Case Report

International Journal of Dental and Health Sciences
Volume 02,Issue 01

CORTICOTOMY- RACE OF ORTHODONTIC TREATMENT WITH THE TIME

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ABSTRACT:

Introduction: The purpose of this case report was to quantify the treatment outcome of corticotomy assisted orthodontic procedure.

Method: Modified corticotomy procedure was performed that is involving only the labial surface of maxillary and mandibular anterior segment and amount of space closed was measured at every month.

Result: The total amount of space closed is maximum in between the period of T0 to T4 and then it gradually reduces.

Conclusion: Corticotomy assisted orthodontic treatment is an effective modality for adults to reduce the treatment duration.

Keywords: corticotomy, Malpositioned teeth.

INTRODUCTION:

Malpositioned teeth are responsible for esthetic and occlusal aberrations in many adults. Patients often forgo orthodontic treatment because of its long duration.[1] Every orthodontic patient requires that their treatment should be completed in a short duration of time.[2]

The search for new approaches to shorten the treatment time without foregoing optimal results has become a primary goal of orthodontics. Low friction and self-ligating bracket systems, robot preformed archwires, rapid canine retraction and alveolar corticotomies are examples of approaches that aim to reduce the time required for orthodontic therapy.[3]

Orthodontic treatment of adults is different and challenging as well as necessitate special concepts and procedures, such as the use of invisible appliances, shorter periods of treatment, the use of lighter forces and more precise tooth movements.[4]

The development of corticotomy-assisted orthodontic treatment (CAOT) opened doors and offered solutions to many limitations in the orthodontic treatment of adults.[4] A corticotomy is defined as a surgical procedure whereby only the cortical bone is cut, perforated, or mechanically altered. The medullary bone is not changed. This is in contrast to an osteotomy, which is defined as a surgical cut through both the cortical and

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medullary bone. This term is frequently used when describing the creation of bone segments.[5] The alveolar corticotomy technique has been revised and modified over the years to eliminate its possible risks, such as periodontal damage and devitalisation of the teeth and osseous segments because of inadequate blood supply.[6]

The first reports on surgical approaches to correct poorly positioned teeth are assigned to L. C. Brian, in 1892, and G. Cunningham, in 1893.[3] Some fifty-odd years later, in 1959, Köle used a combination of interradicular corticotomies and supra-apical osteotomies to speed up tooth movement.[3]

Subsequent publications by Generson et al in 1978, Anholm et al in 1986, Gantes et al in 1990, and Suya in 1991 built upon the supra-apical horizontal osteotomy used by Köle. In these publications the osteotomy cut was replaced with labial and lingual corticotomy cuts. Köle's interpretation of the rapid tooth movement being attributable to "bony block" movement did prevail until the 2001 publication of Wilcko et al.[5] This procedure (by Wilcko et al) included the innovative strategy of combining corticotomy surgery with alveolar grafting referred to as Accelerated Osteogenic Orthodontics (AOO) or as Periodontally Accelerated Osteogenic Orthodontics (PAOO).[4] The method of Accelerated Osteogenic Orthodontics, AOO, is patented as Wilckodontics.[7]

Only few cases were reported in the literature related to corticotomy assisted orthodontics. So the need was felt to present a case report to assess the clinical effects of the corticotomy in humans and to study the rate of en masse retraction of anterior teeth.

MATERIAL AND METHODS:

CASE DETAIL: 24 year old female patient came with the chief complaint of forwardly placed front teeth in upper and lower jaw with no relevant medical history. She desired her orthodontic treatment to be completed in shorter duration. Extraoral examination revealed a Class I skeletal relation with bimaxillary protrusion, convex profile, average mandibular plane angle, protruded upper lips, incompetent (figure 2). Intraorally, the patient had Angle's Class I molar and class I canine relation on both sides with severe proclination of 8 mm in upper arch 6 mm in lower arch (figure 1).

Diagnostic records included a detailed history, clinical examination, study models, radiographs (Orthopantomogram and a Lateral Cephalogram) as well as standard extraoral and intraoral photographs.

