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A Minimally Invasive Perio - Ortho Treatment Plan: Piezocision for acceleration of orthodontic tooth movement.

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Keywords
Orthodontics; corticotomy; piezocision; treatment time; periodontal

Abstract
Comprehensive techniques and prolonged duration of treatment were found to be the reason for reluctance in acceptance of orthodontic treatment among young adult patients. Recently introduced, a novel, minimally invasive technique called piezocision, which uses microincisions and tunneling to enable piezoelectric incisions and hard- or soft-tissue grafting, has been researched. This innovative method offers rapid orthodontic treatment, less discomfort, and positive patient acceptance along with improved periodontium following therapy. This report details the outcomes of a young female patient with persistent residual space between mandibular second premolars and first molars that failed to respond to conventional fixed orthodontic treatment and later, the affected side was managed by a minimally invasive piezocision procedure. The patient was followed for 8 weeks thereafter, and the spacing between the lower second premolar and molar was considerably closed. In order to facilitate the treatment of cases with residual results and also with short treatment time, piezocision can be used as an adjunct to the orthodontic treatment in young adults.

1. Introduction

The number of adult patients seeking orthodontic treatment has significantly grown in recent years due to the availability of more aesthetic choices for patients to select[1]. The prolonged duration of the therapy is one of the numerous factors proven to be a barrier to acceptance of orthodontic treatment[2]. According to studies, a full orthodontic treatment takes at least two years to complete[3]. Patients often anticipate shorter treatment durations of 6–12 months[4].

A range of complications, including cavities, periodontal infections, and root resorption, have been linked to prolonged fixed orthodontic treatment. Many approaches to shorten the overall treatment time for comprehensive orthodontic therapy have been described in various literature. Which are basically divided into surgical and nonsurgical methods. This methods include such as Piezocision[5], corticotomies[6], periodontal ligament distraction[7], self-ligating brackets[8,9], medication[10] microvibrations[11], low-intensity laser[12], photobiomodulation[13] and electromagnetic fields[14].

Corticotomies, piezocision, and micro osteoperforations are used in regular clinical setups and have shown to be a clinical tool that is readily available to the clinician to accelerate the tooth movement and decrease the overall treatment time, without the need for any additional equipment. These surgical methods are described above for reducing treatment duration of comprehensive orthodontic treatment. Although quite effective, the traditional corticotomy involves raising a full-thickness flap and making cortical incisions with a bur. However, due to the trauma involved in raising such a large flap and the extensiveness of the corticotomies, some patients and members of the dental profession have expressed resistance to the procedure. As an alternative to traditional corticotomy, Dibart proposed the minimally invasive Piezocision surgical procedure in 2011[15].

During orthodontic treatment, the piezocision process makes tiny incisions in the gingiva and cortical bone without raising a flap in order to cause the regional acceleratory phenomenon (RAP) and move the teeth rapidly. Frost defined RAP as localized enhanced osteoclastic and osteogenic activity at the site of

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osseous surgery in 1983[16]. The duration of the active therapy is three times less than what is typically observed following conventional treatment.

2. Case Description

A Saudi female aged 20 years was reported to orthodontic office to manage persistent residual space between mandibular second premolars and first molars, that failed to respond to conventional fixed orthodontic biomechanics. Also, she expressed for a short duration of treatment time citing personal matters. She had a history of routine dental appointments and no significant medical conditions. On intraoral examination she showed residual space between mandibular second premolar and molars on both sides, but otherwise gingival health was good. She was found well motivated and had a good oral hygiene. Her lips were competent, and her facial vertical height and soft tissue profile were both appropriate. Her facial symmetry was also acceptable.

On smiling the gingival display was normal 1 to 2mm and she had class I pattern of occlusion in terms of her skeleton.

Goals of Treatment

In order to deal with the patient's complaint of spacing and reduce treatment time, the treatment's goal was to close the space between the mandibular second premolars and molars on both sides of the arch. The patient was informed about orthodontic treatment as well as a novel procedure, Piezocision, a minimally invasive periodontal surgery that accelerates tooth movement. The orthodontic treatment was combined with Piezocision since the patient wanted a short treatment time.

