Journal of Biomedical Engineering MANUSCRIPT
ISSN: 1001-5515 Vol. 40 No. 3 (2023)

Assessment of Retraction and Intrusion in Class II Division 1 case with and without Corticotomy Procedures – An In Vivo Study

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Abstract:

Background: Time duration is an important concern for the adult who seeks orthodontic treatment. As there is an increased chance of hyalinization and periodontal complications, this makes treatment challenging for them. It necessitates the use of lighter forces, a shorter time, and more precise tooth movements. To overcome these time limitations, various surgical techniques have been developed. One of the earliest surgical possible techniques is orthodontic treatment combined with corticotomy. So, this study was undertaken to evaluate the rate of retraction and intrusion with and without corticotomy in Angle's Class II division 1 malocclusion patient.

Material and Method: 20 patients with Angles Class II Division 1 malocclusion, aged (18-30) years were selected. They were divided into 2 groups (10 each)- experimental who receive corticotomy procedures and a control group. The rate of retraction and intrusion was measured radiographically.

Result: Rate of retraction in control group (0.8 ± 0.13 mm/month) and in experimental group (1.1 ± 0.13 mm/month).Pre and post-observation mean amount of intrusion for the control group was (27.8 ± 1.48 mm and 26 ± 1.33 mm), whereas for the experimental group was (27.7 ± 2.26 mm and 25.5 ± 2.32 mm) respectively.

Conclusion: Patients with corticotomy showed 1.1 mm/month of the rate of retraction and 2.2 ± 0.42 mm of intrusion of incisors, which was statistically highly significant to the control group with a retraction rate of 0.8 mm/month and intrusion 1.8 ± 0.71 mm

Keywords: Class II malocclusion; Corticotomy; Modified Burstone Three-piece intrusion arch.

1. Introduction

Angle's Class II malocclusion is of keen interest to practicing orthodontists since they constitute a significant percentage of the cases. In India, it has been reported that there is a definite ethnic trend in the prevalence of these types of malocclusion. Its relatively more prevalent in the North Indian population (10-15%), compared to South India (5%).[1]

DOI: 10.105515/JBE.40.3.21

The treatment objective is to correct the skeletal, dental, and functional mal-relationship. In the undertaking of this process, we hope for the permanence of result, a satisfactory relationship, and maintenance of the Jacksons triad. All this is a large order, and orthodontists have not been uniformly successful in attaining their objectives.[2] So, numerous treatment protocols have been advocated for the management of Class II malocclusions because they do not constitute a single diagnostic entity. These treatment modalities include a variety of fixed appliances, extraction procedures, extraoral traction, arch expansion appliances, surgery, and many more.[3,4] Likewise, deep overbite has commonly seen in children and adults, needs a proper treatment plan.[5]

However, 21st century widens the horizon of orthodontic treatment from simply moving the teeth to a more esthetic-oriented goal, as more and more adults are seeking treatment. Among adults and adolescents, they have several psychological, biological, and clinical differences; for instance, adults have more specific objectives and concerns related to facial and dental aesthetics, the type of orthodontic appliance, and the duration of treatment.[6] In adults, there is an increasing chance that hyalinization will occur during treatment. In addition, cell mobilization and conversion of collagen fibers are also slower. So, they are more prone to periodontal complications since their teeth are confined in the non-flexible alveolar bone. These considerations make orthodontic treatment of adults different and challenging as well as necessitate special concepts and procedures.[7] To overcome these time limitations, and accelerated orthodontics having various techniques like dentoalveolar osteotomy, corticotomy, distraction osteogenesis have been developed to facilitate rapid dentofacial movements. One of the earliest surgical techniques, introduced by Bryan in 1892 was designed to correct dental malocclusion and promote rapid tooth movement.[8] One possible method for completing treatment in a shorter period is through orthodontic treatment combined with corticotomy.[9]

Another problem of Class II malocclusion patients was deep overbite. So, to correct deep bite intrusion arches could be used. Burstone (1977) invented the segmented arch technique for intrusion.[10] Intrusive tooth movement appears to be most effective with a low magnitude of forces of 12-15 gms.[11] An essential feature of the intrusion arch is that it applies force via a single point of contact with incisors, making it a statically determinate force system.

Flared incisors and deep overbite are challenging to treat. So, it can be done by modified Burstone three-piece intrusion arch. The simultaneous intrusion of the incisors along their long axis as well as their retraction can be achieved with the use of a three-piece intrusion arch.

