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Assessment of Anchor Loss during Corticotomy Assisted Orthodontic Tooth Movement

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Abstract: ***Introduction: Corticotomy-facilitated orthodontics provides a means for rapidly moving teeth purportedly with little damage to the periodontium and with reduced treatment duration. Our aim was to enhance the orthodontic tooth movement by reducing the cortical bone layer. The purpose of this study is to assess the amount of anchor loss during corticotomy assisted enmasse retraction. Material and Method: 8 patients with angles class I and class II malocclusion with maxillary crowding requiring maxillary first premolar extraction were selected for the study. Full thickness flaps were raised. Corticotomy was performed in the maxillary anterior segment along with undermining of cortical bone distal to canine. Synthetic graft was placed and flap was repositioned with the help of sutures. Orthodontic force was applied 2 weeks later. Enmasse retraction was done using active tie-backs. Results: There was minimal anchor loss during corticotomy assisted orthodontic tooth movement. Conclusion: CAOT is a promising technique that has many applications in the orthodontic treatment of adults because it helps to overcome many of the current limitations of this treatment, including lengthy duration, potential for periodontal complications, lack of growth and the limited envelope of tooth movement.***

Keywords: Corticotomy assisted orthodontics, PAOO, speedy orthodontics, wilckodontics, AOO

1. Introduction

The development of corticotomy-assisted orthodontic treatment (CAOT) opened doors and offered solutions to many limitations in the orthodontic treatment of adults. This method claims to have several advantages. These include reduced treatment time, enhanced expansion, differential tooth movement, increased traction of impacted teeth and, finally, more post-orthodontic stability.

Surgically facilitated orthodontics is a 100 year old concept, first proposed by Cunningham that has evoked a progression of surgical refinements designed to accelerate orthodontic tooth movement, limit the quantity and pathologic potential of the inevitable bacterial load, enhance stability, and reduce the morbidity of orthognathic alternatives.

Kole in 1959 introduced a surgical procedure involving both corticotomy and osteotomy to accelerate orthodontic tooth movement, based on the concept that teeth move faster when the resistance exerted by the surrounding bone is reduced via a surgical procedure.[1]

Duker performed Kole's study on dogs and stated that weakening the bone by surgery and consequent orthodontic treatment reduces the dangers of injury to periodontal attachment and pulp.[2]

First coined by Frost, the regional acceleratory phenomenon RAP is a collection of physiological healing events. Some of the features of RAP include accelerated bone turnover and decreased bone density[3]. Yaffe et al suggests that RAP in humans begins with few days of surgery, typically peaks at 1 to 2 months and may take from 6 to 24 months to subside. They characterized the initial phase of RAP as increase cortical bone porosity because of increased osteoclastic activity and speculated that bone dehiscence might occur after periodontal surgery in an area where cortical bone is initially thin. They summarized that RAP might be contributing factor to increased mobility of the teeth after periodontal surgery.[4]

Suya in 1991 explained that most orthodontic tooth movement should be completed in the first three to four months after corticotomy and before the fusion of tooth-bone units[5].

A more recent surgical orthodontic therapy was introduced by Wilcko et al. which included the innovative strategy of combining corticotomy surgery with alveolar grafting in a technique referred to as Accelerated Osteogenic Orthodontics (AOO) and more recently to as Periodontally Accelerated Osteogenic Orthodontics (PAOO). Reports indicated that this technique is safe, effective, and extremely predictable, associated with less root resorption and reduced treatment time, and can reduce the need for orthognathic surgery.[6]

Corticotomy and osteotomy were used in orthodontics primarily to resolve crowding in a shorter period of time. Several authors have described cases in which moderate and severe crowding was treated without extraction by corticotomy/ osteotomy-assisted orthodontics and in shorter periods of time. It has been shown that corticotomy is efficient in reducing the treatment time to as little as one/fourth the time usually required for conventional orthodontics. Meeting the demands of adults for speedy orthodontic treatment, this futuristic technique has created a wave of interest amongst the patient as well as orthodontist. This has opened the windows for evaluating Corticotomy accelerated orthodontic treatment. Hence the study was undertaken.

2. Method

8 orthodontic patients (5 females and 3 males) who needed orthodontic treatment with extraction of upper first pre molar were included.