Surgical Procedure

After OPG and Cone-Beam Computerized Tomography (CBCT) analysis, a surgical bilateral corticotomy was planned to accelerate the protraction of first molars, under buccal infiltration local aneasthesia, mesial to the roots of #36 and #46 (Fig 1). Mesial to the mandibular first molars, a single vertical incision was made in the alveolar mucosa, apical to the base of the interdental papilla, 2mm from the root of the molar using a number 15C blade (Fig 2) Piezosurgery was performed using a special insert (US1- BS1 insert Piezotome- Mectron) (Fig 3) to perform corticotomy through the incision by penetrating the cortical bone to 3 mm depth, later simple interrupted suturing was performed using 5-0 polyglactic acid.

On completion of the procedure the patient was prescribed antibiotic and analgesic for pain. Also, patient was advised to apply ice extra orally for the first 24 hours and rinse twice daily with chlorhexidine.

Postoperative care

Patients reported no postoperative swelling, bruising, or severe discomfort after the procedure. Periodontal healing was optimal for her in 2 weeks with minimal scarring. The patient was then asked to return to the orthodontist for further biomechanical activation within 48 hours of Piezocision procedure and follow up biweekly.

Patients was then seen postoperatively at the end of the week and then monthly at a periodontal clinic to monitor and reinforce plaque control measures as needed. The patient was monitored regularly for treatment progress and the results obtained after 2 months were satisfactory and acceptable. The initial treatment goal was achieved and the patient's complaint of space closure between the teeth was addressed. Good occlusion and esthetic results were achieved and the patient was very satisfied with the treatment results. The gum condition, roots, and alveolar bone were all preserved and healthy.

3. Discussion

Piezocision is less invasive to periodontal tissues in appraisal to conventional corticotomy. A systematic review by Jianru Yi et al. (2017) reported that performing Piezocission had no observable adverse effects on periodontal health[17]. In addition, corticotomy decreased the incidence of periodontal hyalinization and root resorption. Pain perception by patients was less than conventional corticotomy[17].

An important advantage of the piezocision technique is that it maintains the mechanical stimulation of the alveolar bone and allows rapid tooth movement by applying higher forces and shortening the period between visits by accelerating tooth movement[15]. Patient motivation and cooperation are essential after piezocission. The transient RAP obtained after the surgery requires increased frequency

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of appointments than conventional technique to accomplish the rapid tooth movements in the early phases of treatment procedure[15]. Piezocision may present a risk of root damage or nerve injury if not planned and applied well[15].

The treatment involved facilitating orthodontic tooth movement with the aim of shortening treatment time, reducing discomfort, and improving patient satisfaction. Many such procedures are used for this rapid tooth movement which are biochemical in nature having limited literature among humans[18-21] and by physical modifications like corticotomies[22]. Initially corticotomies were utilized by burs which were found to cause potential damage to the teeth and alveolar bone[23]. The use of piezoelectric dissection has recently been reported to be safe and effective during prosthetic preparation, ridge augmentation, and sinus bone grafting procedures[24]. Piezoelectric knives, because of its micrometric and selective cuts, is proved to be safe and precise without any significant bone damage[25]. Later, this same concept of periodontally accelerating tooth movement was utilized by Vercellotti using periodontal flap and incision in the buccal and lingual regions, leading to excellent clinical results, but longer surgical time and increased patient discomfort was reported[26].

The technique performed here has shown similar treatment outcomes when compared to the classic decortication approach, but has the additional advantages of shorter treatment times, less invasiveness, and less trauma to the patient. However, in our patient results after piezocision procedure was great in short treatment duration of 8 weeks, but utilizing piezocision in this case was challenging as the patient had failure results after conventional orthodontic treatment.