Treatment objectives:

1. Reduce the severe proclination

2. To reduce the deep overbite and improve the interincisal angle

3. Achieve good anterior guidance

4. Maintain Class I molar relation

5. Improve the facial esthetics with a more balanced lower lip

6. Reduce the treatment duration

Treatment plan:

For the correction of proclination in both the arches extraction of four first premolars with alveolar corticotomy in upper and lower anterior region to fasten the rate of orthodontic tooth movement was planned.

METHODS:

Maxillary and mandibular fixed appliances [0.022" pre-adjusted edgewise appliance from Navy Orthodontic Brackets - Libral Traders] were placed, and the leveling and alignment phase of treatment was completed in the patient. Before starting retraction, a 0.019 x 0.025 stainless steel wire was placed for 1 month to allow the torque changes to occur on individual teeth. Sliding mechanics was used for the retraction of teeth and for this purpose a 0.019 x 0.025 stainless steel archwire with soldered hooks was used. The extraction space was measured in all quadrants before starting orthodontic retraction. Maxillary and mandibular corticotomies were done in the anterior segment on the labial aspect by the technique given by Aboul-Ela et al.[6] For the corticotomy procedure, surgical draping was done (Figure 3) and local anesthesia was injected. A trapezoidal full-thickness mucoperiosteal flap was elevated via a mucoperiosteal elevator on the labial surface of maxillary anterior teeth extending from distal surface of the canine on one side to distal surface of canine on other side. The relieving incisions were placed vertically to avoid compromising the blood supply of the nonflapped tissue. . Vertical corticotomy cuts were made using a tapered fissure bur stopping just short of the alveolar crest between the roots of the teeth; these cuts were connected beyond the apices of the teeth (where possible) with a scalloped horizontal corticotomy cut (Figure 4A and 4B) . Numerous corticotomy perforations (where possible) were made on the root prominences by using a number 2 round bur in a low-speed hand piece under copious irrigation (Figure 4C and 4D). Corticotomy cuts were made extending from the distal surface of canine on one side to distal surface of the canine on other side. Complete hemostasis was achieved. The design of the selective decortication was more to maximize the marrow penetration and bleeding than to create blocks of bone. The corticotomy cuts and perforations were extended just barely into the medullary bone.[7]. No luxation was performed following the partial decortication.[7] An established augmentation procedure using resorbable DFDBA particulate bone graft less than 500 µ materials was then performed over the partially decorticated areas to take advantage of its potential inductive properties (Figure 5A and 5B). Care was taken not to place an excessive amount of grafting material, as this might interfere with replacement of the flaps. Thereafter, the flap was carefully repositioned and sutured using non-resorbable 3-0 Mersilk round body suture material using interdental sling suturing technique. The same procedure was performed on the labial aspect of mandibular anterior teeth (Figure 6). The complete procedure was uneventful. After the corticotomy

procedure, the patient was prescribed an antibiotic (Tablet Clavum 625 mg 3 times a day for 5 days) and an analgesic (Tab. Enzoflam 3 times a day for 3 days). En masse retraction was started immediately after the corticotomy surgery using a closed coil nickel titanium spring. The sutures were removed one week after the corticotomy surgery. The patients were recalled every two weeks to check so that force remained constant throughout the retraction phase.

Nickel titanium closed coil springs (Captain Ortho- 12 mm in length) were used for the retraction (Figure 7). Study casts were made before starting the retraction, 15 days after starting the retraction procedure and then after at an interval of one month over the period of 6 months or till the closure of extraction space whichever period was shorter. (Figure 8) All linear measurements were recorded in millimeters in the upper right, upper left, lower right and lower left quadrants using a digital caliper having precision upto 0.01 mm. The distance between distal surface of the canine and mesial surface of second premolar bracket was measured in all the quadrants.

RESULTS:

Table 1 showing the total amount of space closed in between the period of 0 to 6 month. The total amount of space closed is maximum in between the period of T0 to T4 and then it gradually reduces. Total space closed is maximum in between the period of 1 to 2 months (T2).