Thus, this study aimed to evaluate the rate of anterior retraction using the decortication procedure and simultaneous intrusion using modified burstone three-piece intrusion arch in Angle's Class II division 1 patient.

2. Materials And Method

20 patients were selected from the archives of the Dental College. Patients aged from 18-30 years of age with good, healthy periodontal conditions and no previous history of orthodontic treatment and diagnosis of Angles Class II division 1 malocclusion were included in the study. The research design was a prospective randomized control clinical study.

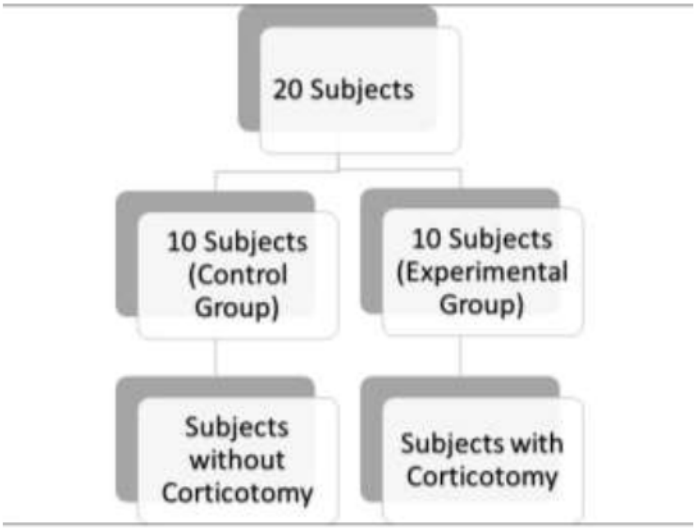

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FIGURE 1: STUDY DESIGN

Patients and parents were explained and informed with written consent and a clearance form from Ethical Committee was obtained.

In the control group after extraction of the upper first premolars, simultaneous intrusion and retraction of the arch were carried out by modified Burstone three-piece intrusion arch, whereas in the experimental group, the surgical acceleratory process- corticotomy was performed before space closure than simultaneous intrusion and retraction were done. The rate of anterior retraction and intrusion of teeth was observed for 6 months.

Surgical Procedure:[9]

- Full-thickness mucoperiosteal flaps were extended from midline up to mesial of the upper second premolar and no flap elevation was performed on the palatal side.
- Selective alveolar decortication between the distal of canine to the contralateral side was performed.
- Vertical cuts were 0.5 mm in-depth and extended approx. 2mm beyond the apices.
- Nano Crystalline Hydroxyapatite bone grafting material (SYBOGRAFTM) was placed over the injured bone.
- The mucoperiosteal flaps were replaced and sutured and were removed after one week.
- Modified Burstone three-piece intrusion arch was delivered for simultaneous intrusion and retraction one week after the surgery.

FIG 2: SURGICAL PROCEDURE

After insertion of the modified burstone three-piece intrusion arch. The rate of anterior retraction and intrusion was measured cephalometrically during a 6-month duration.

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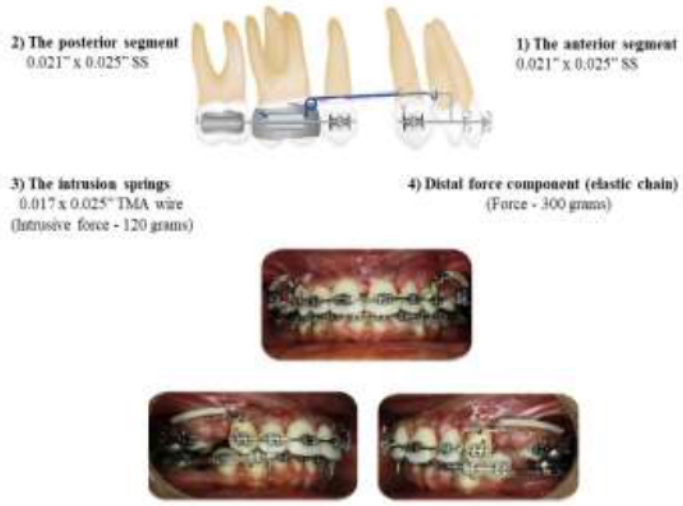

Figure 3: modified burstone three-piece intrusion arch

3. Statistical Analysis

All statistical analyses were performed using version 20.0, SPSS Inc, Chicago, III. Paired t-test measured the incisor retraction between both the groups and the unpaired t-test compared the treatment changes. A 'p' value of < 0.05 was set for statistical significance.

