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Case Report

Dentistry Section

A Simplified Technique to Treat Bimaxillary Protrusion using Micro-osteoperforation: A Case Report

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ABSTRACT

In Asian population, bimaxillary protrusion is a prevalent malocclusion characterised by protruding and proclined upper and lower incisors, as well as increased lip procumbence. A 25-year-old female patient presented with a chief complaint of forwardly placed teeth and bimaxillary protrusion and required fixed mechanotherapy with all four 1st premolar extractions. The patient also desired that the treatment be completed in a short period of time. Since sliding or loop mechanics alone take longer to close extraction spaces, authors chose Micro-osteoperforation (MOP), a minimally invasive procedure used to accelerate orthodontic tooth movement. MOP involves drilling or perforating distal to the canine for en-mass retraction, causing the alveolar bone to release inflammatory cells that accelerate tooth movement. This non invasive technique was used for the treatment. The average rate of tooth movement in each quadrant was 1.7 mm per month. Taking the procedure into account, the patient reported no side-effects during or after drilling, but mild discomfort was felt. The entire space closure took four months. At the end of space closure, a Class I molar and canine relationship was preserved with normal overbite and overjet, with very minimal anchorage loss on the molars. An extraoral improvement in profile from convex to straight was seen. The treatment was completed within 14 months. The novelty of MOP includes faster treatment times and less discomfort during orthodontic treatment. However, like any medical procedure, MOP does carry some risks, such as infection or damage to surrounding teeth or gums. It is important to discuss the risks and benefits of MOP with your orthodontist before deciding whether to undergo the procedure.

Keywords: Accelerated tooth movement, En-masse retraction, Non invasive

CASE REPORT

A 25-year-old female patient presented to the Department of Orthodontics and Dentofacial Orthopaedics with a complaint of forwardly positioned anterior teeth. On extraoral examination, a convex profile and incompetent lips with facial symmetry were seen. Intraoral examination revealed proclined upper and lower anterior teeth, increased overjet of 6 mm, and a normal overbite of 2 mm. Class I canine and molar relations were observed on both sides [Table/Fig-1]. The provisional diagnosis was Class I malocclusion with bimaxillary protrusion. After cephalometric analysis [Table/Fig-2,3], a final diagnosis of Class I malocclusion with bimaxillary protrusion was made, necessitating the extraction of the first premolars in both the upper and lower arch.

[Table/Fig-1]: Pretreatment extraoral frontal, smiling and profile photo with intraoral photos of maxillary and mandibular arch in occlusion and canine relation Class-I malocclusion marked with black.

[Table/Fig-2]: Pretreatment lateral cephalogram and Orthopantogram (OPG).

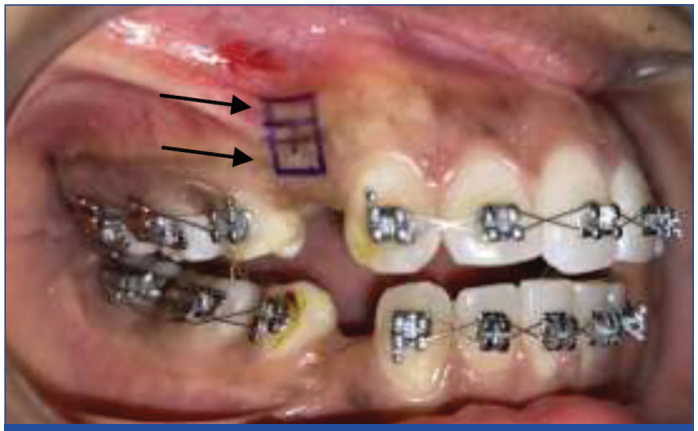
Measurement	Mean value	Pretreatment
SNA	82°	84°
SNB	80°	80°
Mandibular plane angle	21.9°	21°
SN-OP	14°	15°
ANB	2°	4°
Beta Angle	27°-33°	23°
A-B (ll to OP)	-0.4±2 mm	7 mm
1 to NA	22°	27⁰
1 to NA (mm)	4 mm	10 mm
1 to NB	25°	28°
1 to NB (mm)	4 mm	6 mm
IMPA	90°	91°
Effective mandibular length	120±3.4 mm°	97 mm
Nasolabial angle		106
Saddle angle		123

[Table/Fig-3]: Cephalometric values of pretreatment.
SNA: Sella-nasion and Nasion-A lines; SNB: Sella-nasion and Nasion-B lines; ANB: Angle formed by the intersection of Nasion-A and Nasion-B; SN-OP: Sella-nasion-occlusal plane; IMPA: Incisor mandibular plane angle

The treatment plan involved the extraction of the first premolars followed by space closure, which can be achieved through sliding mechanics, loop mechanics, or accelerated orthodontics. Due to the patient's preference for a shorter treatment duration, accelerated orthodontics using Micro-osteoperforation (MOP) was chosen as the least invasive procedure.

