

Case report

Orthodontic Loop-guided Piezocision (OLP): An innovative precision aid in accelerated tooth movement.

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Abstract

The Accelerated osteogenic Orthodontics (AOO) is an emerging contemporary approach for rapid movement of teeth. The acceptable length of orthodontic treatment is contested, however the need for speeding appears to be universally agreed upon. Various surgical adjuncts have been developed to expedite orthodontic tooth movement and to retain optimal occlusal results while shortening treatment timeframes. Despite this, a variety of crucial treatment decisions and approaches may have a greater impact. The purpose of present case study is to suggest a minimally invasive novel orthodontic Loop-guided Piezocision (OLP) approach for quick movement of teeth, without reflection of the flap, with higher precision and minimum post-operative problems. This technique may aid in preventing orthodontic relapse, broaden spectrum of malocclusion correction. This may also eliminates requirement of conventional ortho-surgical procedure, and completes treatment in relatively shorter active orthodontic treatment period.

Keywords: Periodontally accelerated osteogenic orthodontics, Orthodontic Loop guided Piezocision, Rapid orthodontic.

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Introduction

The Periodontically accelerated osteogenic Orthodontics (PAOO) has created a great interest among all the current approaches for rapid orthodontic movement of teeth. It has lately become the focus of several research studies, due to its rationale to

shorten the overall treatment time through the timely bone density modification along with extensive and diffuse demineralization, fewer complications adding to the compliance and satisfaction of the patient.^[1] In this article we aim to propose a novel, minimally invasive new Orthodontic Loop-guided Piezocision

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(OLP Technique) producing a precise surgical insult without reflection of a flap, resulting with increased accuracy, better patient acceptance and minimal post operative complications which also lends itself to repetition so as to maintain the effect of Regional accelerated tooth movement. Regional acceleratory phenomenon is a local reaction to noxious stimuli that defines a process in which the tissue forms quicker than the regional method of regeneration. This phenomenon allows healing 2-10 times quicker than ordinary physiological healing, by improving the different phases of healing.^[2]

The duration of the entire orthodontic treatment, is a major challenge for the patients as well as the orthodontists.^[3] Various surgical techniques including distraction of periodontal ligament,^[3] MOPs,^[4] and piezopuncture^[5] have been developed and tested to address this major challenge. The fundamental principle continues that while moving the teeth quicker, it does not cause irreversible damage to the periodontium. The research performed by the Wilcko brothers on this topic is highlighted as a distinctively revolutionary among the many processes outlined in the literature.^[1] Dibart et al established a new minimally invasive procedure in 2009 which he called 'Piezocision'.^[6] This method is a combination of micro-incisions with selective tunneling to enable soft and hard tissue grafting and decortications of bone by Piezoelectric method. The following case demonstrates the use of a customized looped arch wire to guided Piezocision with an aim in reduction of total treatment duration for correction of class I malocclusion with generalized spacing.

Case Report

A 21 year old healthy female reported to the department with a chief complain of "space between her upper teeth". The medical history was not suggestive of any illness and patient gave a negative history of any allergy. Extraoral examination revealed mesoprosopic face, straight profile with obtuse nasolabial angle (Figure 1). On intraoral examination, Angle's class 1 malocclusion with generalized spacing in upper arch, was observed (Figure 2). Patient had an overjet of 2mm an overbite 1mm with a Bolton discrepancy of 3mm mandibular excess. The ANB of 2 degree on cephalometric evaluation suggested skeletal class I base (Figure 3). As the patient had a pleasing profile, with Class I molar and canine relationship, the prime objective of the treatment was to close the space in the upper arch. Patient was explained the various treatment

modalities available to her after whom she opted for accelerated orthodontics. Consent was taken from the patient for this.

There are several different proven ways to achieve accelerated tooth movements in orthodontics. Various invasive and non invasive methods have been listed in the literature. After detailed assessment of all available options, a minimally invasive Piezocision was planned for the patient.

Description of the Appliance:

A specialized multilooped arch wire was designed to guide the process of Piezocision to attain precision and to avoid the iatrogenic damage to surrounding hard and soft tissues.

Fabrication of multilooped arch wire includes:

1. The desired arch form was given based on patient's study cast made after leveling and aligning phase of treatment using a turret, a 0.017 x 0.025 TMA straight length wire.

2. Vertical loops were formed in relation to each interdental areas on the arch formed, extending from the level of bracket slot to the vestibular area following the root morphology. Vertical loops can be modified depending upon the depth of the vestibule. Five loops were formed extending from canine to canine and these loops served as guiders for the interdental corticotomy cuts on the labial cortex as shown in the Figure 4, which is different from the vertical and horizontal microsurgical Corticotomy used in the Mono-cortical tooth dislocation and ligament distraction (MTDLD) technique.

3. Cone beam computed tomography (CBCT) was taken along with orthodontic loop secured in the bracket slot to check the root form and proximity of roots from the proposed interdental corticotomy cuts (Figure 5).

