Achieving orthodontic goals faster, with micro-osteoperforation and high-frequency vibration

by Dr. Payam Ataii

Dr. Payam Ataii is an award-winning graduate of Tufts Dental School who has treated more than a thousand patients with clear aligners at his private practice in Laguna Hills, California. As winner of the Invisalign Case Shootout, and an Invisalign faculty member for more than 10 years, he was awarded the North America Align Educator of the Year award in 2016, followed by GP Contributor of the Year 2017. He has trained doctors nationally and internationally. Ataii’s articles have appeared in national and international peer-reviewed dental journal publications, as well as in mainstream media articles and on television. He has presented lectures around the country, and holds patents allowing patients to reap the rewards of modern technology.
While many mechanical aspects of treatment available today facilitate tooth movement, historically the only option for speeding up the process involved surgical intervention such as osteogenesis, corticotomy or osteotomy.\(^1\) To enable greater tooth movement in less time, I prefer minimally invasive options, such as micro-osteoperforation (MOP), in conjunction with both traditional orthodontics and clear aligner therapy. I also incorporate high frequency vibration (HFV) into my practice to improve patient aligner seating, which may translate to more predictable tooth movement—and reduced pain when switching aligners.

MOP was shown in one study to accelerate the rate of tooth movement 2.3 times faster than without the treatment.\(^2\) In my experience, this procedure is especially helpful for effective tooth movements, as well as for patients who need a combination of orthodontic and restorative treatments that could take 12–24 months before they even begin their restorative phase. This waiting period can be discouraging and can also result in the patient forgoing necessary treatment.

MOP produces little to no discomfort or swelling. Before treatment, the patient can be treated with an effective topical anesthetic gel, or with minimal infiltration and a chlorhexidine rinse for 60 seconds before and after treatment. If patients need analgesic for minor discomfort after MOPs, they should be advised to take acetaminophen; NSAIDs such as aspirin and ibuprofen should be avoided because they inhibit the inflammatory effect of MOP and reduce its effectiveness.\(^3\)

**MOP: Getting teeth back on track**

For patients who have challenging orthodontic issues, MOP has successfully affected their treatment goals. For example, one patient who came to my office after previous orthodontic treatment presented with an anterior 3mm open bite from first molar to first molar with posterior occlusion only on the second molars, a bilateral posterior crossbite and an anterior maxillary cant up on the right side (Fig. 1). While he wanted a cosmetic solution to his issues, he did not want wires and brackets or surgical intervention. This posed a common clear aligner challenge clinicians face with open bites. The relative extrusions required were beyond the 2mm aligners can typically deliver, and the goal was to close the posterior open bite and land him on a more functional position to eliminate the edge-to-edge bite.

**Fig. 1:** Initial photos. Malocclusion: canted edge-to-edge posterior open bite, anterior open bite greater than 3mm and a midmaxillary facial deficiency. Patient was treated with reactive micro-osteoperforation (MOP) treatments at month 4 and month 8. Expected treatment time: 22 months. Actual treatment time with MOP: 13 months.

**Fig. 2:** Day of and immediately after second MOP treatment.
Halfway through the treatment, it was evident that the teeth were no longer tracking. At that point, four months into the treatment, we treated the patient reactively with MOP and then again at month 8 (Fig. 2). We gained much better tracking and movements of teeth, including the projected goal of better anterior coupling finishing 1mm overjet overbite. In just under a year, he had a better smile line, and his open bite was getting closed.

We got the anterior bite closed and landed the posterior bite, and the patient could even close his teeth and “chew his food better.” The results were positive because MOP targets osteoclast activation, the main rate-controlling factor in orthodontic tooth movement.4 Introduction of a controlled microtrauma, without affecting the integrity and architecture of hard and soft tissue, stimulates the inflammatory defense mechanism in the body, which then creates a synergy with the effects of orthodontic forces to accelerate the bone remodeling response.4 Temporary reductions in bone density for 12–14 weeks allowed the difficult tooth movements to translate, and the teeth to move as predicted and planned on the aligner software.