Follow up evaluations revealed no loss of tooth vitality, no changes in periodontal probing health, good preservation of the papillae, and no gingival recession. No evidence of crestal bone height reduction or apical root resorption was detected

DISCUSSION:

In conventional orthodontic therapy, movement occurs via crestal bone resorption. Although this biomechanical movement is effective, its application is limited in adult patients. Prolonged and/or strong compression of the periodontal ligament may produce histologic modification of the fibers, as well as ligament ankylosis and root resorption. Orthodontists treating adult patients generally prefer to apply light biomechanical forces to avoid the risk of periodontal damage. However this method requires a lengthy therapeutic approach.[1]

Orthopedist Harold Frost recognized that following the surgical wounding of the cortical bone, the regional acceleratory phenomenon (RAP) potentiates tissue reorganization and healing by way of a transient burst of localized hard and soft tissue remodeling with dominating features involving accelerated bone turnover and decreases in regional bone densities which results in rapid tooth movement.[7] It has been demonstrated that the residual soft tissue matrix has the ability to induce remineralization after the cessation of tooth movement.[7]

In this case report, the design of the corticotomy procedure included cortical perforations in the buccal cortical plate of

bone only and without the reflection of a palatal flap. The justification of this is the assumption that the RAP induced by the buccal corticotomy would readily involve the noncorticotomized palatal side. Moreover, the main purposes of adopting this conservative technique were to reduce operation time and postoperative patient discomfort by eliminating exposure of the patient to the risks of an additional palatal surgery. These modifications attempted to optimize the treatment outcome of the surgical procedure with minimal if any effects on the periodontium. This modified procedure was discussed by Aboul-Ela et al[6] in their study. This method includes the advantages of corticotomy surgery and alveolar augmentation. This method is not only safe, but has made it possible to help and even thicken the layer of pre-treatment bone over the prominences of the roots. Fenestrations can be covered, and consequently the likelihood of dehiscence formation can be reduced where there is still a vital root surface. Not only can the teeth be moved rapidly, but this can be accomplished without significantly jeopardizing root length.

Nickel-titanium springs were used for retraction to permit constant force application. The force applied by them was in the range of 150 -200 gram per side.[6] The necessary adjustments were done every two weeks so that force remained constant throughout the retraction phase. Tooth movement can only sustain post-corticotomy surgery if a thin layer of bone is present over the root surface in the direction of the intended tooth movement. Additionally, continued tooth movement prevents tissues immediately adjacent to the root from remineralizing and that was the reason why the adjustments were done every 2 weeks and this was in accordance with study done by Shoichiro Iino et al[8] and Vittorio Grenga et al.[9]

According to Shadw Mohammed et al[6] the rate of retraction of canine was higher: approximately two times faster on the corticotomy side compared with the control side. The rate of retraction was approximately 0.7 to 0.8 mm per month on control side. In this case report, the rate of retraction is approximately in the range of 1.15 to 1.28 mm per month.

Post-operative mild amount of facial swelling and pain for three days were seen after the corticotomy procedure. Subcutaneous hematomas of the face and the neck had not been reported. These findings were in accordance with Liou et al [10] who had stated that pulp was vital, even though the tooth was moved rapidly at the rate of 1.2 mm. These findings were also in accordance with Aboul-Ela et al[6], who in their study, stated that the assessment of probing depths, attachment loss, and gingival recession in particular showed no significant differences between the operated and nonoperated sides.

CONCLUSION:

- Decrease in treatment duration
- Modified surgical approach i.e. limiting the corticotomy to the labial aspects only is used , thus reducing post-operative morbidity.

- Advantageous to the patient's periodontal health because less time in fixed appliances reduces patient ''burn-out''

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TABLES:

Table 1. Space closure (in millimeters)

PATIENT 1				
PERIOD	UR	UL	LR	LL
T0	0.6	0.62	0.65	0.63
T1	0.66	0.65	0.58	0.61
T2	1.24	1.28	1.23	1.22
T3	1.17	1.07	1.12	1.09
T4	0.95	1.01	0.95	0.98
T5	0.96	0.88	0.93	0.84
T6	0.89	0.9	0.93	0.9

where

T0- The measurement of space closure from start of retraction to 15 days was considered as T0.

T1- The measurement of space closure from 15 days to 1 month was considered as T1.

T2- The measurement of space closure from 1 month to 2 month was considered as T2.

T3- The measurement of space closure from 2 month to 3 month was considered as T3.

T4- The measurement of space closure from 3 month to 4 month was considered as T4.

T5- The measurement of space closure from 4 month to 5 month was considered as T5.

T6- The measurement of space closure from 5 month to 6 month was considered as T6.

T7- The measurement of space closure from 0 month to 6 month was considered as T7.