Treatment progress:

Bands with buccal tubes were positioned in upper and lower first molars. 3M Unitek Gemini metal bracket with 0.22" slot were bonded on maxillary and mandibular arches and transpalatal arch and lingual arch were inserted followed by placement of 0.016 NiTi arch wires in both maxillary and mandibular arches. Wire sequence of 0.016 SS, 0.019 X 0.025NiTi & 0.019 X 0.025SS was continued. After four months of active orthodontic therapy, a periodontal evaluation on the patient for Piezocision surgery was carried out. A customized multilooped arch wire in the bracket slots and

the wire was secured with elastomeric ligatures, before the surgical appointment (Figure 6). Aseptic condition was maintained before placing the multi-looped arch wire.

Surgical Procedure:

Before local anesthesia administration, the patient was asked to rinse the mouth with chlorhexidine gluconate 0.12% for 1 min. The patient was administered with local infiltration anaesthesia (2% lidocaine with epinephrine 1:80,000) with a 27-gauge needle. After clinically relating the placement of loop with the radiograph; an incision marking was given using an H&E pencil (Figure 7).

After achieving adequate anesthesia, piezocision was performed in the inter radicular area as per the protocol suggested by Dibart et al.^{[6],[7],[8],[9]} A scalpel blade #15 was held perpendicular to the alveolar bone to give the buccal incision extending 10 mm apically (Figure 8) providing access for the insertion of peizotome. The peizotome was used for decortications of the bone to facilitate rapid accelerated phenomenon (RAP), after having completed the superficial soft tissue incisions. This was performed by inserting the insert head of band saw blade no1 into the openings of the gingiva and decorating up to a depth of 3mm of the alveolar bone (Figure 9). Holding the peizotome perpendicular to the cortical bone was very important to avoid nicking the adjacent root structure and restricting the peizotome action to the most planned out safe zone. After completion of decortications, suture was placed using 5-0 chromic gut and a periodontal dressing was placed. Patient was prescribed antibiotic, analgesics and chlorhexidine gluconate for mouth rinsing for 7 days. Patient was recalled after 2 weeks for follow up and suture removal.

The catabolic phase of RAP is of extreme importance to the orthodontist as the rate of movement of teeth is maximum during this period. Hence, 2-4 weeks after the peizo incision should judiciously be utilized to achieve greater bulk of tooth movement. Space closure was started immediately after the surgical procedure in 0.017 X 0.025 SS with elastomeric chains. The results were achieved 6 weeks after the Piezocision procedure and the overall treatment duration for completion of the case was 7 months, which was 2-3 times shorter than the expected treatment duration in an identical case treated by conventional orthodontics. But the time taken without piezocision to finish same type of case, can

be a matter of future comparative study for better analysis.^{[10],[11]}

Treatment results:

Post-treatment evaluation showed a highly pleasing aesthetic profile of the patient (Figure 10). During the entire treatment duration, a Class I molar and canine relationship was maintained (Figure 11). Cephalometric analysis corroborated with the clinical findings and also showed a reduction in proclination of maxillary anteriors (Figure 12).

Discussion

The esthetic enhancement during orthodontic treatment is a significant problem for patients, so is the length of treatment during which the goals of treatment are to be accomplished. Patients often lack the patience to wait for ideal required time for orthodontic treatment; hence the need of guided the orthodontic practice. Accelerated orthodontics has piqued the interest of orthodontists and periodontists around the world. The proof to that would be the study of recent published literature^{[12],[13]}.

Various methods have been suggested during orthodontic treatment to reduce the length of the treatment. When the bone is injured, an inflammatory response followed by very dynamic healing process occurs at the site of surgically intervention which can enhance the tooth movement. Such methods are Corticotomy, Piezocision, interseptal bone reduction, micro-osteo perforation, vibratory force delivery, low level laser therapy^{[14]-[17]}. Of these methods, first four are invasive methods and require surgical interventions. The surgical interventions cannot be a blind approach as there is always a scope of human error and chance to damage the tooth or surrounding tissues. The method to be employed by the clinician for accelerating the tooth movement should be minimally invasive but at the same time equally accurate and effective.

Sertac A et al^[18] researched the Piezocision effect and its transversal periodontal impact. They observed that during tooth movement there was a substantial difference between the control and experimental groups. (lower loss of anchorage and significant canine distalization). In addition, in the experimental group, the distalization time was reduced. Accelerated tooth movement, reduced loss of anchorage in posterior teeth and no change in the transverse maxilla were observed in Piezocision-assisted distalization. Furthermore, there were no adverse effects of Piezocision on the periodontal health.

In a research undertaken by Sanjideh et al^[17] where they compared the rate of movement of teeth using a split-mouth design with single-sided corticotomy in foxhounds; the authors noted that the frequency of movement of teeth peaked between the 22nd 25th days and decelerated afterwards. The side facilitated by corticotomy shifted twice as far as the opposite side during this 3-week period.

