"When do I get my braces off?" – the constant question. We hear it several times a day. Virtually all of our patients would like to have their orthodontic experience be shorter. The pursuit of treatment efficiency has resulted in wonderful refinements in the mechanical delivery aspects of care. Bracket designs and customizations, archwire metallurgy and customization continue to evolve with the intention to make orthodontic treatment shorter in duration. All of these efforts have been successful to some degree or another depending upon the individual patient’s needs. Over the last decade, manipulating the biology of tooth movement has also become an exciting focus of effort to pursue treatment efficiency.

ACCELERATION BIOLOGY

The use of pharmaceutical (vitamins C and D, prostaglandin and osteoblast injections), electromagnetic stimulation, cyclic forces (vibration), laser and surgical stimuli in combination with light mechanical forces of some orthodontic systems for accelerating orthodontic tooth movement and inducing bone remodeling has attracted considerable scientific interest. What they all have in common is that their biological mechanism is based on a physiological healing process known as regional acceleratory phenomenon (RAP) (Fig. 1).

A cascade of events occurs with the initiation of tooth movement. The fascinating interplay of osteoblast and osteoclast communication to remodel bone is mediated by cytokine chemicals messengers.

Iatrogenic induction of trauma, intentional surgical injury of the periodontal tissue, results in receptor activator of nuclear factor kappa ligand (RANKL) gene expression on the surface of osteoblasts. This increases osteoclast formation on the pressure side of the periodontal ligament during force application to an individual tooth. These factors, among others yet to be defined, result in bone remodeling and ultimately accelerate the movement of a tooth through alveolar bone.

CLINICAL ACCELERATION OPTIONS

Propel alveolar micro-osteoperforation, Wilckodontics, Piezoincisions, and AcceleDent are all current modalities available to the orthodontic clinician.

Propel

Propel is a device uniquely designed to perform the alveocentesis procedure. Alveocentesis is a novel technique that creates micro-osteoperforations. Propel is an FDA-registered 510k exempt Class I device designed
for single use only. The instrument provides a surgical stainless-steel leading edge similar in appearance to an orthodontic mini-screw but uniquely designed and patented to be used to atraumatically perforate the alveolus directly through keratinized gingiva as well as movable mucosa. The Propel device is specifically designed and patented to maximize the remodeling process, while eliminating soft-tissue damage and enabling any orthodontist the ability to accelerate treatment in his/her office (Fig. 2a).

Wilckodontics

Since the 1950s, periodontists had been using corticotomy procedures to increase the rate of tooth movement.

Corticotomy is a series of bony cuts through the alveolar bone around the teeth. In the 1990s, the Drs. Wilcko, using CT scans, concluded that a marked reduction in mineralization of the alveolar bone was the reason for the accelerated tooth movement following corticotomies. In 1995, Drs. Wilcko patented the Accelerated Osteogenic Orthodontics (AOO) technique. Unlike a usual corticotomy, AOO doesn’t just cut into the bone, but decorticates it; along with a full thickness flap, cuts and perforations are made along the roots. A portion of the bone’s external surface is removed, needing the placement of slow resorbing cortical particulate allograft to maintain an open network for the proliferation of bone-forming cells. During healing, the bone naturally goes through a phase known as osteopenia, where its mineral content is temporarily decreased. The tissues of the alveolar bone release rich deposits of calcium, and new bone begins to mineralize in about 20 to 55 days. While the bone is in this transient state, braces can move your teeth very quickly, because the bone is softer and there is less resistance to the force of the braces. Corticotomy-facilitated orthodontics with concomitant bone grafting requiring a full thickness flap the patient is often out of work for 10 days and has compromised nutrition for up to one month. Patients require follow-up visits for suture removal and monitoring. Patients are prescribed antibiotics and narcotics to cover the patients from pain and infection (Fig. 3).

Piezoincisions

Vertical interproximal incisions are made, below the interdental papilla, on the buccal aspect of the maxilla using a surgical blade, with local anesthesia, one week after bonding brackets. These incisions are kept minimal, just to allow access of the piezo surgical knife. The piezo knife is used to create a cortical alveolar incision through the gingival opening to a depth of approximately 3mm. Because of the rapid and temporary demineralization that occurs after piezoincision as a result of the RAP effect, tooth displacement is accelerated and treatment time...
can decrease up to 60 percent. Interdental corticotomy with a Piezotome does not requiring a full thickness flap but is often combined with tunnel grafting for highly crowded areas. This procedure is generally performed by a periodontist or oral surgeon requiring an additional fee (Fig. 4).

**AcceleDent**

According to the AcceleDent website, the technology behind the AcceleDent System is predicated on the application of pulsating, low magnitude forces (cyclic forces) to the dentition and surrounding bone as a means of accelerating orthodontic tooth movement through enhanced bone remodeling. A removable device was designed to create vibration as a patient bites into a vibrating rubber interdental bite surface. A patient must insert and bite into the vibrating device 20 minutes/day. This approach is gaining popularity among Invisalign providers (Fig. 5).

The factors influencing selection of the acceleration modality of choice could be:

• **Cost**
• **Invasiveness**
• **Ease of implementation in an orthodontic environment without referral to a different specialist**
• **Instrumentation**
• **Patient Compliance**
• **Case acceptance by the individual patient**
• **Most importantly, effectiveness**

When considering all of the choices available, the patient experience should be given a high priority. With this in mind, Propel micro-osteoperforation seems to rise in rank order on the list because of its simplicity relative to Piezoincision and Wilckodontics. Both procedures are significantly more invasive and have greater post-procedure pain and probability for infection than micro-osteoperforation. However all three procedures carry the same contraindications, which include: 1) active untreated periodontal disease, 2) uncontrolled osteoporosis or other local or systemic bone pathologies and 3) long-term use of medications such as anti-inflammatory, immunosuppressive agents, steroids or bisphosphonates.³

Placement of orthodontic mini-screws has become an almost daily occurrence in many clinical practices. Often, mini-screw placement and alveolar micro-osteoperforation can be employed for specific applications on the same individual. When the patients and orthodontists understand the ease of mini-screw placement, it elucidates that alveocetesis is a procedure easy to perform chairside even in an open-bay office and equally as easy to tolerate by the patient. The micro-invasiveness of the treatment allows the patient to immediately return to normal activities.