FIGURES:

Figure 1:Preoperaative intraoral photographs A. Frontal view B. Right lateral view C. Left lateral view D. Upper occlusal view E. Lower occlusal view

Figure 2: Preoperaative extraoral photographs A. Frontal view B. Front view (smiling) C. Lateral profile D. Oblique profile

Figure 3: Surgical preparation of the patient

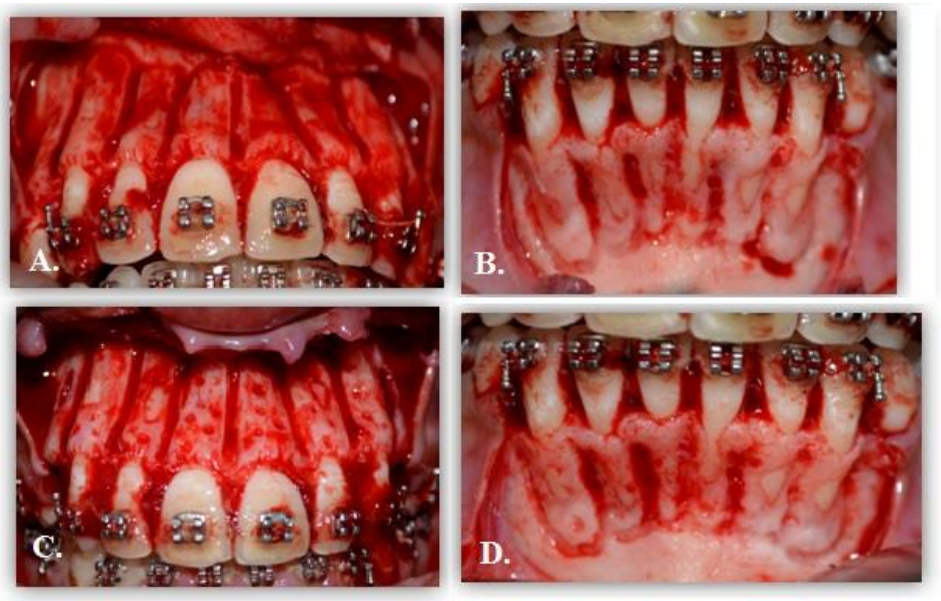

Figure 4: Intraoral photographs of corticotomy cuts A. Maxillary vertical and subapical cuts B. Mandibular vertical and subapical cuts C. Maxillary cortical perforations D. Mandibular cortical perforations.

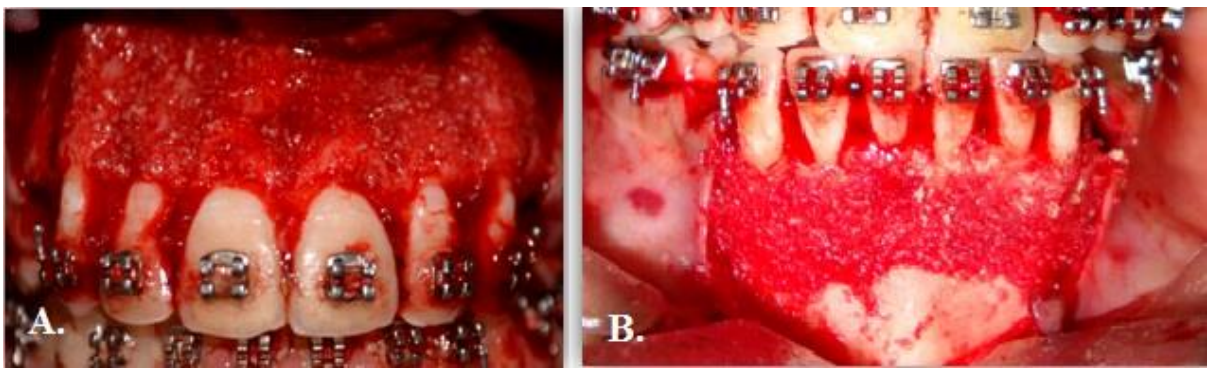

Figure 5. Intraoral photographs after placement of DFDB bone graft A. Maxillary B. Mandibular

Figure 6. Intraoral photographs of suture placement.

