

Case Report

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Micro-osteoperforations facilitated alignment of mandibular incisors: A case series.

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ABSTRACT

Background: The long treatment duration of fixed orthodontic therapy is one of the major concerns associated with orthodontic treatment and hence various methods to reduce treatment time are being researched nowadays. Of the various methods employed for accelerating the tooth movement, the surgical methods which work on RAP (regional acceleratory phenomenon) show the most promising result. However, the invasiveness of these procedures limits their clinical acceptability. Micro-osteoperforations is surgical method of accelerating tooth movement which is gaining popularity due to its promising results and reduced invasiveness.

Aim: To show micro-osteoperforations facilitated rapid alignment in crowding cases.

Method: In this case series, we treated dental crowding malocclusion (Little's irregularity index between 4-6mm) with mini-implant facilitated micro-osteoperforations. Six MOPs were performed using mini-implant, two MOPs each mesial to the canines on both sides and between central incisors in the midline on labial aspect of mandible. The outcome measures were to

-Reduced overall treatment time needed to complete alignment of mandibular anterior teeth.

-Improved patient reported outcome measures i.e. subject's perception of pain, comfort and satisfaction.

Results: In all cases, the treatment time for complete alignment of mandibular incisors was reduced remarkably along with patient satisfaction.

Conclusion: MI-facilitated MOPs accelerated tooth movement without any significant pain and discomfort.

Key words: Accelerated orthodontics, regional acceleratory phenomenon (RAP), micro-osteoperforations, dental crowding.

INTRODUCTION

The long treatment duration is a major concern associated with the orthodontic treatment for both the patient as well as the orthodontist. Therefore, the treatment modalities that decrease treatment time without compromising the treatment outcome are an active area of research in orthodontics today. The various approaches being tested for accelerated tooth movement (ATM) can be broadly classified as biological, mechanical, physical and surgical approaches.^{1,2} Out of all these approaches, the surgical procedures have been found to be most consistent and promising in achieving the desired results. However the invasiveness of the surgical techniques have resulted in their low acceptance by the patients and hence lesser invasive methods like piezocision,^{3,4} computer-guided piezocision,⁵

laser-assisted flapless corticotomy,⁶ discision⁷ and micro-osteoperforations⁸ have been explored.

One such lesser invasive method using flapless shallow 'cortical perforations' as a means of fine-tuning inflammation levels for enhanced tooth movement was first carried out in animal studies.⁹ Alikhani M et al. named it as 'micro-osteoperforations' (MOPs) and carried it out in a human clinical study using a special MOP device 'Propel'. Their study had shown a 2.3 fold increase in rate of tooth movement as well as ready acceptance by the patients.⁸

These days mini-implants (MIs) are a commonly utilized tool in an orthodontic office. Realizing MOPs as an effective, comfortable and safe procedure to accelerate the tooth movement and the ready acceptability of mini-implant by the patients and clinicians, we used the mini-implants to place

micro-osteoperforations in dental crowding cases. Dental crowding is the most common type of malocclusion¹⁰ and levelling and alignment of such cases take upto 8 months.¹¹

The following case series describes dental crowding cases in which mini-implant facilitated micro-osteoperforations were placed resulting in significant reduction in the time required for levelling and alignment.

CASE REPORT

Summary of cases and diagnosis

Three adolescent male aged between 15-17 years reported with the chief complaint of crowding in the lower jaw which caused problem in oral hygiene maintenance in that area. Though highly motivated for orthodontic treatment, their issue was that they were going out of state for further studies and had a maximum of 1 year for treatment. Since their major issue was mandibular crowding (Little's irregularity index 4-6mm), we decided that reducing the time required for levelling and alignment will significantly reduce the total treatment time. Pre treatment OPG revealed presence of all permanent teeth and no evident bone loss. Since the patients had good esthetics and no major changes were anticipated /planned no lateral cephalogram was taken.

➤ Treatment Goals

The patients required non-extraction treatment with levelling and alignment of both the arches. To reduce the treatment time, the patients were given the option of micro-osteoperforations assisted orthodontic levelling and alignment. The procedure was thoroughly explained to the patients and also clearly told that this might shorten the treatment time though there is no guarantee of the same. All cases readily agreed for the new procedure.

➤ Treatment Objectives

The treatment objective was to obtain a good alignment of teeth along with maintaining the Class I molar and canine relationship and achieving normal overjet and overbite and good finishing and detailing of the cases within a year.

Treatment Progress

All the cases were bonded with 0.022-inch slot MBT prescription appliance (Ortho Organizers, San Marcos, Calif). Before placing the initial levelling archwire (0.014" NiTi), MOPs were placed. Panoramic radiographs were utilized to assess the long axis of the teeth and root proximity prior to the procedure.

