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EFFECT OF EXTRACTION TECNIQUE ON THE RATE OF CANINE RETRACTION; A SPLIT MOUTH STUDY

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Abstract:

The method of tooth extraction may affect amount of bone and thus may affect orthodontic tooth movement.

Materials and Methods:*This study is a split mouth clinical trial. A total of 14 female patients were enrolled in the study. Following the leveling and alignment stage, the patient was sent for extraction either with conventional forceps way for one side and the other side with the aid of the Piezotome.*

Results*:The average rate of canine retraction for the four months of the study and the total amount of canine retraction weren't significant. Regarding marginal bone loss,in control side (forceps extraction side) mean marginal bone loss was found to be 0.07 mm (+_ 0.1). In the piezotome side mean marginal bone loss was found to be 5.8 mm (0.23).The difference between two sides was statistically significant (p<0.05).*

Conclusions:*The method of teeth extraction didn't affect the rate of canine retraction into the extraction socket. Piezotome was believed to produce more atraumatic extraction, however the amount of marginal bone loss was significantly greater compared to the conventional forceps extraction method.*

Introduction

Orthodontic treatment often involves the extraction of teeth to gain space for the correction of crowding or proclined teeth. The principal concern for the patient and the general practitioners is performing the procedure atraumatically.For the orthodontist, there is an additional prospective to preserve the cortical plates from breaking during extraction which can lead to ridge narrowing. Fractured cortical plates can lead to narrowed out ridges that may interfere with complete closure of extraction space closure. (1)

Traumatic extraction can lead to resorptive remodeling of alveolar bone, (2) followed by decrease of the volume of alveolar bone which may complicate and delay orthodontic space closure. (3)

Thus, preservation of the alveolar ridge during extraction will help to maintain the composition of regenerated woven bone with subsequent less detrimental orthodontic tooth movement. (4)

Still much is unknown regarding various factors affecting rate of orthodontic tooth movement. Factors like variation in bone structure and periodontal ligament surrounding the root are responsible for variation in tooth movement.

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The instrument selection and the technique used for extraction significantly affect the amount of paradental tissue loss. There has also been an increased interest in atraumatic tooth extraction in order to maintain bone for future implant insertion in the past decade. Marginal alveolar bone ridge protection has influence in achieving optimal functional, aesthetic and orthodontic treatment results. So, newer instruments and techniques for extraction were developed for minimizing trauma to paradental structures over the period of time.

These instruments include Periotomes, Powered Periotomes, Physics Forceps, Benex extractor and many other which assist the surgeon to performextractions more predictably, atrumatically and with minimum discomfort to patient.[5]

Still much unknown regarding various factors affecting the rate of orthodontic tooth movement. Variation in the bone structure and periodontal ligament surrounding the root affect the tooth movement. [5-7]

Hasler et al, in his clinical study has found that tooth movement is faster into recent than into a healed extraction site. [8]

The Physics forceps were developed by Golden Dental Solutions, Michigan which is based on the biomechanical principles of a first-class lever, creep and stress distribution without the squeezing, grasping, twisting and pulling forces to perform atrumatic extraction. [9] Conventional forceps work by forces placed equally on the facial and lingual portion of the tooth and elevating it out of the socket by movement of the operator's arm and wrist. This pulling force technique invites unnecessary complications including fracture of roots, bone and loss of tissue.

Recently, Piezotome was introduced, which produces specific ultrasound frequency modulation (22000 – 35000 Hz). The unit provides extreme precision and safety as well as micrometric cutting, thus allowing one to selectively section the mineralized bone structures. Moreover, the device causes less bleeding during and after the operation and the healing process is shorter compared to conventional forceps. Normal extraction of teeth using piezoelectric tips depends on cutting of periodontal ligaments attachment and bone surrounding the roots to be extracted that lead to easier luxation and extraction of teeth. This process when done in upper first premolars, it jeopardizes the thin buccal cortical bone related to it but not affecting the integrity and health of soft tissue related. [10, 11]

The null hypothesis of this study is that no difference on the effect of the method of extraction on the rate of orthodontic tooth movement.

Materials and Methods

The study was conducted as a randomized split mouth design.

Inclusion criteria

1. **Female patients with age range 16-20 years.**
2. **Class II division 1 patients in need of extraction of at least of two maxillary premolars.**
3. **Symmetric arch form with minimum crowding.**
4. **Free from any systemic diseases.**
5. **No history of any drug intake affecting the bone.**

Sample collection:

The patients were collected from the orthodontic department, Alexandria University.