The patients aged ranged from 15 – 27 years.

Corticotomy was carried out in maxillary arches of all the patients after extraction of both upper first pre molars.

Selection Criteria

Inclusion Criteria

1) Patients were explained about the procedure and written consents were obtained for the same.
2) Patients with good periodontal condition were selected.
3) Patients with high density of bone were selected.
4) Patients with class I/II malocclusion with crowding were selected.
5) Patients requiring first premolar extraction as part of orthodontic treatment were selected.

Exclusion Criteria

1) Patients with poor periodontal health.
2) Patients with medically compromised condition.
3) Patients with osteoporosis.
4) Treatment would be terminated on signs and symptoms of excessive pain, root resorption or devitalization.
5) Non co-operative patients.

3. Clinical Procedure

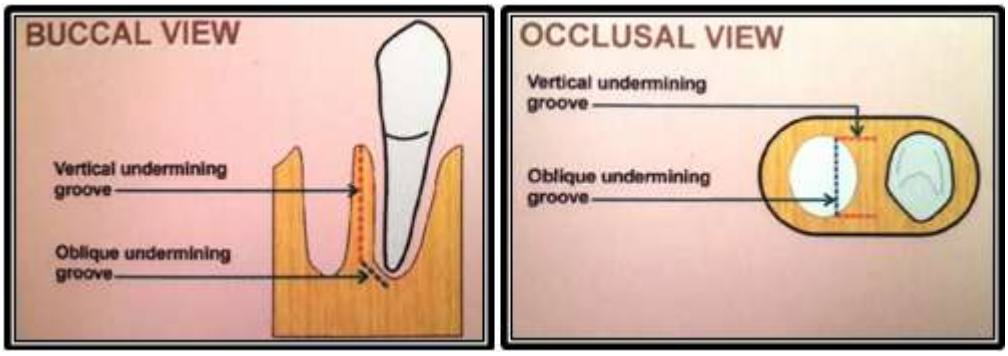
8 orthodontic patients who were willing to take orthodontic treatment were taken for the study. 0.22 slot MBT prescription brackets were used in the study. Surgery was performed under local anesthesia.

First premolars were extracted. Sulcular incision full thickness mucoperiosteal flaps were reflected on buccal aspect, flaps were reflected beyond the apices of the anterior teeth.

Selective decortication was performed on buccal aspect with the help of no.1 or no.2 round bur of high speed handpiece, depth of the cuts was around 1.5 to 2 mm.

Vertical corticotomy cuts stopping just short of alveolar crest were made between the teeth and those cuts were connected beyond the apices of the teeth with scalloped horizontal corticotomy cut.

Numerous corticotomy perforations were made in the cortical layer around 0.5mm in depth.



- Lateral cephalograms were taken before the first premolar extraction and after space closure.
- Cephalometric tracings were traced and maxilla was superimposed and mesial movement of the first molar was calculated.

4. Results

Determination of Anchor Loss

Pre-treatment cephalograms and post space closure cephalograms were obtained and tracings were done. Vertical line was dropped from Ptm. And distance from distal of upper first molar was calculated. Difference in values of pre and post treatment cephalograms was the amount of anchor loss.

Pre and post space closure values were compared by paired t test.

Pre-treatment values

Post space closure values

Mean= 20.63±1.69(SD)

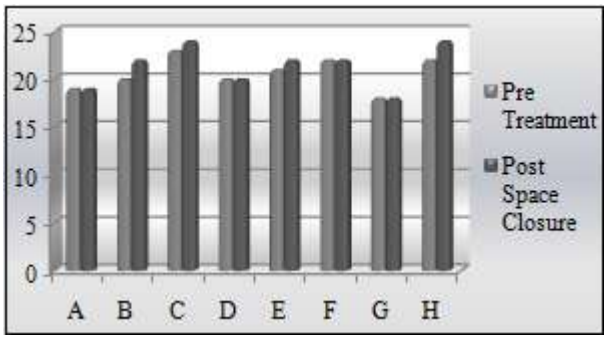
Mean= 21.00±2.08(SD)

P= 0.1030

The difference was not statistically significant.

