [20]. Orthodontic literature includes only 3 case reports of maxillary incisor intrusion with miniscrews [7]. Kanomi reported intrusion of 6mm in 4 months for mandibular incisors. Ohnishi et al also obtained incisor intrusion relative to the lower lip [19]. Kim et al applied a segmental intrusive force between the maxillary central incisors. The incisors were protruded by 18 degrees relative to the F-H plane.

The maxillary first molars showed no movement in the miniscrew

group. Since the intrusive force was given with a tip back bend in the utility arch, the maxillary molars were tipped back distally [1]. Crown movement was minimized by constraining the arch with a cinch-back bend but mesial root movement was seen. The most important drawback of intrusion mechanics is root resorption [21]. Root resorption can hardly be detected earlier than 6 months with conventional radiographs [22]. Perhaps a measurement of root density by using CT scans could be useful. Clinicians are frequently prudent in using miniscrews and find the procedure to be invasive [23]. However, the introduction of miniscrews has simplified most orthodontic mechanics and reduced treatment time by minimization of unwanted side effects [24]. The side-effects are minimal and patient acceptance was positive. However long-term effects should be evaluated.

Conclusion

Intrusion of incisors by using miniscrews was beneficial in minimizing incisor protrusion. However in growing children, intrusion arches are preferred over miniscrews for deep bite correction. Ricketts utility arch is the most commonly used intrusion arch and for miniscrew application, 4 miniplates are commonly used.

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