A total of 14 patients were included in the study after meeting the selection criteria. (Figure 1)

Figure 1: Sample case meeting inclusion criteria

Full diagnostic records were obtained from all patients including study casts, panoramic x-ray, lateral cephalometric x-rays and full intraoral and extraoral photos.

All patients signed an informed consent prior to participation in the study.

Orthodontic preparation prior to extraction:

Bonding of the maxillary arch with straight wire 0.022 inch slot brackets (orthos , ormco corporation) was performed.

Leveling and alignment was initiated with wire sequence of 0.014 NiTi, .0018 NiTi and 0.018 St.St. wires with minimum periods of wire change of 4 weeks.

Then 0.016X0.022 St St arch wire was fitted for 2 weeks and the patient was sent for cone beam computed tomography for the maxilla

The patients were sent for the extraction of the maxillary first premolars. One side was extracted with the conventional technique using the suitable extraction forceps and the other side was extracted using piezotome. (Acteon, Satelec Company, France)

Surgical procedures:

For all cases pre-extraction bone levels were measured radiogrpaically at buccal and palatal sides of the premolar from the apex of the root to the crest of alveolar bone.

Standard aseptic surgical protocol was done for each patient and local infiltration anesthesia was given at the palatal and buccal mucosa in every extraction site using Mepecaine-

L(Mepivacaine 31.36mg/1.8ml+Levonoreadefrine 0.09mg/1.8ml, Alexandria Co. for pharmaceutical and chemical industries< Alexandria, Egypt)

In the study side Acteon Piezotome with LC1and LC2 tips was used on the buccal and palatal surfaces of the roots while the LC2 tip was used mesially and distally. Both were inserted parallel to the root surface in asweeping motion to include the entire root surface from the cervical line till the root apex. Cutting the root attachment to bone was done to ensure complete mobilization of the rootthen final removal was done by the aid of standard upper premolar forceps. (Figure 2&3)

Figure 2: Piezotome apparatus and tips used in study

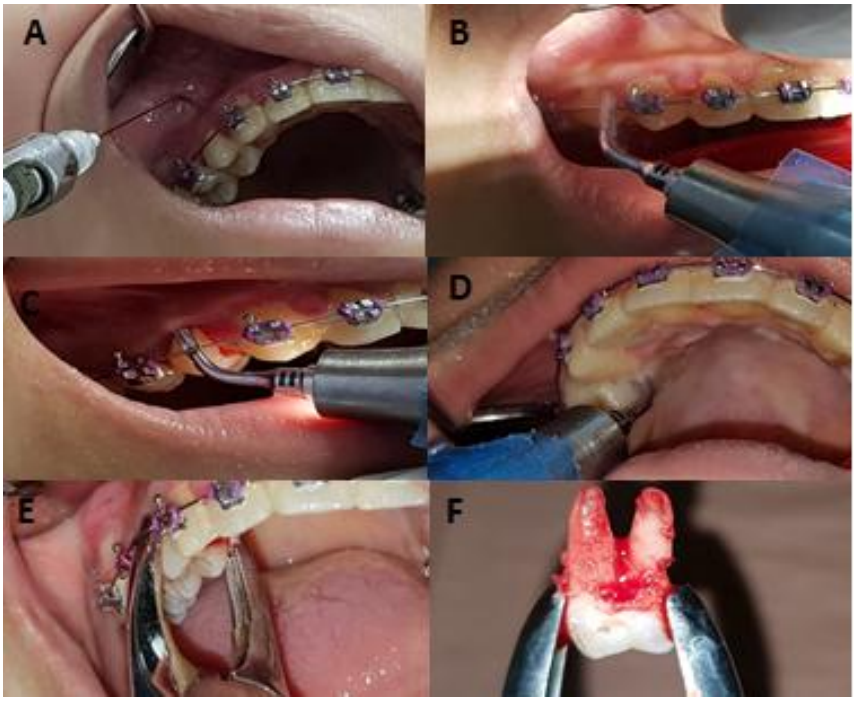

Figure 3: Steps of extraction technique used in study side

In the control side upper premolar forceps was used for extraction by buccal and palatal movements with final buccal and occlusal movement.no elevators or periotomes were for all control sides.

For all patients extraction site was covered using gauze packs and followed post-extraction instructions.