The error of Measurement was determined by, 10 randomly selected cephalograms were retraced, and all measurements were repeated to estimate the repeatability of the measurements. Reproducibility coefficients were found greater than 0.90 for both linear and angular measurements, which did not reveal any measurement error.

4. Results

The rate of retraction of the anterior segment in the control group was 0.8±0.13 mm/month, whereas in the experimental group was 1.1±0.13 mm/month. The mean difference in the rate of retraction was found to be 0.3 mm/month. (Table 1) Total mean retraction after 6 months was found to be 4.8 mm in the control group and the experimental group was 6.6 mm.(Graph 1).

Table 1: Rate Of Retraction

Study groups	Mean SD (mm/month)	Mean difference	p* Value, Significance
Control Group	0.8 ± 0.13	0.3	p<0.001 (HS)
Experimental Group	1.1 ± 0.08		

*Student's unpaired *t*-test

GRAPH 1: RATE OF RETRACTION

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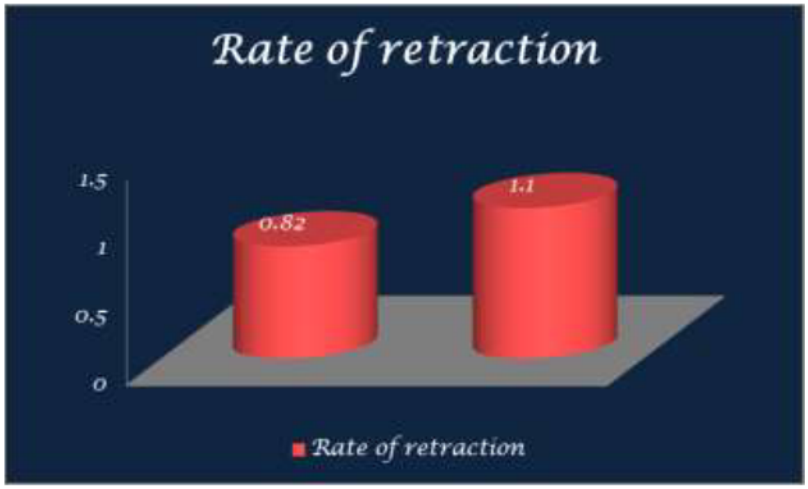


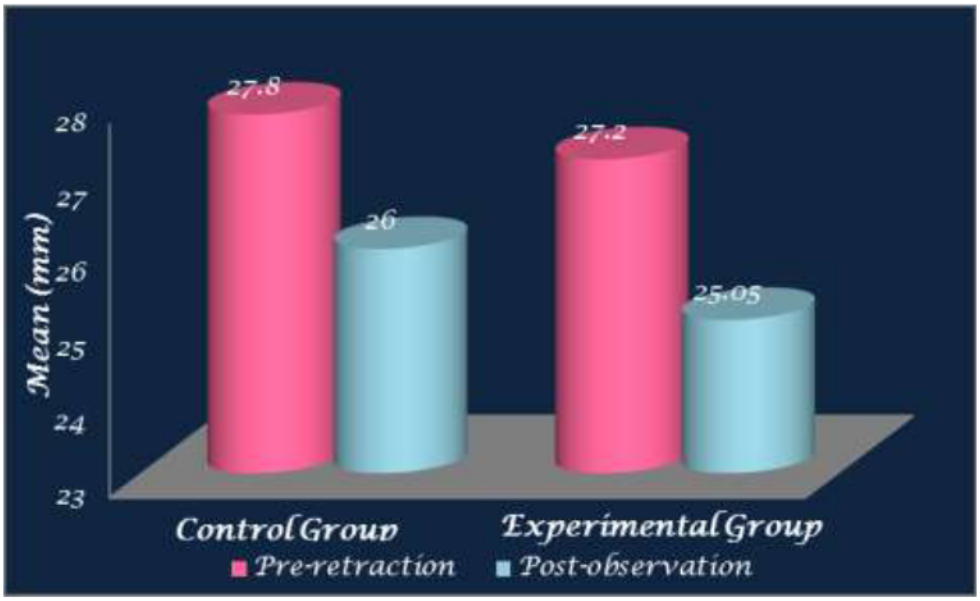
The amount of intrusion pre and post-observation for the control group was 27.8 ± 1.48 mm and 26 ±1.33 mm respectively, whereas for the experimental group was 27.7 ± 2.26 mm and 25.5 ± 2.32 mm. The Control group showed 1.8 ± 0.71 mm of intrusion of incisor whereas the experimental group showed 2.2 ± 0.42 mm of intrusion of incisors during the same phase. The mean difference between two groups between pre-retraction and post-observation phase was 0.4 mm shown in Table 2 and Graph 2.