Patient compliance is a major factor when considering AcceleDent. For Invisalign patients, who are already committed to daily compliance of wearing aligners, AcceleDent becomes a valid option to add to the daily routine in order to speed up treatment progress. However, complying with the additional task of a daily 20 minute vibration session with an AcceleDent device may prove to be an expensive daily burden for some patients. AcceleDent has an MSRP of $1,300.

**ACCELERATION EXAMPLES WITH PROPEL**

Virtually all orthodontic movements can be accelerated with Propel alveolar micro-osteoperforation. Even some of the most frustrating and predictably difficult inefficient orthodontic movements are made predictable and faster (Figs. 5-14).

**ACCELERATION IMPLEMENTATION**

The advent of manipulating biology rather than mechanical systems is an exciting area of focus for the
coming years as the specialty of orthodontics continues to innovate and evolve. Interested clinicians should strategically implement a successful protocol for alveolar micro-osteoperforation sites that facilitates patient acceptance with good communication. A few suggestions for beginning practice protocol in that regard would be:

Select a simple space closure or difficult rotation clinical situation that will only require a few micro-osteoperforation in order to become familiar with the instrument in a minimally challenging situation. These are prevalent in your office on a daily basis.

Explain the procedure in a patient-friendly and confident manner. “We are excited to be offering a treatment that is significantly shortening patient’s treatment time. It involves making the area comfortable with anesthetic, then using a device to make micro-changes to the bone in the area of the movement.” I use the analogy of going to the local mall to get your ear pierced and strengthen the perception that the risks are extremely minimal.

Show the patients images and time frames from the Propel patient website and give them a brochure. Explain that many patients experience up to 50 percent increase in the rate of movement and show a specific example that matches their smile to back it up.

The cost of the disposable one-time use Propel instrument is $149 MSRP (discounted when purchased in larger quantities). Considering that a new micro-osteoperforation procedure can be performed up to every six to eight weeks to re-initiate the iatrogenic inflammatory cascade referred to as RAP “Regional Acceleratory Phenomenon”6, the orthodontic practice owner must make a decision what the value of a 50 percent increase in the velocity of movement is worth in terms of reduction in office visits and increased patient satisfaction, relative to the Propel cost, and then charge an appropriate fee.

The savvy clinician should schedule some time for the first procedure outside of the regular clinical day. It is a good idea to consider a non-patient day when the needs of the patient can be managed easily with an assistant and without the other distractions of patient flow.

Have the patient rinse with Peridex two times for one minute each.

Apply your favorite topical anesthetic that you use for TAD insertion, or infiltrate the area(s) with a local anesthetic to completely obtund the periosteum.

Assess the alveolar bone for the appropriate tip-length needed to maximize the depth of the perforation both mesial and distal to the tooth in question. Visualize adjacent roots using radiographic imaging and intra-

Figures 6 & 7: Second molar protraction with four months of force application and three propel procedures. Figure 8: Palatal impacted canines can be directed to the alveolar ridge with better efficiency. Figures 9 & 10: Propel micro-osteoperforation every six weeks around circumference of each canine and as well as a trail from the impacted tooth to the alveolar ridge. 24 weeks from the first procedure, six procedures every four weeks. Figures 11 & 12: Canine substitution can be accelerated. Figure 13: Micro-osteoperforation sites. Figures 14 & 15: Treatment completed 24 weeks. Six procedures every four weeks to accelerate space closure.
oral landmarks to guide your approach. For edentulous ridges, perforations can be made at the crest of the ridge, both buccal and lingualy. Some clinicians have suggested making perforations as apical as possible so as to maximize the creation of local osteopenia along the entire root surface of the tooth (teeth) in question.

Use the Propel treatment to make your perforations with careful, deliberately smooth rotations of the instrument to the appropriate depth until the LED light goes on indicating depth has been reached. Control any bleeding with the application of a vasoconstrictive agent such as Astringident or just apply minimal pressure for one minute with gauze.

Give post-treatment instructions. Should include acetaminophen (Tylenol) only and absolutely no ibuprofen (Advil or Aleve) as NSAIDs are shown to down regulate cytokine production.

Follow up the next day with a phone call to find out how the patient is doing and answer any questions.

It seems reasonable to conclude that Alevocentesis using the Propel device is a positive option to offer our patients. Use of the Propel device offers distinct advantages over the other current options available. It is exciting to think of the myriad of clinical situations in which all alveolar micro-osteoperforation could be helpful to orthodontic clinicians in our relentless pursuit of treatment efficiency and predictability.

REFERENCES


ABOUT THE AUTHOR

Dr. John Pobanz owns and operates Pobanz Orthodontics in his hometown of Ogden, Utah. He holds a Masters of Science degree in oral biology with an emphasis on bone physiology. He completed his dental and orthodontic training at the University of Nebraska and is a diplomate of the American Board of Orthodontics. Dr. Pobanz delivers lectures to national audiences on topics ranging from creative practice marketing to effective practice management and team building, in addition to progressive applications of temporary anchorage devices.

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