Premolar extractions were done at the beginning of the therapy, followed by strapping the maxillary and mandibular arches with 0.022*0.028 slots (McLaughlin-Bennett-Trevisi MBT prescription). The first levelling and alignment wire used was a 0.016 inch long Nickel Titanium (NiTi) wire, followed by rectangles wires made of 0.016*0.022 and 0.019*0.025 NiTi. Stainless steel wires ranging from 0.019 to 0.025 inches were affixed to both arches to prepare for retraction.

Under local anaesthesia (2% lidocaine with 1:100000 epinephrine), the first two holes were made distally to the canines on the crestal bone, 5 mm and 8 mm apart, as indicated by the black arrows in [Table/Fig-4]. MOPs were then performed using a bone screw measuring 1.6 mm in diameter and 3.0 mm in length, with the aid of an implant screwdriver device [Table/Fig-5]. Canine retraction was continued using a NiTi coil spring exerting 200 g of force [Table/Fig-6].

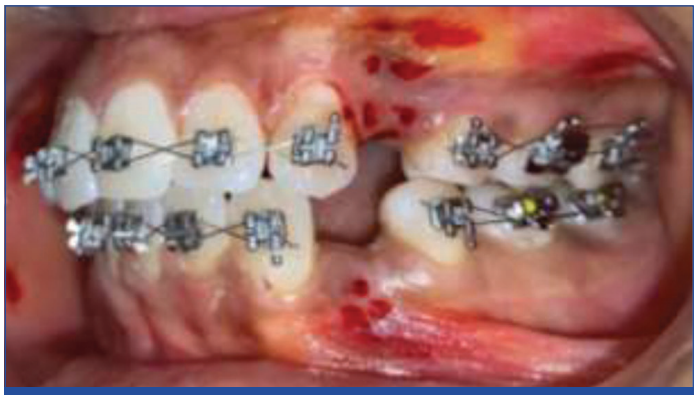


[Table/Fig-4]: Marking for Micro-osteoperforation (MOP).

[Table/Fig-5]: Making holes for Micro-osteoperforation (MOP) using a screwdriver device.

[Table/Fig-6]: Canine retraction.

Each quadrant saw an average tooth movement rate of 1.7 mm per month. The patient reported no side-effects during or after drilling, although some discomfort was felt during screw tightening [Table/Fig-7]. The overall space closure was completed within four months, resulting in the maintenance of a Class I molar and canine relation was maintained with normal overbite, reduced overjet, and improved profile from convex to straight [Table/Fig-8]. The treatment was completed in a total time span of 14 months.



[Table/Fig-7]: Vertical ditch for Micro-osteoperforation (MOP) distal to canine in both the archs.

[Table/Fig-8]: Post-treatment extraoral frontal, smiling and profile photo with intraoral photos of maxillary and mandibular arch in occlusion and canine relation and molar relation Class-I marked with black.

As the patient was in the first trimester, radiographs were not taken. However, after a 6-month follow-up, no relapse was seen after the clinical evaluation.

DISCUSSION

Accelerated orthodontics is a type of orthodontic treatment that aims to reduce the treatment time required to achieve desired orthodontic results. Traditional orthodontic treatment can take 18-24 months or longer. Accelerated orthodontics claims to achieve the same results in a significantly shorter time frame, usually ranging from 3-9 months. Accelerated orthodontic treatment is achieved by applying more force to the teeth than in traditional orthodontic treatment. This is done through the use of innovative orthodontic appliances, such as vibration devices or MOP, which help stimulate bone remodeling and accelerate tooth movement [1]. While accelerated orthodontics may shorten treatment time, it may not be suitable for all patients. If a patient is a good candidate for accelerated orthodontic treatment, an orthodontist must perform a thorough evaluation [1].

