Accelerated Orthodontic Treatment

INTRODUCTION

In our increasingly informed and aware society, the need for orthodontic treatment has been growing. Today not only children but a large number of adults are seeking orthodontic treatment to enhance the social and psychological status of their life. With an increase in age of our patients, there is also an increase in the demand for faster and more efficient orthodontic treatment. While technological developments provide materials and appliances that can produce more efficient treatment, the speed of treatment is still controlled with biological response. Recently, researchers from the Consortium for Translational Orthodontic Research (CTOR) at New York University College of Dentistry, were able to develop a technique to increase the rate of tooth movement, applying the same biological principles activated during fracture healing (8,3,4). In response to injury our bone activates a repair mechanism that removes the injured bone and builds a new bone. During this process, osteoclasts (cells that resorb bone) are activated and for a short period of time bone density decreases around the area of the fracture site. The osteoclast response is followed by activation of osteoblasts that will create a new bone with normal density (2,3,4). Taking advantage of this bone repair mechanism, NYU researchers developed a methodology, called osteoperforation to accelerate tooth movement. During osteoperforation, small holes are created in the alveolar bone adjacent to the teeth that need to be moved, under local anesthesia, without the need for any tissue flap. This method moves teeth at least twice as fast as the normal rate shown in both animal and human studies.

KEYWORDS

osteoperforations, bone remodeling, accelerated orthodontics, cytokine expression

CLINICAL PROCEDURE

In the case studies discussed here, we utilized a conservative method of accelerating bone turn over via small osteoperforations in the cortical plate. The clinical procedure is as follows:

1. Obtain an up to date panoramic radiograph or periapical radiograph of the region of interest.
2. Apply infiltrative local anesthesia.
3. Manually perform the osteoperforations (Fig 1. Illustrates the special osteoperforation instrument used which was developed by AlveoLogic™ in collaboration with NYU.).
4. Place about three to four osteoperforations proximal to the teeth/tooth to be moved.
5. Prescribe a non-anti-inflammatory analgesic such as acetaminophen or paracetamol (Tylenol).
6. Evaluate the patient every four weeks and repeat the procedure if necessary.
CLINICAL APPLICATION

There are numerous applications for osteoperforation-assisted accelerated tooth movement. Below we discuss 3 different clinical scenarios where osteoperforations were performed:

a. Adult Patients: In the past, the majority of patients receiving orthodontic treatment were predominantly juveniles and young adolescents. However, in recent years, adults who did not have the opportunity to receive orthodontic treatment when they were young are more actively seeking treatment. However, adult patients are inevitably more demanding on the overall aspects of their treatment, especially on the duration of treatment which may have a greater social impact on them when compared to adolescents. Furthermore, as we increase in age, our tissues are also less biologically active and our ability to adapt also diminishes. As such, tooth movement may not only be more uncomfortable for adults but also tends to occur at a slower rate (5,6). The following case study illustrates how routine premolar and canine retraction can be accelerated significantly with osteoperforations in adult patients:

Case Study 1:

A 28 year old male presented with a Class II Div 1 subdivision left malocclusion. The treatment plan included obtaining a Class I canine relationship on the left and a reduction of overjet via the unilateral extraction of the upper left 2nd premolar. After initial leveling and alignment of his dentition, the upper left 2nd premolar was extracted and the upper left 1st premolar was retracted via conventional orthodontics (Fig 2a). An orthodontic mini-implant was used to maintain anchorage.

After four months, only half of the extraction space was closed. At this point, osteoperforations were performed between the upper left 2nd premolar and the molar to enhance the tooth movement (Fig 2b).

b. Closure of Edentulous Spaces: Adult patients also exhibit a greater incidence of mutilated dentition with missing teeth requiring prosthetic treatment. A cost-effective option to implants may involve orthodontic closure of the edentulous region. The following case report illustrates this possibility:

Case Study 2:

A 32 year old female was referred to the orthodontic clinic by the general dentist who had extracted an unrestorable lower right 1st molar (Fig 3a). Due to financial concerns, the patient was reluctant to undergo a bone augmentation and a subsequent implant to replace the extracted molar. The general dentist inquired on the feasibility of closing the extraction space orthodontically via protraction of the right 2nd molar.

In four weeks, all the remaining extraction space was closed and the upper left canine also drifted distally considerably (Fig 2c).
The patient’s lower arch was bonded and banded and after the initial leveling and alignment stage, osteoperforations were performed between the lower right 1st premolar and 2nd premolar. The protraction force to the lower right 2nd molar was applied via a nickel-titanium closing coil spring to an orthodontic mini-implant placed between the lower right 2nd and 1st premolar, to prevent distal movement of the 2nd premolar (Fig 3b).

The osteoperforations and activation of the coil spring were repeated every 6 weeks. In the second visit, lingual buttons were placed to allow the use of elastomeric chains to enhance the protractive force and within four months of the initial osteoperforations, the extraction space was closed (Fig 3c).

**c. Moving teeth through poor quality bone or knife-edged ridges:** Oftentimes, when teeth are lost or missing congenitally, the alveolar ridge bone in that area atrophies and the quality and quantity of the bone is compromised. This poses a challenge not only to the restorative dentist who may need to place implants in the area but also to orthodontists as tooth movement through these areas is relatively slow. Osteoperforations induce a biological response which accelerates bone remodeling and results in tooth movement, hence as a useful technique in these scenarios. The following case report illustrates how we may move teeth through poor quality alveolar ridge of congenitally missing lower second premolars:

**Case Study 3:**

A 35 year old female presented to the clinic with congenitally missing lower 2nd premolars resulting in poor alveolar ridges. Her referring dentist stated that the space was insufficient for implants and wanted to know what options were available. After consulting with the patient and the referring dentist, we decided to close the spaces orthodontically by protraction of the lower molars.

The patient’s lower arch was bonded and banded and after the initial leveling and alignment stage, osteoperforations were performed between the lower right 1st premolar and 2nd premolar. The protraction force to the lower right 2nd molar was applied via a nickel-titanium closing coil spring to an orthodontic mini-implant placed between the lower right 2nd and 1st premolar, to prevent distal movement of the 2nd premolar (Fig 3b).

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**CONTRAINDICATIONS**

These guidelines are definitely not prescriptive or exhaustive and it is always prudent for the clinician to consult the patient’s physician before performing any osteoperforations:

a. Patients with bleeding or immune disorders
b. Patients who require prophylactic antibiotics
c. Patients who have had previous radiotherapy of the mandible
d. Patients taking anti-inflammatory medications (1,7)

**DISCUSSION AND SUMMARY**

As the demand for aesthetics and adult orthodontic treatment grows, the orthodontist is faced with new challenges each day. The ability to provide patients the option of accelerating orthodontic movement even in cases in which movement may otherwise be difficult to achieve conventionally, should be part of an all encompassing approach towards patient care. As seen in these case series, the use of conservative osteoperforations may prove to be a useful skill for accelerating tooth movement. However, one can never reiterate enough that prudency and sound judgment in the diagnosis and treatment planning stage should always take precedence and that a fine balance needs to be achieved between the patient, the orthodontist and the referring dentist.

**REFERENCES**


