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RELIABILITY OF LATERAL CEPHALOGRAM VERSUS STUDY CAST IN ASSESSMENT OF ANCHORAGE LOSS WITH CORTICOTOMY

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ABSTRACT:

Objectives: *The aim of the study was to compare the effectiveness of lateral cephalogram and study cast measurements in assessment of anteroposterior molar movement with corticotomy assisted en masse retraction.*

Materials and Methods:

This retrospective study was done on pre and post treatment study casts and lateral cephalograms of previously treated twenty female patients, age range (18-25 years) with Class II division 1 malocclusion where orthodontic treatment entailed extraction of upper first premolars. Patients were orthodontically treated with preadjusted edgewise appliances. Anchorage was reinforced by transpalatal arch with engagement of second molar. En masse retraction of the maxillary anterior teeth using sliding mechanics. Flapless piezoelectric corticotomy was done. The anchorage loss was assessed through pterygoid vertical method on digitally traced lateral cephalograms. Maxillary casts were digitally scanned. The distance between medial end of third palatal rugae and central fossa of anchor molar was measured to evaluate the anteroposterior molar movement. Statistical Analysis was performed to compare the mean values of anchorage loss measured on lateral cephalograms and study models.

Results: *Anchorage loss measurements were statistically significant on both lateral cephalogram and study cast with corticotomy assisted en masse retraction. There was no significant difference between the mean horizontal movement of maxillary first molar measured on the lateral cephalogram and that was seen on the study cast.*

Conclusion: *Study cast was as reliable as lateral cephalogram in assessment of anchorage loss. Either of the methods could be used to measure anteroposterior tooth movement.*

Keywords: *Corticotomy, Anchorage loss, Study cast, Lateral cephalometry*

INTRODUCTION

One of the chief complaints in adult orthodontic patients is dentoalveolar protrusion. So, reduction of protrusive lips and facial esthetics improvements are major goals at orthodontic treatment with maxillary protrusion patients.[1]Extraction of the bilateral maxillary first premolars is a common approach in correcting a maxillary dentoalveolar protrusion, to allow space for retraction of anteriors and to reduce facial convexity and procumbency of lips.[2] Thus, in these patients anchorage loss should be wherever possible minimized.[3]Loss of anchorage after the extraction of premolar teeth has been classified based on the magnitude of the first permanent molars mesial movement during retraction of anteriors.[4]Adjunct appliances are used in maximum anchorage

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cases, such as miniscrews, Nance appliance, transpalatal arch, engagement of second molar and extraoral anchorage, are often used for molar anchorage reinfrocement.[5]Anchorage loss is a multifactorial reciprocal reaction to orthodontic treatment and is influenced by the degree of crowding, tooth movement types (tipping or bodily), age of the patient, angulation and length of root.[6]

Several treatment approaches and biomechanical techniques have been suggested over the past decades to achieve minimal or no anchorage loss during en-masse retraction of anterior teeth.[7] Corticotomy-assisted orthodontics development has provided new facilities to many orthodontic treatment limitations .[8]Although corticotomy is an old technique back to the early 1900s, it was not adequately introduced until the patent technique named Accelerated Osteogenic Orthodontics (AOO) was developed by Wilcko.[9] This technique enhanced tooth movement, subsequently decreasing treatment time through cortical bone injury via linear cutting and then orthodontic treatment is performed. [8]

Anchorage loss measurement have been classically done by superimposition of cephalometrics to determine the teeth movement with regard to stable reference points which has been considered the only reliable method.[10] However, the tracing process , superimposition and analysis of cephalometric radiographs is consuming for time, sensitive technique which require radiation exposure and consecutive radiographs of the same magnification which intercept many clinicians from taking these records routinely . Another anchorage loss calculating method is by comparing the consecutive study casts, taking the palatal rugae area as a stable landmark for linear values measurement.[11]

There is a little literature comparing the anchorage loss measurement accuracy which is measured on lateral cephalometric radiograph versus on the study model. Thus, the aim of this retrospective study was to compare the anteroposterior molar movement respective to the palatal rugae area as a landmark on the study casts with that measured on lateral cephalometric radiographs in corticotomy assisted maxillary en masse retraction cases.

Materials and Methods:

The proposed sample size in this study was 20 which had a power of 80% to yield a result which is statistically significant. Sample size estimation based on a previous study.[12] This comparative retrospective study was ethically approved from Research Ethics Committee of Faculty of Dental Medicine, Al Azhar University Girls Branch and it was carried upon pre and post treatment study casts and lateral cephalograms taken from files of previously treated twenty female patients at the outpatient clinic, orthodontic department and they were selected according to the following inclusion criteria:

- Class II division 1 malocclusion with ANB angle more than 5 degree, overjet more than 5mm with Age range (18-25 years) and orthodontic treatment entailed extraction of upper first premolars.