In both sides post-extraction bone heights were measured immediately clinically and radiogrpaically at the same points done preoperatively. (Figure 4)

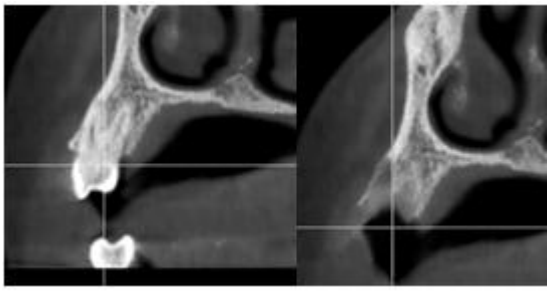

Figure 4: CBCT evaluation of the bone level

Orthodontic canine retraction:

The orthodontist was blinded for the technique of the extraction performed.

Study casts were taken prior to canine retraction. The canine retraction was performed one week after the extraction with NiTi closed coil spring stretched directly between the maxillary first molar and maxillary canine hook.

The force was adjusted to be 150 gm per side using force gauge(Correx force gauge). (Figure 5)

Figure 5: Correx tension gauge for retraction force measurement

Coil spring was activated every 4 weeks and a study casts were obtained at every activation visit. The period of study was arranged for 4 months whether the canine retraction was complete or not.

Medial and lateral ends of the first and third palatal rugae were identified as stable reference points on the casts. The midpoint between the medial end of the first rugae and the third rugae were marked. The casts were then scanned using Sirona InEos X5 scanner and digital cast was obtained. (Figure 6)

Figure 6: Cast scanner used in the study.

All STL files were imported into Viewbox 4.0 software and the rate of canine retraction was measured.In order to calculate the rate of tooth movement, the displacement of the cusp tip of both canines, detected as the perpendicular distance on the constructed median palatine rugae, were measured and averaged. Each measurement was repeated three times by the same operator and the mean value was determined. (Figure 7)

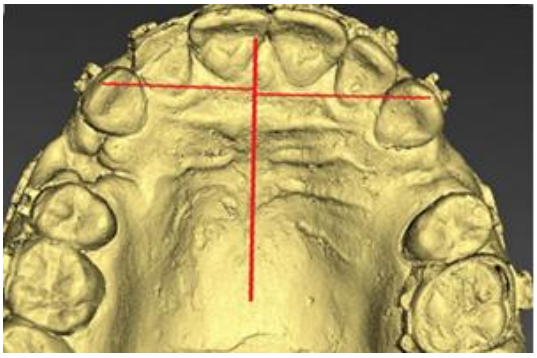

Figure 7: Scanned cast ready for measurement

Results

Postoperative clinical follow up showed uneventful healing with no postoperative complications in both groups. Mild to moderate postoperative pain was manageable and completely resolved within the first week in all patients.

Rate of canine retraction:

The average rate of canine retraction was measured and compared per month for the four months of the study between the control and study sides.

Month	Control	Study	Significance
Av mm/Month 1	0.83	0.82	0.86
Av mm/Month 2	0.83	0.84	0.46
Av mm/Month 3	0.8	0.83	0.56
Av mm/Month 4	0.81	0.81	1

Table 1: Comparison showing the average rate of canine retraction per month.

The average total canine retraction was also compared between the control and study sides (independent sample t- test with level of significance set at $p<0.05$)

	Control	Study	Significance
Average total movement(mm)	0.8175	0.825	0.42 Not significant

Table 2: Comparison between two groups regarding the average total canine movement.

Marginal bone loss:

Statistical analyses were made using independent sample t-test. In control side (forceps extraction side) mean marginal bone loss was found to be 0.07 mm (+_ 0.1).

In the piezotome side mean marginal bone loss was found to be 5.8 mm (0.23)

The difference between two sides was statistically significant ($p<0.05$).

Discussion

Orthodontic treatment involves as a part of its treatment plan the need for extraction of certain teeth either to relief crowding, correct protrusive teeth and/or level of curve of spee.

The method of teeth extraction whether traumatic or atraumatic affect the integrity of bone and socket healing which in turn may affect the way the teeth move orthodontically into this extraction socket.

No study up to date (Pubmed search December 2018) has tested the effect of teeth extraction method on the rate of canine retraction.

With the limitation of this study, the method of teeth extraction didn't affect the rate

of canine retraction into the extraction socket. Piezotome was believed to produce more atraumatic extraction, however the amount of marginal bone loss was significantly greater compared to the conventional forceps extraction method.

Further research needed for other atraumatic methods of teeth extraction with larger sample size are needed to study the effect on orthodontic tooth movement.

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