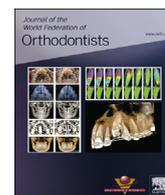


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Editorial

Accelerating orthodontic treatment: How convincing is the evidence?



Altering the pace of tooth movement to reduce treatment time has always fascinated orthodontic researchers and clinicians alike. The surge in the published literature, the ongoing discussions in orthodontic blogs and symposiums as well as the increased number of conference presentations tend to affirm the previous statement. Even though a variety of treatment modalities are suggested as a result of human and animal trials, to a clinician the most attractive and easily understood are surgery, vibration and the use of low-level lasers. However, major questions still challenge the inquisitive mind of the orthodontic clinician and one has to wonder—How far have we come? Is it really cost effective for the treatment outcomes achieved? Are treatment outcomes any more stable? The answers to the first two questions are partially answered through various critical analyses and narrative reviews and the third question is yet to be touched by the best research institutions.

Most experiments directed towards accelerating tooth movement were initiated by the finding that cells can respond biologically to more than one signal at one time, be it physical or chemical. Heavy forces to induce such a reaction were tried by Farrar in 1888 followed by the use of surgical insults by Kole in 1959. Many years later the application of electric currents was tested by Davidovitch (1980) as well as the injection of prostaglandins by Yamasaki (1984). With the fact that an ideal accelerating method should comply with basic biologic foundations of orthodontic tooth movement and should be efficient with no side effects on para dental tissues, one question still challenges every orthodontic researcher—With the research data spanning over 130 years, will it ever be possible to treat most orthodontic patients in a very short period of time?

The basic tenet of tooth movement biology attributes the mechanism of orthodontic treatment response to a combination of sterile inflammatory response and mechanotransduction, acting in tandem. This entails increasing the release of cytokines and optimizing the tooth moving forces at the same time respectively. Proponents of surgical approaches reduce the bone content through modalities with different names such as osteotomies, corticotomies, piezocision, micro-osteo perforations and the like which in turn induce increase in inflammatory response, triggering the regional acceleratory phenomenon, the natural healing process. With the reduction in bone content, the conventional force levels become excessive bringing in more tooth movement within limited time! Researchers who favor physical approaches augment conventional orthodontic forces with additional force levels through vibratory approaches or induce trauma through lower level laser treatment, again

inducing more inflammation with an influx of pro-inflammatory cytokines to the area. All these approaches actually challenge the basic fundamental biology behind orthodontic tooth movement and the concept of 'sterile necrosis' and 'hyalinization' with excessive force application or inflammation. Again, the basic questions still remain unanswered—Are we challenging natural healing processes by incorporating these mechanics to our armamentarium along with the additional cost to our patients? Is there a biologic saturation point, wherein the released inflammatory cytokines reach a threshold and become a source of iatrogenic damage and more importantly, for how long does the increased release of cytokines exist once they are stimulated by any of the above-mentioned methods?

Using modified Ottawa method (which searches articles from the date of publication of a previous systematic review using qualitative, quantitative and 'other' indicators), Rozen et al [1] concluded in 2015 that there is great need for an updated systematic review on accelerated tooth movement. In the same year, El-Angbawi et al [2] and Fleming et al [3] conducted two Cochrane reviews on non-surgical adjunctive measures and surgical adjunctive procedures for accelerating tooth movement respectively. Both reviews pointed out the limited amount of high-quality evidence with both the procedures for reaching a conclusion and, the need for well-designed randomized control trials. The publications appearing after this evaluated the effectiveness of vibratory stimuli and piezocision, only to conclude that weak evidence exists to support these modalities. In 2017 Yi et al [4] published a systematic review of systematic reviews on accelerating tooth movement to conclude that the existing quality of evidence ranges from very low to low! They reported that low quality evidence exists in favor of low-level laser treatment (5J and 8J cm²) combined with corticotomy while all other methods (photobiomodulation, pulsed electromagnetic field, interseptal bone reduction, vibrations and electric currents) presented evidence of very low quality. Injections with relaxin and extracorporeal shock presented no impact over tooth movement process. A review of molecular level research (amount of release of biomarkers of periodontal ligament and alveolar bone remodelling) revealed that with various surgical approaches (corticotomy, micro-osteo perforations and corticision) an elevation of TNF-alpha by 2.3 times and tartarate resistant acid phosphatase (TRAP) levels, (indicative of osteoclast count and activity), by 1.5 to 4.0 times was observed in comparison to conventional orthodontic tooth movement [5].

The inconsistent data and a lack of agreement among authors using similar techniques for accelerating tooth movement might

be due to patient or clinician characteristics, methodological differences, evaluation criteria selected and/or the quality of evidence generated. With approximately 1 mm of space closure per month using conventional orthodontic therapy, the results presented with almost all accelerating methods ranges between 1.2 to 1.8 mm per month. This shows that some progress is possible, but it should be kept in mind that studies with unclear methodology are prone to produce biased treatment outcomes. What we need are robust, well-designed clinical trials complying with CONSORT (Consolidated Standards of Reporting Trials) guidelines and extensions of it. With clinical trials involving surgical interventions, it is critical to follow IDEAL (Idea, Development, Exploration, Assessment, Long-term Follow-up, Improving the Quality of Research in Surgery) recommendations.

Briefly, the need of time is conducting properly designed studies and following those which have included, the entire orthodontic treatment duration along with at least 2-5 years follow-up treatment records.

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