Table 2: Amount Of Intrusion (U1-Nf)

Study groups U1-Nasal Floor	Mean Values (in mm)		Mean Diff. (in mm)	p* value Level of Significance
	Pre-Retraction (T1)	Post-Observation (T2)		
Control Group	27.8 ± 1.48	26 ± 1.33	1.8 ± 0.71	p<0.05
Experimental Group	27.7 ± 2.26	25.5 ± 2.32	2.2 ± 0.42	

*Student's unpaired *t*-test

GRAPH 2: ASSESSMENT OF RATE OF INTRUSION



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There was a statistically highly significant difference seen in the amount of intrusion between the control group and the experimental group ($p<0.001$).No significant difference in the values obtained for males and females within each group.

Discussion

A paradigm shift in the various treatment modalities to decrease the overall treatment time is occurring. However, in Angle's Class II division 1 malocclusion with extraction protocol on an average takes 21 to 27 months.[6] To accelerate the treatment modality several novel approaches have been tried, which includes: distraction osteogenesis, low-level laser therapy, MOP, mechanical vibrations, and corticotomy.[13]

Corticotomy is an effective and safe method to accelerate orthodontic tooth movement.[14] It's a surgical procedure whereby only the cortical bone is cut, perforated, or mechanically altered, the medullary bone is not altered. Kole's in 1959 first described the modern-day corticotomy-facilitated orthodontics technique.[8,12] In this study, corticotomy cuts were performed only on the labial cortical plate. Wilcko et al recommended placing cuts on both the buccal and lingual cortical plate.[15] But, Germac D et al used a modified corticotomy technique for retraction of the lower anterior. The vertical cuts were placed only on the desired labial cortical plate, and a thin chisel was used to reach the lingual cortical plate from the labial side.[16] Similar conservative approach was used in the study.

Wilcko et al started retraction two weeks after the surgery.[15,17] Contrary to this, Chung et al started retraction immediately after corticotomy. [18] Prabhakar R et al had given Burstone a three-piece intrusion arch for simultaneous intrusion and retraction of anterior segment soon after a week of periodontal surgery.[19] Similarly, intrusion and retraction of the anterior segment were started one week after corticotomy.

In Class II division-1 malocclusion, both deep-bite and excessive overjet need to be corrected. If required intrusion and retraction of anterior teeth with maximum molar anchorage. Burstone three-piece intrusion arch makes it possible to intrude flared incisors and retract these teeth simultaneously. An intrusive force applied parallel to the long axis of incisors and lingual to the center of resistance of the anterior teeth. So, the resultant intrusive force is redirected in a more lingual position. As a result of the clockwise moment was produced, that will simultaneously intrude and retract.[20]
60 grams of intrusive force are applied on the right and left sides. The small distal force of 150 gm is added by placing an elastomeric chain extending from the molars to the anterior segment of wire on each side which was similar to the force applied by Reddy C et al on treating bimaxillary protrusion cases after corticotomy.[21] The mean rate of retraction of anterior teeth in both groups was compared and a significant difference was noted between the control group and experimental group.

Goel P and Tandon R compared the amount of intrusion of maxillary incisors by three different intrusion techniques i.e Rickett's utility arch, Kalra's Simultaneous Intrusion & Retraction arch, and arch with Reverse Curve of Spee. The mean true incisor intrusion achieved with utility arch was 1.6 mm, with KSIR arch 1.25 mm and with RCS 0.70 mm respectively.[22] In the present study mean amount of intrusion achieved in the control group was 1.8 ± 0.71 mm and in the experimental group, was 2.2 ± 0.42 mm which was slightly more compared to the control group at the end of 6 months observation period.

In the present study, only Class II Division 1 malocclusion patients with specifically defined parameters were selected. So, the results cannot be arbitrarily extrapolated to the success that can be achieved with other categories of malocclusions such as those characterized by growth patterns. Since the sample size was limited and the results might not be the same with a larger sample size, further investigation is necessary to elucidate.

5. Conclusion

When treatment is prolonged, a continued high degradative activity with osteoclasia causes severe root resorption.[23]Therefore, control of treatment time is of importance in most cases when the intrusion of the maxillary incisors is performed. Thus it can be stated that corticotomy can assist in achieving the required intrusion and retraction in a shorter time with more predictable results.

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