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A comparative evaluation of orthodontic correction in different malocclusions by minimally invasive accelerated orthodontic treatment

Manu Sharma[1], Vreiti Sangha[2], Nasir Khan[3]

[1]BDS DMD General Dentist, straightenmyteeth@gmail.com
[2]DDS MDS Department of Periodontics, osseodoc@gmail.com
[3]BDS MDS Department of Orthodontics, New Delhi
Dr.nasir.oracure@gmail.com

ABSTRACT

Duration of orthodontic treatment is a crucial parameter from patient as well as orthodontist point of view. Considering this aspect in mind accelerated orthodontic came into existence. The purpose of this split mouth study was to evaluate effectiveness of piezocision-based flapless corticotomy. 50 orthodontic patients requiring first premolar extraction were selected. Following teeth extraction radiographic guided micro incisions and localized piezocision corticotomy was performed on the side selected as study side. Time elapsed to close the space by both conventional technique and corticotomy was noted. A repeated measure ANOVA was used to compare the duration of canine retraction between both the sides. A significant difference in duration of space closure was seen. It was concluded that likewise conventional corticotomy technique flapless piezocision technique was also a successful method of orthodontic tooth movement; but this is less invasive and more comfortable to patients.

Keywords: Corticotomy; minimally invasive; accelerated orthodontics

Introduction

The answer to most commonly asked question; "how long will my orthodontic treatment last, doctor?" mostly disappoints the patient. Prolonged duration of treatment is most challenging aspect of orthodontic treatment. Longer treatment time has its own consequences[1]. The early concept[2] of accelerated tooth movement was based on osteotomy techniques dated back to the 1890s. Kole[3] introduced the concept of corticotomy in 1950s. This is less invasive as in this technique medullary bone is not involved except the subapical region. The orthodontic tooth movement is controlled by the amount of bone resorptions which is consequently controlled by the osteoclast cell activity. So factors which recruit osteoclast cell precursors from circulation and stimulate differentiation of these cells to osteoclast cell play a major role in accelerated tooth movement. In 2001 Wilcko proposed that acceleration of tooth movement was not due to bony block movement; rather a process of bone remodeling at the surgical site, which was called regional acceleratory phenomenon (RAP) The rate of orthodontic tooth movement is around 1 mm in a month. Rapid orthodontic tooth movement occurs in regional acceleratory phenomenon along with periodontal changes with a bone graft which raises the alveolar bone and also corrects alveolar bone dehiscences and fenestrations[4]. RAP was first named and described by Frost[5]. Lee et al. proposed that alveolar decortication, osteotomy and/or dental distraction strategies are related to biology in relation to the tooth movement[6]. The osteoclastic and osteoblastic activity in RAP was described by Ferguson et al[7]. The aim of this study was to assess effectiveness of piezocision-based flapless corticotomy in different malocclusion.

MATERIALS AND METHODS

50 patients were selected for the study based on following inclusion and exclusion criteria.

Inclusion criteria:

- Unrestored maxillary and mandibular canines and incisors
- Patient with class I bimaxillary protrusion or class II div 1 malocclusion
- Age between 18 to 25 years.
- upper first premolar extraction cases

Exclusion criteria:

- Developmental absence/hypodontia of the maxillary or mandibular canines or incisors
- Dental anomalies e.g. transposition of teeth, microdontia etc.
- Dental casts with damaged maxillary or mandibular canines or incisors
- Partially erupted maxillary or mandibular canines or incisors
- Maxillary anterior crowding.
- Patients with systemic diseases.
- Physically and mentally challenged patients.

A split mouth study was planned. The side where conventional method of canine retraction was planned was labeled as control side while other side where corticotomy was planned labelled as study side. After initial alignment rectangular 19*25 SS wire was placed as continuous archwire in MBT 022 slot prescription bracket in maxillary arch. Following teeth extraction radiographic guided micro incisions and localized piezocision corticotomy was performed on the side selected as study side. The surgical processes were carried out under local anesthesia. For absolute anchorage and avoiding anchorage loss mini-implants were placed in buccal cortical plate between second premolar and first molar. Separate canine retraction was planned in both quadrants using closed coil spring. The time elapsed in complete extraction space closure by canine distalisation was noted for both control side and study side.

RESULTS

The data were subjected to statistical analysis using SPSS (Statistical Package for Social Sciences) version 20.0 statistical analysis software. The time duration that was elapsed for space closure was measured for both control and study side. The mean, standard deviation, minimum, and maximum values were calculated for both groups. A repeated measure ANOVA was used to compare the duration of canine retraction between both the sides. A significant difference in duration of space closure was seen.

Table 1: comparison of time elapsed (in month) to close the extraction space by canine distalisation

	n	Mean ± S.D.	t-value	p-value
Control side	50	7.24±0.91	0.68	0.03*
Study side	50	5.44±0.80		

*: indicates a statistical significant difference.

DISCUSSION

Present study was designed to evaluate piezocision-based flapless corticotomy in separate canine retraction. To compare the efficacy of method split mouth study design was planned. The overall duration of space closure by canine retraction was 1.4 times faster in corticotomy side. This finding is in agreement with previous studies[8,9].

Previous study suggested two times faster result in corticotomy assisted orthodontic tooth movement than conventional orthodontics which was more significant in early stages after surgical procedure[10]. However in another study Cho et al[11]reported four times faster movement in upper jaw of two beagle dogs. Despite of similar composition and bone density selection of animal model might be one reason for such higher accelerated tooth movement as dogs have 2 times faster metabolism and iliac bone formation rate than humans. Secondly corticotomy was performed on both the buccal and lingual sides in contrast to present study.
85% greater amount of tooth movement in the corticotomy sides than the control ones was suggested in study conducted by Sanjideh et al[12].
In order to overcome selection bias we designed split mouth study where both the procedures of canine retraction was planned in same arch of a patient. There may be a chance of anchorage loss while extraction space closure; so we selected mini-implants for anchorage. This is in accordance with Aboul-Ela et al[13] who found no significant molar anchorage loss during canine retraction on either the corticotomy or the control side. They used mini implants for anchorage on both sides.
Earlier study were conducted to evaluate more invasive corticotomy procedures; where more surgical procedure was required. In this study minimally invasive procedure of corticotomy was designed. Both the techniques of corticotomy resulted in good result in extraction space closure. In earlier studies despite some extent of root resorptions and anchorage loss alveolar ridge expansion-assisted orthodontic space closure was also suggested as less-invasive treatment alternative for edentulous spaces in the mandibular posterior region[14]. Selection of more male patient might be a limitation of this study. A future comparative split mouth study can be planned to compare both conventional and flapless corticotomy.

CONCLUSION

It was concluded that likewise conventional corticotomy technique flapless piezocision technique was also a successful method of orthodontic tooth movement; but this is less invasive and more comfortable to patients.

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