The patients were asked to rinse their mouth twice by chlorhexidine for 1 minute. MOPs were performed on the buccal cortical bone, under local anaesthesia (2% lidocaine

with 1:100,000 epinephrine) with standard asepsis using a self-drilling 1.6 mm x 8 mm orthodontic mini-implant with the help of MI_screw driver (Tomas, DENTAURUM GmbH & Co. KG). Total 6 MOPs were placed at three sites i.e. interproximally between mandibular canine and lateral incisor on both right and left sides and between central incisors in the midline on labial aspect of mandible (**Fig. 1**).¹² Each site received 2 MOP's, first 2mm apical to alveolar crest and second 2mm below the first in a vertical line making a total of six MOPs (**Fig. 2**). The depth of perforation was decided by adding buccal cortical bone depth (using coronal and sagittal sections of CBCT) plus gingival tissue depth (measured by transgingival probing using Williams probe) at the level of planned perforation sites. Pressure was applied using cotton pellets to achieve hemostasis after MOPs placement.



Figure 1: MOP sites shown on the study model



Figure 2: MOP sites shown clinically

The levelling orthodontic wire (0.014" NiTi) was ligated using 0.010" steel ligature wires during the same appointment at which MOPs were placed. The arch wire sequence used was 0.014-inch NiTi, 0.016-inch NiTi, 0.016 X 0.022-inch NiTi, 0.017 X .025-inch NiTi and finally 0.019 X .025-inch stainless steel.

RESULTS

In all the cases (**Fig. 3, 4, 5**) crowding was relieved within 2

months. Consequently complete alignment and levelling which usually takes about 6-8 months was completed in 3-4 months in the above cases. This significantly reduced the treatment time and the total treatment was finished within 9-12 months. Ideal overjet and overbite was achieved with Class I molar and canine relationship.



Figure 3: Case 1- A & B) Pre treatment anterior and mandibular occlusal view; C) Mid Treatment; D & E) Post treatment anterior and mandibular occlusal view



Figure 4: Case 2- A & B) Pre treatment anterior and mandibular occlusal view; C) Mid Treatment; D & E) Post treatment anterior and mandibular occlusal view



Figure 5: Case 3- A & B) Pre treatment anterior and mandibular occlusal view; C) Mid Treatment; D & E) Post treatment anterior and mandibular occlusal view

DISCUSSION

Most of the treatment modalities based on RAP are invasive in nature. Complications range from slight interdental bone loss and loss of attached gingiva to periodontal defects, which can occur in cases with short interdental distances. Subcutaneous hematomas in the neck and face have also been reported after more invasive corticotomies.¹³ In an effort to reduce postsurgical morbidity, alternative surgical procedures have been introduced. Kim et al.¹⁴ introduced 'Corticision' that include transmucosal penetration of the cortical bone with a reinforced surgical blade and mallet, thus eliminating the need for a periosteal flap. Dibart described a new minimally invasive procedure called 'Piezocision' that also performed corticotomies without a periosteal flap.¹⁵

In previous animal study by Teixeira describes the use of flapless minimal 'cortical perforations' as a means of fine-tuning inflammation levels for enhanced tooth movement by creating shallow perforations without the need for flaps.⁹ Alikhani M et al.⁸ described this procedure as 'micro-osteoperforations' (MOP) and used it for the first time in humans reporting a 2.3 fold faster tooth movement. They even devised a new device 'Propel' available commercially as a disposable device by Propel Orthodontics specially for this purpose.⁸

Being minimally invasive technique, micro-osteoperforation is an effective, comfortable, and safe procedure to accelerate tooth movement and it significantly reduce the duration of orthodontic treatment.⁸ MOPs can be incorporated into routine orthodontic mechanics and at different stages of treatment,

facilitating alignment, retraction and root movement, stimulating bone remodeling in areas of deficient alveolar bone and reducing the stress on anchor units.¹⁶

A recent study by Tracy cheung et al used mini implants (MI) to create micro-osteoperforations eliminating the need for specially designed Propel device for the procedure. The study showed increased tooth movement with no significant difference in root resorption with the procedure.¹⁷ As mini implants are readily used in orthodontics, they offer an attractive method for MOP placement with promising clinical acceptance both from orthodontic patients and orthodontists.

So in this case series, we described the effects of micro-osteoperforations using mini implants on the rate of alleviating mandibular anterior crowding during fixed orthodontic treatment over a period of time. Our cases show reduction in the treatment time upto 44%. Similar results have been reported by Teixeira et al.,⁹ Alikhani et al.,⁸ Tsai et al.¹⁸, Bansal et al.¹² showing 53%, 62%, 33% and 44% reduction in treatment time in the MOP side as compared to the control side respectively. Our findings are also in agreement with other less invasive procedures like Piezocision,³ Laser-assisted flapless corticotomy,⁶ Piezocision group using customized brackets⁴ and Discision⁷ showing 1.5 to 2 times, 2 times, 1.6 times and 35.5% faster tooth movement respectively.

CONCLUSION

The case series shows that combining MI-facilitated MOP procedure with routine orthodontics can reduce the duration of orthodontic treatment that can be safely incorporated in routine practice.

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