4. Conclusion

As a novel and less invasive technique Piezocision, can be used as an adjunct to achieve rapid tooth movement orthodontically without the prolonged discomfort and long treatment duration by conventional orthodontic approach. Piezocision shows to be effectual for patients and clinicians and is a great advantage for greater acceptance among practitioners.

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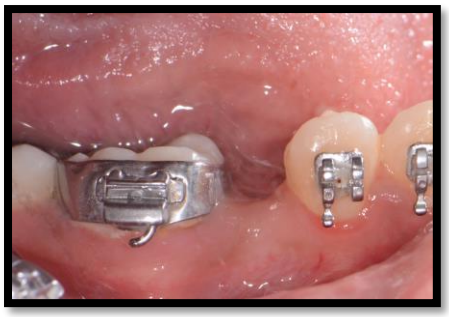

Figure 1a: Preoperative right side view

Figure 1b: Preoperative left side view

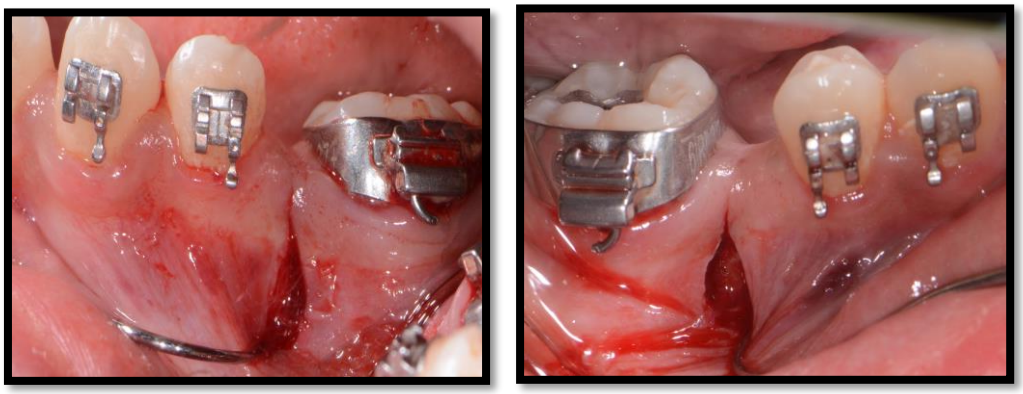

Figure 2 : Incision during the treatment procedure

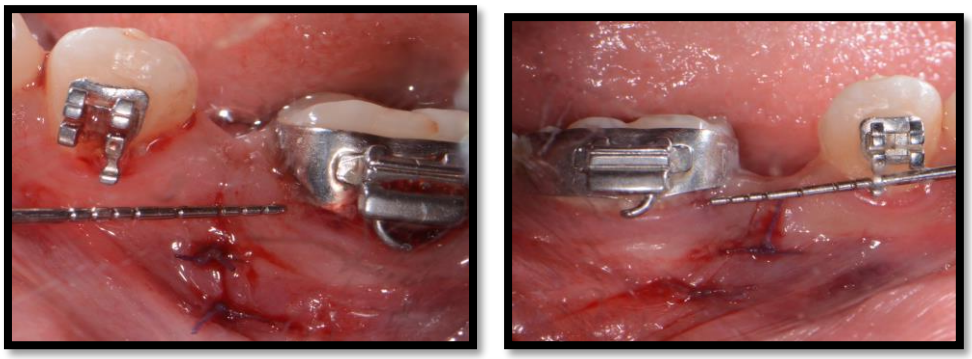

Figure 3 : Suturing after the treatment procedure

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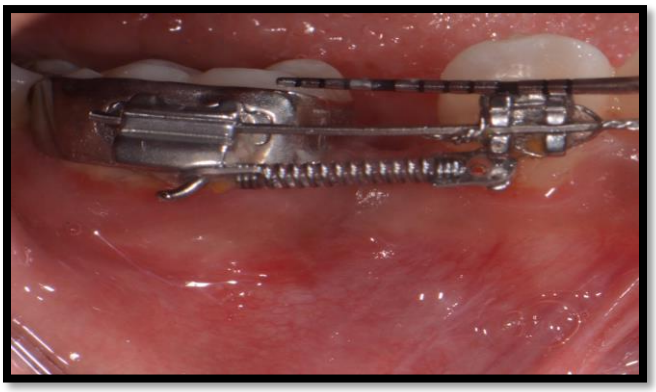

