The 6 Rs of orthodontics

Research, Root Resorption, Retention, Relapse & Respiration

Part 2 – Root Resorption

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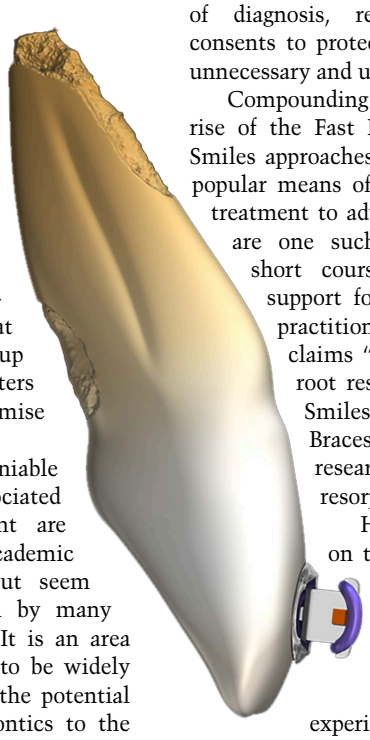
As discussed in the first edition of The 6 Rs of Orthodontics – Relapse (Nov/Dec 2017), the difficulties of achieving long-term case stability are well-documented. A permanent result is anticipated by patients and dental professionals alike, but the research does not match the expectation. This came as a surprise to a number of general dental practitioners who were unaware of the commonplace in which relapse occurs in orthodontic cases.

Also highlighted in the first article was the Australian Society of Orthodontists (ASO) claim that the specialist orthodontist is better qualified to perform orthodontics because of their additional hours of training.[1] Therefore, the dental profession would expect the majority of specialist orthodontists to be highly knowledgeable of the most up to date research.

This article will focus on two more Rs – Root resorption – and the unseen damage that is all too common in orthodontic treatment.

According to Professor Ali Darendeliler, Professor and chair, Discipline of Orthodontics, Faculty of Dentistry, University of Sydney, "Root Resorption affects up to 100% of ALL treated cases and in severe cases can be up to 4mm or more of root loss."[2] However, the most comprehensive research into orthodontic results can be found within a team of researchers at Sydney University. Headed by Professor Darendeliler, the team has published a series of 20 articles on the 'Physical properties of root cementum' in the American Journal of Orthodontics and Dentofacial Orthodontics (AJODO).

Part 18 of the series highlights damage to the tooth as an inevitable consequence of orthodontic treatment with fixed appliances. "Root resorption is intimately associated with the biological processes that occur during orthodontic tooth movement. This phenomenon is commonly known as orthodontically induced inflammatory root resorption (OIIRR) and is often unpredictable; it is an inevitable pathologic consequence of orthodontic tooth movement that compromises the success of orthodontic treatment."[3] The researchers also found that reduction of root length is not only the consequence of orthodontic treatment, but also discovered the root surface that undergoes compression ends up creating root resorption craters which may further compromise tooth health in the future.



Therefore, it is undeniable that these problems associated with orthodontic treatment are acknowledged in the academic circles of the specialty but seem to be somewhat unknown by many that practice orthodontics. It is an area of orthodontics that needs to be widely discussed when explaining the potential difficulties of fixed orthodontics to the ever-growing number of dentists widening their scope of practice.

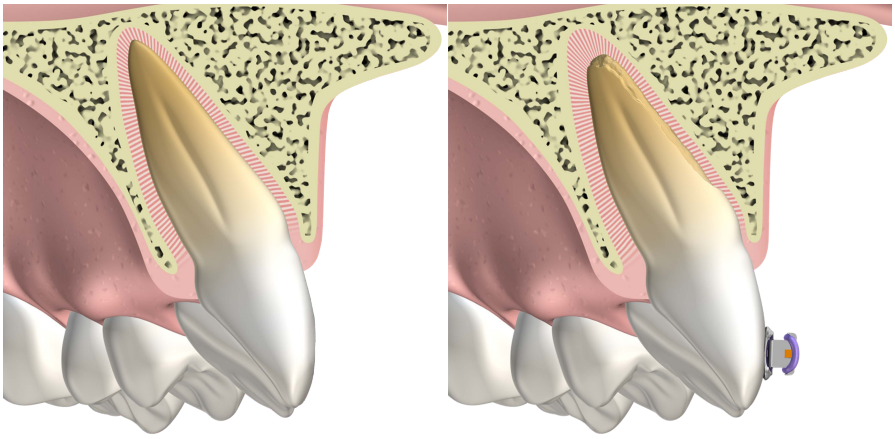
Heimisdottir et al (2005) highlighted that "the severity of root resorption of lateral incisors cannot be accurately judged from radiographs alone,"[4] which was also highlighted by the team at Sydney University.[3]

Another study conducted by Ramanathan et al (2006) found "root resorption is an undesirable sequela of orthodontic tooth movement."[5] It was also found that "Apical root resorption is one of the most common iatrogenic problems associated with orthodontic treatment. It is becoming an increasingly more serious problem from a medico-legal standpoint. It appears that orthodontists are not able to avoid this problem completely. It is necessary that the speciality define this uncertainty and establish criteria of diagnosis, records and informed consents to protect its members against unnecessary and unjustified litigation."[5]

