

## Editorial

# Orthodontically Induced Inflammatory Root Resorption (OIIRR)

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Orthodontically induced inflammatory root resorption (OIIRR) is considered the second most common side effect of orthodontic treatment after white spot lesions. It is the consequence of a sterile inflammatory process that is extremely complex and multifactorial and happens in the periodontal ligament area when orthodontic force moves the root inside the PDL space and causes compression of the PDL tissue and ultimately occlusion of the blood vessels. Although, the outcome is frequently similar to other forms of root resorption, orthodontic root resorption is distinct from the other types of root resorption. It has been shown that there is a strong relationship between orthodontic tooth movement and external root resorption with evident individual variation in its severity. Unfortunately the exact underlying mechanism responsible for OIIRR is still unknown.

Several predisposing factors including but not limited to:

- Genetics (TNFRSF11A locus that encodes RANK, allele1 at the IL-1 $\beta$  gene)
- Medical conditions (asthma, allergic conditions)
- Medication (Alcohol, high dose of corticosteroids)
- Dental conditions (history of trauma, periodontitis, parafunction)
- Root morphology (previous resorption, abnormality in the root, agenesis)
- Orthodontic force magnitude (significantly heavier than clinically used)
- Orthodontic tooth movement (intrusion, torque against cortical bone)
- Treatment duration

Most of the predisposing factors can be found out before starting orthodontic treatment either from the medical and dental history or radiographs. Clinician should have enough information to determine

susceptible individuals or teeth at this point in most but not all cases. Afterward, it will be factors during treatment delivery. Orthodontic mechanics play a role in the incidence and severity of OIIRR but no single variable can be isolated as the major risk factor. However, force magnitude and duration are key factors that were revealed to have strong influence on OIIRR by previous studies. The combination of heavy continuous force for an adequate period of time will highly influence the process of OIIRR. Monitoring during treatment with proper radiographs (CBCT or Periapical) can help in limiting the extent of OIIRR by early detection. A radiograph in the first six months of treatment found to be helpful in detecting high-risk patients.

At the cellular level, intact periodontium (specifically cementum) reduces the risk of OIIRR. Damage to the cementum due to previous trauma, infection, heavy force, ...etc. increases the risk of root resorption. Cementum and PDL cellular population (mainly cementoblasts) are the one responsible for OIIRR repair. It was found that OIIRR at one point after occurrence it undergoes a reparative process with a layer of cellular irregular cementum, the end result for each patient is the difference between the resorptive and reparative potentials. These reparative episodes occur during force application but more evident in the time between activations. For this reason, longer intervals between activations are recommended for higher risk patients.

Clinical management of OIIRR starts at the diagnostic stage, where the clinician can determine risk level and proceed accordingly. In high-risk patients, clinician will lean more toward shorter treatment options (IPR instead of extraction), compromise on some objectives and select the proper mechanics to deliver. Sometimes in very high-risk cases or poor crown/root ratio to begin with, no treatment is a valid option. During treatment monitoring with x-rays, light forces and infrequent activations can help. If severe OIIRR occurs even with all precautions, revisiting the treatment plan sometimes is necessary. One of the new emerging technologies in treating OIIRR is the use of LIPUS to prevent and repair the root. This technology has been documented very well in the literature of enhancing bone fracture healing and gaining strong evidence after in vivo and in vitro studies on root resorption repair. Despite that this technology is not available commercially yet but the research shows that it is only a matter of time. Finally, retention of teeth with severe OIIRR has to be designed to splint teeth in addition to retaining results.