Accelerated orthodontics is a type of orthodontic treatment that aims to speed up the movement of teeth into their proper position. There are several types of accelerated orthodontics, including:

- MOP
- Propel orthodontics

- Wilckodontics
- Corticotomy-assisted orthodontics
- AcceleDent [2-4].

Each type of accelerated orthodontics has its own benefits and drawbacks, and the best option will depend on the individual's situation and preferences. MOP is a minimally invasive orthodontic procedure that involves creating small holes in the bone around the teeth using a specialised instrument. These tiny perforations, which are typically 1-2 mm in diameter and 3-4 mm deep, stimulate the bone to release certain chemicals that accelerate tooth movement [1,2,5].

During the MOP procedure, the orthodontist will first numb the area around the teeth with a local anaesthetic. Then, they will use a special instrument to create the perforations in the bone around the teeth. The procedure is usually quick, and most patients report feeling minimal discomfort. After the procedure, patients may experience some soreness or discomfort, but this usually resolves within a few days [6,7]. MOP is typically used in conjunction with other orthodontic treatments, such as braces or clear aligners, to speed up the movement of teeth into their proper position. The procedure can be performed on both adults and children, and it has been shown to be safe and effective in numerous studies [8].

The MOP is a minimally invasive procedure that involves creating tiny holes in the alveolar bone surrounding the teeth to stimulate bone remodeling and accelerate tooth movement [9]. This technique has gained popularity in recent years as a way to reduce the duration of orthodontic treatment, improve patient comfort, and achieve better treatment outcomes. In the present discussion, authors will explore some of the key aspects of MOP and its risks and benefits [10]. Alkebsi A et al., analysed the available evidence on the use of MOP in orthodontic treatment. The review found that MOP can significantly increase the rate of tooth movement and reduce the duration of orthodontic treatment [10].

Kundi I et al., a systematic review and meta-analysis published in the journal Progress in Orthodontics in 2020, analysed the results of 16 studies on the use of MOP in orthodontic treatment. The review found that MOP can significantly increase the rate of tooth movement and reduce the duration of orthodontic treatment [11]. Overall, the available literature suggests that MOP can accelerate tooth movement and reduce the duration of orthodontic treatment. However, more high-quality research is needed to establish the long-term safety and efficacy of MOP, as well as the optimal protocol for its use in clinical practice [12].

One of the main advantages of MOP is its simplicity and ease of use. The procedure can be performed chairside in a matter of minutes using a handheld device that creates microperforations in the bone. The perforations are typically 1-2 mm in diameter and spaced 3-4 mm apart and can be placed around the teeth that require movement [5]. The perforations create a localised inflammatory response that triggers the release of cytokines and growth factors, which in turn stimulate bone remodeling and tooth movement [9]. This process can reduce the duration of orthodontic treatment by up to 50%, depending on the severity of the malocclusion and the desired treatment outcomes [5,11]. Another advantage of MOP is its safety profile. The procedure is minimally invasive and does not involve cutting or removing any tissue. The risk of infection or other complications is low, and patients typically experience little to no pain or discomfort [6]. In addition, MOP can be used in conjunction with other orthodontic techniques, such as aligners or braces, to enhance their effectiveness and achieve more predictable treatment outcomes [1,5,12].

Despite these advantages, there are some limitations and potential drawbacks to MOP that should be considered. While the risk of these complications is low, they can occur in some cases, especially if the perforations are placed too close to the roots or if the teeth are already compromised. In the recent study, MOP did not speed up canine retraction, but they did appear to facilitate root movement [13,14].

Hence, MOP is a promising technique that has the potential to revolutionise orthodontic treatment by reducing treatment time, improving patient comfort, and enhancing treatment outcomes [15]. While there are some limitations and potential risks associated with this technique, the benefits appear to outweigh the drawbacks in most cases [16]. Orthodontic practitioners should consider incorporating MOP into their treatment protocols as a way to improve the patient experience and achieve better treatment outcomes.

CONCLUSION(S)

Among the defined invasive techniques for accelerating orthodontic tooth movement and treatment times, MOP stands out as a minimally invasive, easy-to-use, repeatable, and efficient new method that can eliminate some of the disadvantages of surgery. In the present case, MOP accelerated anterior retraction in bimaxillary protrusion cases and did not affect molar anchorage. Although it is reported that side-effects such as pain or root resorption are not observed due to MOP, long-term studies are required.

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