Figure 4a: 2 weeks postoperative on right side

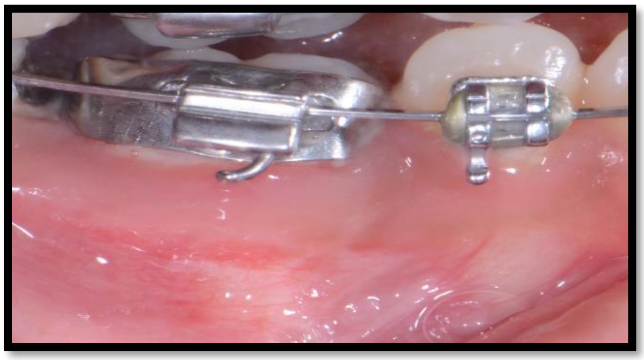

Figure 5a: 8 weeks postoperative on right side

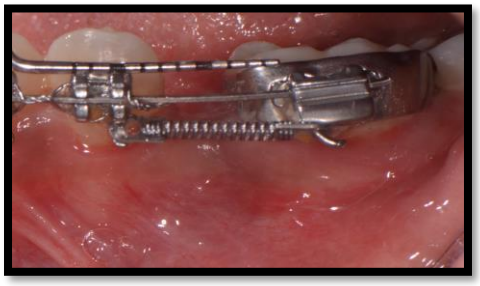

Figure 4b: 2 weeks postoperative on left side

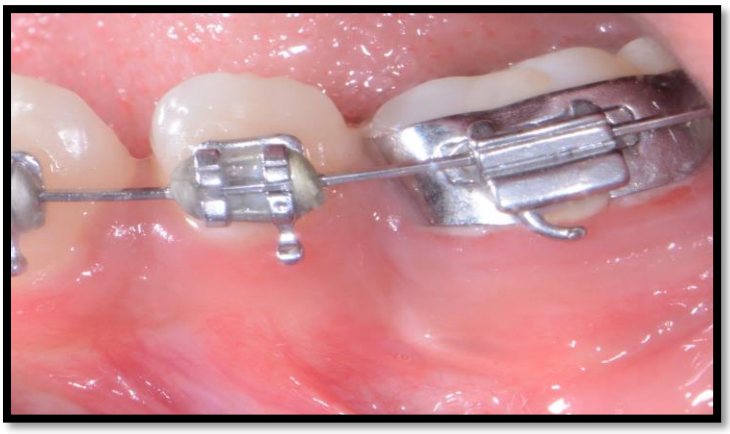

Figure 5b: 8 weeks post-operative on left side

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Figure 6a: OPG preoperative

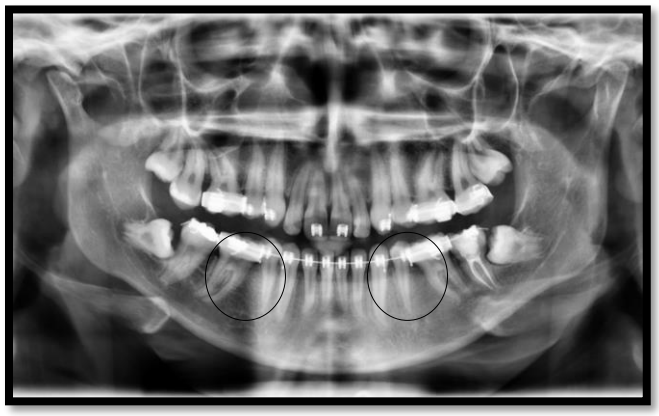

Figure 6b: OPG postoperative