Figure 7. Intraoral photographs of the mechanics used for retraction

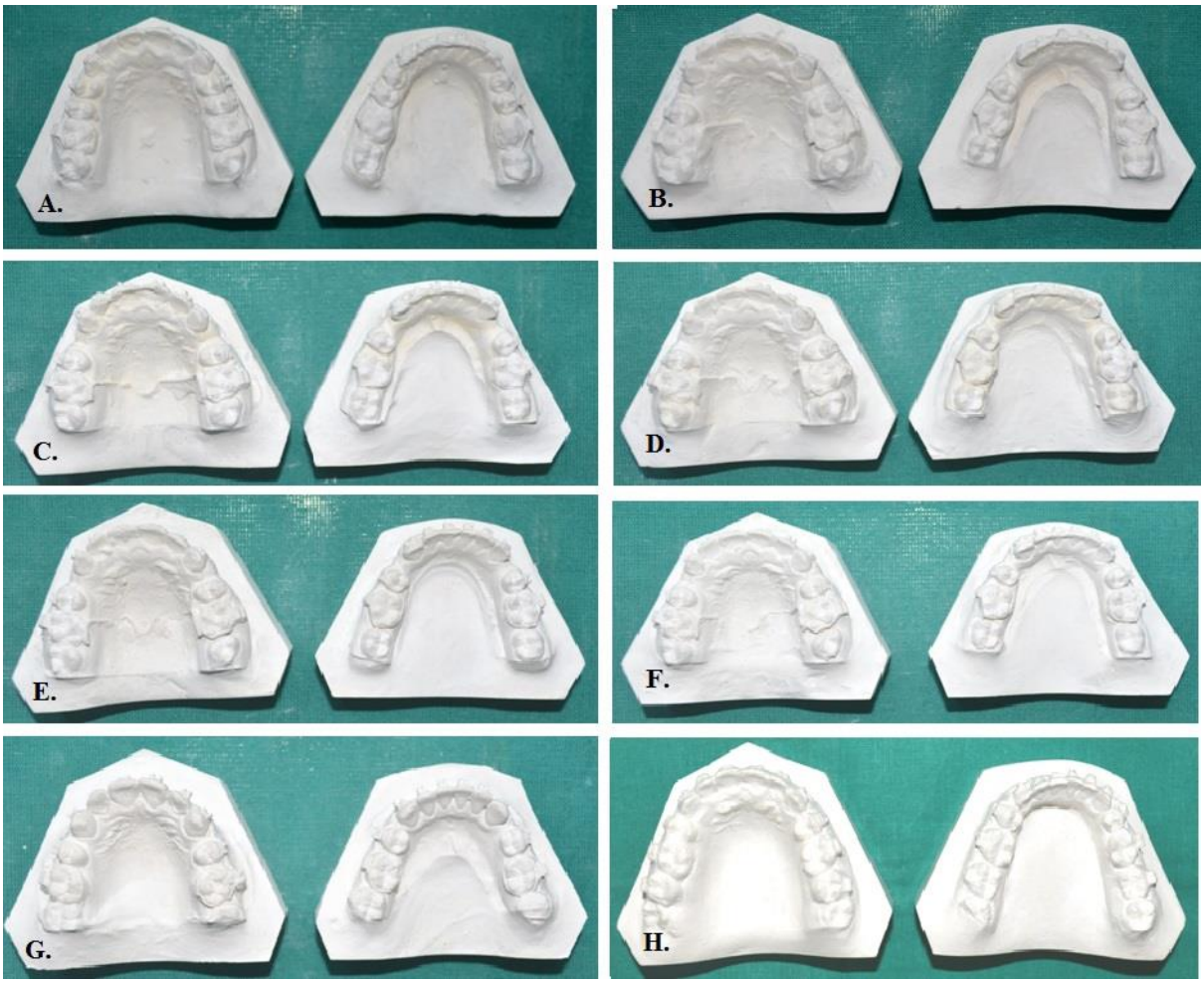

Figure 8. Photographs of study models A. At 0 days (before corticotomy procedure) B. 15 days after corticotomy procedure C. 1 month after corticotomy procedure D. 2 months after corticotomy procedure E. 3 months after corticotomy procedure F. 4 months after corticotomy procedure. G. 5 months after corticotomy procedure H. 6 months after corticotomy procedure