In the current report, a guiding technique to place the incision accurately in the interdental spaces rather than following a blind approach and increase the chances of damaging roots and causing irreversible damage to the tooth, was attempted. For an accurate placement of the incision around the tooth without damaging the root or cause unnecessary periodontal insult the multi-vertical looped arch wire was designed. This technique was highly accurate as the position of the loop in interdental areas was further verified with the help of CBCT. To prevent accidental contact with any critical anatomic structure or tooth roots with the piezoelectric micro-saw, a safety distance of 1.5 mm was maintained, as suggested by Cassetta et al^[19]. Elastomeric E chains were used with optimum retraction force within the optimum biological boundaries. Piezocision is a minimally invasive surgical technique compared with other similar methods. The primary advantage is that there is no need for lingual or palatal surgical intervention from the buccal side alone. O Gibreal et al.^[20] proposed that in instances of severe crowding, the piezocision flapless Corticotomy technique was very efficient in accelerating orthodontic movement of teeth and the complete alignment of severely crowded mandibular anteriors with this method took about 59% less therapy time compared to the conventional treatment. Long et al ^[21] that Corticotomy enabled orthodontic tooth movement to be accelerated and also added that it was a safe procedure. Recently Liu R et al ^[20] documented that during orthodontic movement, corticotomy significantly promoted osteogenic and proliferative activity, accelerated tooth movement, and eliminated root resorption by up regulating Wnt signal pathway which regulates the proliferation and dissociations of osteoblasts and other functional activities and this signal pathway during bone formation is well documented.^{[23],[24]}

Conclusion

Thus, efficient rapid tooth movement can be achieved with OLP technique with minimal interventions which will definitely increase the precision in



Figure 1: Pre treatment Extraoral photographs



Figure 2: Pre treatment Intraoral photographs

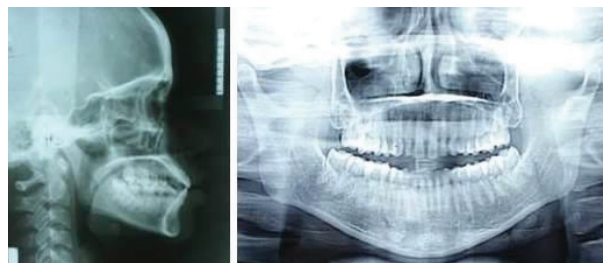


Figure 3: Pre treatment Radiographs

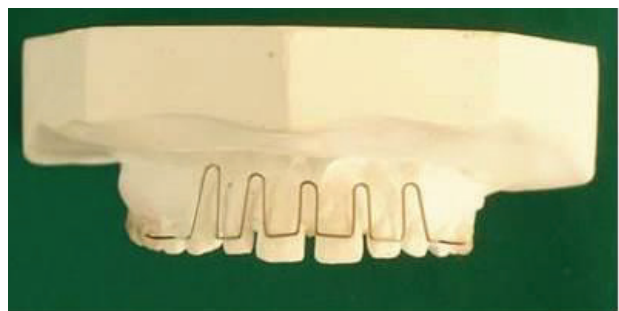


Figure 4: Appliance design

piezocision and reduce the overall treatment time. This technique belongs in a specialty arena where both orthodontists and periodontists work together

from diagnosis through treatment and retention for better outcome of the treatment.

Figures with Legends:



Figure 5: CBCT image

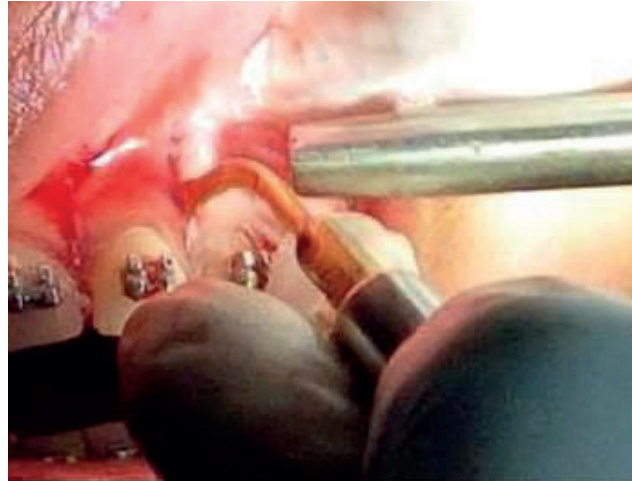


Figure 9: Decortications by Peizotome



Figure 6: Appliance delivered



Figure 10: Post treatment Extraoral photographs



Figure 7: Incision marking given



Figure 11: Post treatment Intraoral photographs



Figure 8: Soft tissue incision given



Figure 12: Post treatment Radiographs

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Supplementary materials. Not applicable

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