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RESEARCH ARTICLE

CORTICOTOMY ASSISTED LOWER MOLAR PROTRACTION IN ORTHODONTIC TREATMENT

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ABSTRACT

An increasing number of adult patients have been seeking orthodontic treatment, and a short treatment time has been a recurring request. To meet their expectations, a number of innovative techniques have been developed to accelerate orthodontic tooth movement. Corticotomy-assisted orthodontic treatment is an established and efficient technique that has gradually gained popularity as an adjunct treatment option for the orthodontic treatment of adults in which there is selective alveolar decortication with or without bone grafting. Orthodontic closure of old, edentulous spaces in the mandibular posterior region is a major challenge because of high density of mandibular bone. In this case report, we have performed corticotomy that can expedite space closure while maintaining control over tooth angulations in adult patients with long-standing edentulous sites.

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INTRODUCTION

Permanent mandibular molars are the most commonly missing teeth in adults. The treatment of choice in patients with single missing teeth is either a fixed three-unit bridge or an endosseous dental implant. Alternatively, orthodontic space closure of a remodeled edentulous space by second molar substitution for missing first molars is a viable treatment option if adequate anchorage is established. Temporary anchorage devices are effective in providing absolute anchorage for second molar protraction and thereby preventing unwanted side effects in the anterior segment (Kim *et al.*, 2009).

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Technological advances in orthodontics are primarily aimed at reducing treatment time, reducing postoperative pain, and enhancing periodontal health. Treatment time for space closure by second molar protraction in adults ranges from 2 to 4 years (Hom BM, Turley PK, 1984) as the rate of tooth movement depends on bone density, turnover rate, and hyalinization of the periodontal ligament (Lino S *et al.*, 2007). In the adult patient, there is reduced cellular activity and increased bone density, and hyalinized zones are formed more readily on the pressure side, thereby reducing the tooth movement and increasing treatment duration (Ong MM, Wang HL, 2002). To reduce the treatment time, different treatment approaches have been reported with some degree of success in animal and clinical studies. Some of these procedures include use of lasers or electrical stimulation, vibration, corticision, piezoincision, corticotomies, and osteotomies.

Pre treatment



Figure 1. Spacing between 45 and 47



Figure 2. Pre treatment Orthopantomogram
Mesiodistal space is 8mm

Surgical Treatment:



Figure 3. Crestal Incision



Figure 4. Full thickness flap reflected



Figure 5. Indentation Corticotomy on



Figure 6. Interrupted 4-0 sutures given buccal and occlusal
cortical plate in

3 months follow up



Figure 7. Mesiodistal space reduced with



Figure 8. Orthopantomogram after 3 months follow up with
protraction of 47

5 months follow up:



Figure 9. Space closure



Figure 10. Orthopantomogram after 5 months follow up

Corticotomy-facilitated tooth movement was first described by L.C. Bryan in 1893. However it was first introduced in 1959 by Kole as a means for rapid tooth movement. Corticotomy is a procedure whereby only the cortical bone is cut, perforated, or mechanically altered in a controlled surgical manner and at the same time penetrating into the bone marrow minimally. This is in contrast to an osteotomy, which is defined as a surgical cut through both cortical and medullary bone (Wilko TM, 2009). A technique in which combination of a selective decortications facilitated orthodontic technique and alveolar augmentation is performed is known as Periodontally accelerated osteogenic orthodontics (PAOO) (Wilcoet al., 2001). Orthopedist Harold Frost recognized that surgical wounding of osseous hard tissue results in striking reorganizing activity adjacent to the site of injury in osseous and/or soft tissue surgery. He collectively termed this cascade of physiologic healing events the regional acceleratory phenomenon (RAP) (Frost, 1983). The two main features of RAP in bone healing include decreased regional bone density and accelerated bone turnover, which are believed to facilitate orthodontic tooth movement. The RAP begins within a few days of injury, typically peaks at 1–2 months, usually lasts 4 months in bone and may take 6 to more than 24 months to subside. As PAAO technique is time consuming and expensive, selective alveolar decortication was planned in this patient for protraction of lower right first molar.

CASE REPORT

A 24 year old male patient was referred to the department of Periodontology regarding opinion about space closure in the region of 46 from the department of orthodontics. After approximately 2 years into his treatment, space closure was still not achieved in the area of 46 which was extracted before fixed orthodontic therapy began. Patient was healthy with no medical history. No signs and symptoms of temporomandibular dysfunction were observed. His intra oral examination revealed Angle's class II malocclusion on left side. After carefully assessing his condition, it was decided that space closure could be achieved surgically.