Table 7: Pre and post space closure values

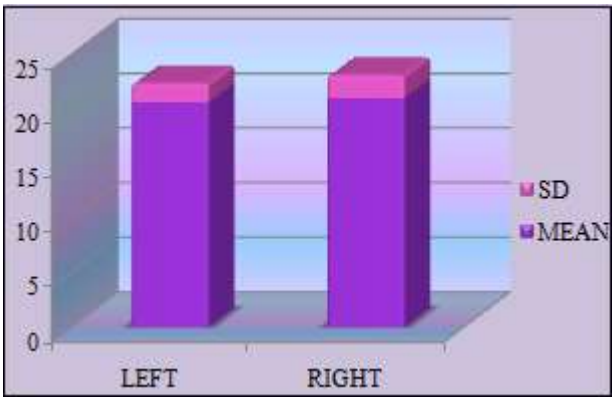
	Anchor Loss	
	Pre treatment	Post space closure
A	19	19
B	20	22
C	23	24
D	20	20
E	21	22
F	22	22
G	18	18
H	22	24



Graph 8: Pre and post space closure measurements

Table 8: Comparing mean of anchor loss

	Mean	SD	SEM	P Value	T value	Results
Pre Treatment	20.63	1.69	0.60	0.1030	1.9215	NS
Post Space Closure	21.00	2.08	0.79			



Graph 9: Mean of pre-treatment and post space closure values

5. Discussion

Various authors have given various methods of determining the anchor loss some renowned are Lotzof L.P. and Fine H.A. palatal plug method and Rickets cephalometric method[8].

AmirParviz R. Davoody measured the efficacy of anchorage control between differential moment's mechanics and temporary anchorage devices in a clinical trial. Lateral cephalograms were taken before and after incisor retraction. The ratio of molar protraction to incisor retraction was calculated and intra group and intergroup changes in upper lip, maxillary incisor and molar position were analyzed by paired and independent t-tests. He concluded that both anchorage modalities show statistically significant retraction of the lips during treatment[9].

Silvia Geron studied the factorial response which is responsible for the anchorage loss. For the measurement of anchorage loss he used two methods one is radiographic method in which he uses lateral cephalograms of pre and post treatment difference of the distal contact point of maxillary first molar to a line perpendicular to occlusal plane through sella. Other one is dental cast analysis in which they mark posterior ruga point and the mesial contact point of first molar and midpalatal raphe was used to construct a median reference line. Then these casts were photocopied at 200% enlargement. He measured the distance between two points. The difference between pre and post treatment length is the anchorage loss. Study suggested that incorporation of second molars in the anchorage strategy, low retraction forces, and frictionless mechanics are superior to the conventional means. They calculated the anchorage loss 0.5mm/year for the females and 0.9mm/year for the males[10].

Wook Heo did the comparison of the anchorage loss in En Masse retraction and two step retraction of maxillary anterior teeth in adult class I women patient. He also gave the different methods to calculate the anchorage loss by plotting ptm vertical and measuring the distance from 1st molar. Also measured anchor loss by measuring the distance traveled by the mesial of first molar to palatal plane. This is very simple and efficient method to determine the anchor loss[11].

Eric JW Liou, and C. Shing Huang retracted canine by distraction of periodontal ligament and observed the average mesial movement of the first molars was less than 0.5 mm in 3 weeks. Seventy three percent of the first molars did not move mesially, and 27% of them moved mesially less than 0.5 mm on the cephalometric superimposition. The average mesial movement was 0.1 mm in the maxillary first molars, and 0.2 mm in the mandibular first molars, respectively[12].

John V Merson has shown molar distalization with segmental corticotomy around the molars, the anchorage value and resistance of molar to distal movement is effectively reduced with no any extra anterior anchorage device required. Because corticotomy increases remodeling at the localized site only this may be the reason for increase in anchorage because anchorage also depends upon bone density[13].

In this study, we have taken lateral cephalograms before the treatment and after the completion of retraction. Tracings were made of that cephalograms. And the horizontal distance from the pterygoid vertical (perpendicular to FH plane) to the distal surface of the first molar is measured. Anchor loss is calculated by subtracting pre and post retraction values.

The anchor loss in the present study was minimal i. e. 1.25mm which was statistically non-significant.

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