- Patients with healthy periodontium, the dental history was free from previous orthodontic treatment and the medical history was free from any diseases or medications.

Patients were orthodontically treated with preadjusted edgewise appliances (0.022 x 0.028 inch). Anchorage was reinforced by transpalatal arch (0.036 inch) with engagement of second molar .En masse retraction of the maxillary anterior teeth using sliding mechanics with an initial force of approximately 300 gm per side initiated immediately after the surgical procedure, activation was done every two weeks.

Flapless corticotomy was done using Piezotome (NSK VarioSurg3). Interproximal corticotomy cuts were done through gingival incisions with 3mm depth where they extended from distal surface of upper right canine to distal surface of left canine at the buccal and palatal cortical plate. (fig.1)The posterior segment (second premolar, first and second molar) was not decorticated to enable them to serve as an anchorage unit.

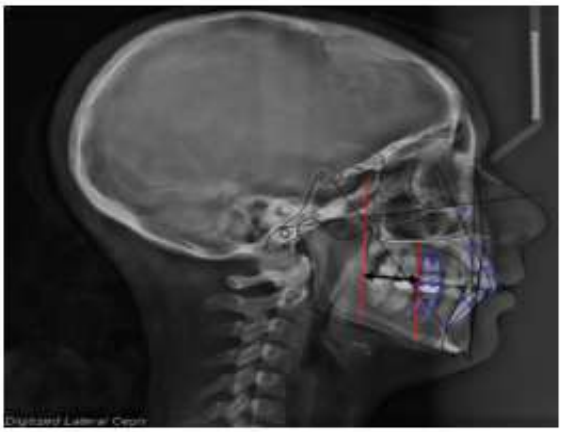
(Fig.1): Flapless corticotomy cuts at:
a) Buccal cortical plate **b) palatal cortical plate**

The cephalograms were digitally traced by a single researcher using (Dolphin imaging software). Anteroposterior movement of anchor molar in upper arch was measured by pterygoid vertical method such that the distance from pterygoid vertical to the most distal point on the distal surface of the anchor molar was measured. (Fig: 2)They were again reevaluated by the same examiner after a week for intraexaminer reliability and the arithmetical mean of these readings were taken as the standard value for statistical evaluation and assessment.

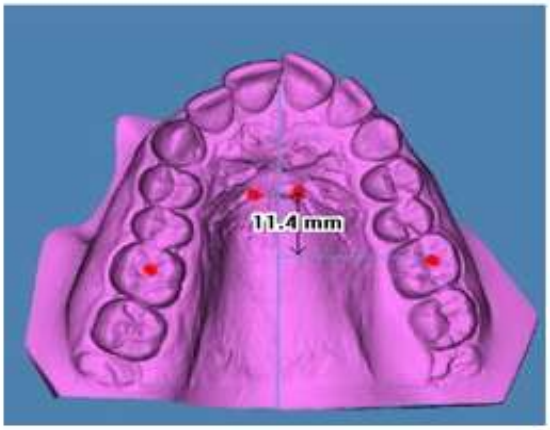
The occlusal surface of maxillary casts pre and post treatment were scanned by three dimension digital scanner " Shining 3D EX Pro " and measurements were done by " Dolphin imaging software" program. A line drawn through anterior and posterior midpalatal raphe landmark was used to construct a median reference line. Perpendicular lines were constructed from the central fossa of right and left upper first molars to the median reference line. The medial point of the third palatal rugae were marked on both the right and left side. The linear distance is measured between the third right medial rugae to a line drawn

perpendicular to the central fossa of right upper 1st molar intersecting at median reference line. The Linear distance is measured also between the third left medial rugae to a line drawn perpendicular to the central fossa of left upper 1st molar intersecting at median reference line. (Fig: 3) The values of posttreatment were subtracted from pretreatment for both right and left sides and mean anchorage loss was calculated. All references points were reidentified and measurements were recalculated using the same software after a four-week interval. The Intraclass correlation coefficient test was used to determine the reproducibility of the applied method, i.e. intra-observer reliability, whereas paired t-tests were used to determine any systematic error.

(Fig.2)



(Fig.3)



Measurement of anchorage loss on: Fig.2: digital cephalogram Fig.3: scanned cast

Results:

Statistical analysis: Data was analyzed using IBM statistical package for social science (SPSS).

Mean and standard deviation were calculated using descriptive statistics. Comparison between pretreatment and posttreatment values of lateral cephalogram versus study cast was performed using paired t-test. Significance level was predetermined at probability less than 5 % (P ≤0.05). For assessment of measurements reliability, intraclass correlation was used.