After initially falling off track, this patient was thrilled to complete treatment ahead of schedule and achieved an aesthetic final solution in less than two years (Fig. 3). Typically this patient’s treatment time would have been 22 months, but including MOP truncated treatment time down to 13 months. This patient would have been a candidate for orthognathic surgery because of his maxillary deficiencies, airway and upper-vs.-lower arch discrepancies, but we were able to avoid surgery and achieve excellent results with the much less invasive MOPs.

HFV: Facilitating the seating of clear aligners

I have encountered aligner tracking issues that could significantly affect patient treatment time. During aligner therapy, if teeth are not tracking well in the aligners, teeth will stop moving or even move in an undesired direction. In these cases, I introduce the VPro5 high-frequency vibration aligner seater (Propel Orthodontics) to get the treatment back on track and reduce or eliminate pain attributed to the aligner therapy.5 In my practice, patient compliance is high because this HFV device delivers vibration in five minutes while the patient is at home each night. A recent study has reported a 99.6 percent daily compliance rate with at-home use as well as a “clinically meaningful, immediate, and extended reduction in orthodontic pain.”5

Another study that evaluated the effect of HFV devices on clear aligner exchange intervals and treatment time has shown the beneficial aspects of HFV with clear-aligner therapy. Besides reducing pain, the study noted that “accelerated and more predictable tooth movement was achieved using adjunctive HFV treatment with aligner therapy.” In fact, using the HFV device allowed 64 percent faster aligner exchanges than the control in the study. The study subjects required fewer refinements than control subjects and fewer aligners to complete treatment than in the control groups.6
My second patient did not want any type of jaw surgery or treatment other than clear aligner treatment, so we decided on Invisalign therapy, with a treatment plan that included a course of 28 aligners. The patient had a Class III clinical bite. The treatment plan was to use interproximal reduction (IPR) on the lower arch bicuspid and anterior region, and to lingualse and tip the lower arch back. Proclining the upper anterior teeth forward was also planned to give him the ideal 1mm overjet and overbite with a better aesthetic result.

However, as treatment progressed, the very large roots of his teeth and very dense bone seemed to be preventing the aligners from seating and tracking; there was a 2–3mm space/void between the aligners and the tooth (Fig. 4, p. 30).

We discussed performing a refinement scan and ordering a new set of aligners at no cost, or purchasing the HFV device with the goal of finishing much quicker by getting “back on track” with enhanced mechanical seating of the current set of aligners. The patient elected on using the HFV device since it required only five minutes per night. We used the HFV device reactively in this case to ensure the aligner was achieving maximum contact with all surfaces of the teeth. This is critical to the delivery of the programmed aligner forces especially when faced with nontracking, or stubborn teeth (Figs. 5, p. 30 and 6). After creating the ideal interproximation spaces, and with the patient switching aligners once a week, by the fourth aligner the aligners were seating well, and the teeth were on the right track and moving in the right direction.

A third patient came to my practice with a Class II clinical deep bite and a history of bicuspid extractions. The patient had relapsed with lower crowding and more than a 60 percent deep bite. The treatment plan entailed reducing the deep bite with the addition of lingual bite ramps on the upper arch and resolving the lower crowding. In this case as well, we used HFV reactively for better aligner seating and to increase patient compliance (Figs. 7 and 8).

Both MOP and HFV help me achieve more predictable tooth movement in a minimally invasive manner and with reduced patient pain. Again, with only five minutes of daily wear with HFV, patient compliance is very high. All these benefits save me and the patient time because I do not have to order a new set of aligners and wait to get the set while the teeth are shifting. In my opinion, our “science and specialty” has come a long way, and these two options allow patients to achieve their orthodontic goals with very little effort in a shortened treatment time.

REFERENCES