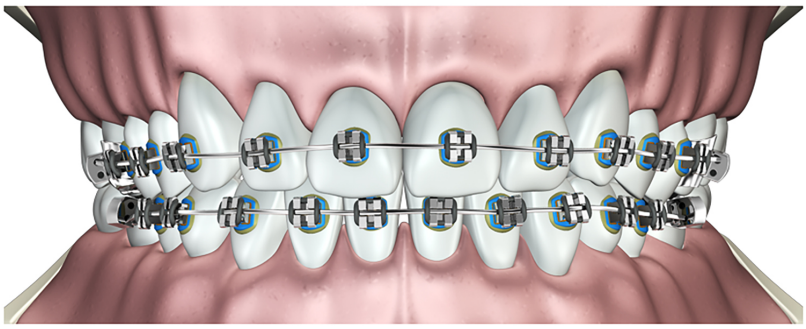
Compounding the issue is the recent rise of the Fast Braces and Six Month Smiles approaches, which have proven a popular means of providing orthodontic treatment to adults. Six Month Smiles are one such company that offer short courses with considerable support for the less experienced practitioner. Their website claims "there is less chance of root resorption for Six Month Smiles cases"[6] while the Fast Braces website claims their research "presented less root resorption than the others."[7]

However, the research on the Fast Braces website does not have the same conclusion that is claimed. When a practitioner is told that less resorption is experienced using faster tooth movement there should be an air of scepticism. And always, read the research papers thoroughly.

When comparing apical root resorption using three different fixed appliance techniques, the Brazilian study quoted on the Fast Braces website found a slight difference in the group that used the Viazis triangular bracket. However, further examination reveals the high prevalence of root resorption, regardless of the preferred technique. The study concluded "considering the whole sample, there was no root resorption in 2.25% of the analysed teeth."[8] That means 97.75% of the group experienced root resorption. So, let us be aware, the use of a different



Left: No root resorption using intermittent forces with fixed or removable appliances.
Right: Root resorption with continuous forces using fixed appliances.



Research shows continuous force applied by fixed braces causes root resorption.

brackets does not significantly reduce the incidence or severity of root resorption.

How can we reduce the incidence of root damage? Are we bound to admit to our patients and parents that the use of fixed appliances will cause damage to the root surfaces, the root length and possibly reduce the tooth life? Added to this is the uncertainty of fixed retainers continually causing root damage as the patient ages, which can cause tooth loss in the future and is a real medico-legal issue the profession needs to openly face.

Part 11 of the 'Physical properties of root cementum' series examined the possibility that using fixed appliances with intermittent use, rather than continuous force, coupled with modern arch wire techniques may decrease the incidence and severity of root resorption. The results concluded; "Intermittent force produced less root resorption than continuous force."[9]

"The application of intermittent orthodontic forces of 225 cN for 8 weeks (14 days of force application, 3 days of rest, then 4 days of force application repeated for 6 weeks) caused less root resorption than continuous forces of 225 cN for 8 weeks. Although it might not be clinically practical, compared with continuous forces, intermittent forces might be a safer method to prevent significant root resorption.This regimen, however, could compromise the efficiency of tooth movement."[9] It may be less convenient but the path to preventing root resorption certainly lies in this ground-breaking research.

Kumasako et al (2009) echoed the same findings that intermittent force is a more efficient way to avoid root resorption, as well as recruit the osteoclasts, when compared to continuous force. "Results show that an 8-hour intermittent force efficiently recruits osteoclasts while causing minimal root resorption."[10]

The researchers at Sydney University found even more astounding results. "A radiographic study established that fixed appliances are more detrimental to the roots of maxillary incisors than activators and spring plate removable appliances. Another radiographic study by the same authors involved comparing patients treated with full fixed edgewise appliances with Class II elastics and rectangular wires with patients treated with activators, plates with clasps, and vertical elastics. The patients treated with fixed appliances had notable OIIRR (root resorption), but the other group had none."[9]

We can extrapolate from these findings that the Sydney team found NO root resorption while using intermittent forces of removable appliances. Therefore, it is curious that these research findings are not applied into the clinical practice.

It is clear from the three aforementioned studies that the conclusion is root resorption can be minimised by intermittent orthodontic techniques.

The latest tendency in orthodontics is to use self-ligating brackets and "archwires and corresponding sequencing have been carefully selected to keep the applied force in the "optimal force zone" during each of the four phases of treatment."[11] It is curious that this trend appears to directly contradict the recommendations from research quoted earlier in this article. James L Ackerman concluded in March 2015 that "it is fair to say that orthodontics has been more technology driven than biologically or scientifically based."[12]

There is a medico-legal problem upcoming for the industry because the research shows us there are less damaging ways to practice orthodontics and either reduce or completely eliminate root resorption. Patients and parents should be given the safer option, but one wonders about the concerns of the specialist orthodontist having to live up to claims on the Australian Society of Orthodontics website that orthodontic treatment is beneficial because "having well aligned teeth and jaws gives you healthier teeth that will last a lifetime."[13]

For those General Dentists who are not proficient in evaluating orthodontic research and may not be aware of the potential root resorption dangers or the medico-legal aspect of providing orthodontic treatment, it is important to know there are less damaging alternatives.

The Myobrace® system is orthodontic treatment that utilises removable appliances and uses intermittent forces with a 12-hour on, 12-hour off program to treat aberrant myofunctional disorders. Research into Myobrace® appliances also demonstrates that benefits of the system include Class II correction,[14] myofunctional correction[15] and obstructive sleep apnoea correction.[16]

Increased awareness of root resorption and intermittent orthodontic techniques that potentially reduce or completely eradicate root damage is an important step forward for the industry from a medico-legal standpoint. As always, the profession needs to apply research recommendations into the clinical setting and implement a more biological approach to orthodontics. The next article in The 6 Rs of Orthodontics series will focus on Retention. ◆

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