Table 1: Anchorage loss using Lateral cephalogram:

Measurement	Pretreatment Mean +/- (SD)	Posttreatment Mean +/- (SD)	Anchorage loss (Mean difference)	P Value
U6 position	22.1 +/-1.6	19.7 +/- 1.7	2.4	0.011*

According to Table (1) the mean horizontal maxillary first molar movement using lateral cephalogram was (2.4 mm).Anchorage loss measurement on lateral cephalogram showed statistically significant difference (p- 0.011).

Table 2: Anchorage loss using study cast:

Measurement	Pretreatment Mean +/- (SD)	Posttreatment Mean +/- (SD)	Anchorage loss (Mean difference)	P Value
U6 position	13.1 +/-1.7	10.9 +/- 1.8	2.2	0.016*

According to Table (2) the mean horizontal maxillary first molar movement using study cast was (2.2 mm). Anchorage loss measurement on study cast showed statistically significant difference (P-0.016).

Table 3: Paired t-test for comparison of lateral cephalogram and study cast:

Variable	Lateral cephalogram	Study cast	Mean difference	P Value
Anchorage loss	2.4	2.2	0.2	0.096 ^{ns}

Table (3) showed comparison between the mean horizontal movement of the maxillary first molar on the lateral cephalogram and study cast in order to measure the anchorage loss in anteroposterior plane.

It was found that no statistical significant difference between the upper first molar horizontal movement assessed on the lateral cephalogram and study cast (p -0.096).

Discussion:

Anchorage loss is a possible side effect that would arrest the desirable outcome of orthodontic treatment, it is a multifactorial reaction in which mechanics and crowding are the primary factors. Evaluation of anchorage loss is imperative in every stage of treatment. In the present study anchorage loss was measured post treatment.

Cephalometric measurement in the past was the only reliable method for assessment of tooth movement. But with the disadvantage of radiation exposure and inherent limitation of superimposition of the bilateral structures, it becomes inevitable to take special measures to differentiate between the bilateral molar teeth. An alternative method includes the study cast for assessment of dental changes as it provides a three dimensional view. Whereas, no such limitation was subjected in the measurement of anchorage loss. However, the study cast suffered from a limitation that it assesses the anteroposterior anchorage loss in the maxillary arch only.

This present retrospective study was carried out with the purpose of comparing the reliability of lateral cephalogram versus study cast as an aid for measuring anchorage loss anteroposteriorly after en masse retraction assisted with corticotomy.

In this study the medial point of third palatal rugae was taken as a stable reference point on the study cast. A previous study [11] stated that orthodontic treatment have no statistically significant effect on the position of palatal rugae area thus it could be used as a mean of cast analysis. Several studies [13, 14] have demonstrated that measurements relative to the third palatal rugae were reliable to assess the anteroposterior movements of the first molar.

The mean horizontal movement of maxillary first molar on lateral cephalogram and study

cast was calculated to be (2.4 mm) and (2.2 mm) respectively. Anchorage loss measurement on lateral cephalogram and study cast showed statistically significant difference. A previous studies [12, 15, 16] were in agreement with the present study suggesting the occurrence of anchorage loss with corticotomy.

Biswas et al [12]demonstrated that anchorage loss in the corticotomy group was increased compared to the non corticotomy group. They suggested that the possible reason for increased anchorage loss in corticotomy cases would be that activation was done in every two weeks whereas in other cases activation was done in six weeks of time. However, Sakthi et al[16] showed that there was better anchorage control with the undecorticated molar segment during the retraction period but was found to increase as time advanced. A previous study[15] proved that alveolar corticotomies on the anterior teeth combined with inclusion of second molars proved to be efficient for intraoral anchorage reinforcements for en-masse retraction of the maxillary anterior teeth where it found that the difference at horizontal movements of the upper first molars in both mini screw anchorage and traditional orthodontic mechanics groups is clinically insignificant.

The mean difference between the horizontal movement of the maxillary first molar on the lateral cephalogram and study cast was (0.2 mm) with P value (0.096).Thus, there was no significant difference between lateral cephalogram and study cast in the assessment of anchorage loss which indicates that study cast measurements are as reliable as lateral cephalogram measurement. These results were in agreement with previous study[13] which compared the lateral cephalometric superimposition and the scanned copy of dental cast taking the palatal rugae as the stable reference mark. It was concluded that the both methods are equally reliable.

A previous study[17] agreed with these results which found that there were no statistical differences between the study cast and radiographic records for comparison of orthodontic treatment changes.

Conclusion: Study cast was as reliable as lateral cephalogram in assessment of anchorage loss. Either of the methods could be used to measure anteroposterior tooth movement.

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