Surgical technique: There are three basic types of corticotomy that might be planned in adult patients with missing lower first molars in atrophic alveolar ridges (Kook et al., 2013)

- Traditional or circumscribed corticotomy involves 2mm vertical and horizontal cuts in the cortical bone

circumscribing the teeth to be moved It can be used in cases of thin bony root coverage.

- Triangular corticotomy describes the removal of triangular portions of the buccal and lingual cortical plates. It can be implemented when more efficient root movement is required or where the buccal cortical bone is too thin for decortication or indentation.
- Indented decortication, a modification of the technique described by Wilco and colleagues, involves making several perforations on the buccal, lingual, and occlusal surfaces of the cortical plate with a round bur. The bone layer covering the root surface must be thick enough for this procedure.

In this case, it was decided to proceed with indented decortication because of the thick cortical bone present in the mandibular posterior region.

The area selected for surgery was anesthetized using lidocaine hydrochloride 2 % with adrenaline 1:80,000. Flap design: Crestal incision and vertical releasing incision was place to preserve the interdental papilla and a full thickness flap was raised (Figure 3&4). Corticotomy: The decortication was carried out on the cortical plates in the missing first molar region of the fourth quadrant using a round carbide bur under copious irrigation to prevent overheating. Perforations were made on the buccal and occlusal region (Figure 5). Due to presence of vital structures like the lingual artery and difficulty in accessibility, no perforation were performed in the lingual region. Patient was recalled after 7 days for suture removal and was sent to the department of orthodontics for molar protraction. Patient was called once a month for orthodontic activation till the complete closure was achieved in the missing 46 region. Complete closure of 46 region was observed in 5 months (Figure 9) which was made possible due to corticotomy procedure.

DISCUSSION

Selective alveolar corticotomy has been shown to shorten treatment, enhance stability, and open new possibilities for tooth movement (Hassan A, 2010). Corticotomy-assisted space closure can be a viable treatment option in cases of atrophic alveolar bone and inappropriate crown/root ratios due to vertical bone loss. Corticotomy-facilitated orthodontics is also indicated for non-extraction treatment of crowding, shortening treatment duration, extrusion of ankylosed teeth, intrusion of

posterior teeth to close anterior open bites and impacted canines (Eelke and Hoogveen, 2014). Contraindications include patients with severe active periodontal disease, inadequately treated endodontic problems, patients on long term medications which will slow down bone metabolism, such as bisphosphonate and NSAIDs and patients on long term steroid therapy due to presence of devitalized areas of bone and patients with inadequate width of attached gingiva (Pan Chern Hwei, 2014). In present case, the mesiodial dimension between 45 and 47 was 8mm (Figure 1). Selective decortication was done to protract the lower second molar in the 4th quadrant with help of indentation corticotomy (Figure 5). This technique was in accordance to Kook YA et al, 2013 who performed indentation corticotomy in a 29-year-old female presented for closure of a wide edentulous space formed due to missing lower left first molar. Also, in this case a miniscrew was placed between the lower left canine and first premolar to provide anchorage for molar protraction using power chain between the screw head and the second-molar hook. Two months later, the space had been closed, mostly by mesial tilting of the lower left second molar.

In first 3 months time a space closure upto 5mm from original 8mm was achieved and there was a complete space closure in 5 months time (Figure 7&9). Gantes and colleagues have shown that tooth movement begins shortly after selective alveolar corticotomies (Gantes et al., 1990). Many previous studies showed that second molars could move forward through the edentulous areas, but this generally required skeletal anchorage for anchor reinforcement because anterior dental anchorage is inadequate to protract even a single first molar without reciprocal retraction of the incisors or movement of the dental midline (Kravitz, 2008). In this case, the edentulous space was closed completely without skeletal anchorage reinforcement. The treatments described in the present article was completed in five months. This reduced treatment time compared to conventional tooth movement might be due to the regional accelerated phenomenon (Frost, 1981). RAP is a complex physiologic process with dominating features involving accelerated bone turnover and decreased regional bone densities. Despite no particulate grafting, the space closure was achieved only by mere perforation which is less time consuming and cost effective for the patients. More clinical trials of simple corticotomy induced space closure are required.

Conclusion

Selective alveolar corticotomy could be considered as a feasible treatment modality for adults with missing teeth when a fixed prosthesis or implant restoration is not possible or desired. Selective corticotomy can be considered as an inclusive part that can be easily included as a routine part of overall orthodontic treatment specifically designed for the space closure in molars.

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