REVIEW

Advances in Orthodontic Retention During Covid - 19: Whats on the Horizon?

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Abstract:

On routine dental practice on of the greatest challenge an orthodontist faces during post-orthodontic treatment in relapse. Orthodontic retention is one of the crucial part of orthodontic treatment. Over the past two decades' various techniques, methods, biomedical agents have been introduced that help in orthodontic retention. This article gives a brief idea focuses on the underlying mechanics and mechanism of these biological agents and techniques to reduce the rate of relapse on treated patients without the need of retainers and the effects of COVID 19 pandemic on orthodontic retention.

Keywords: Orthodontic retainers, COVID 19, Biomedical agents, RANK-RANKL, Medication-related osteonecrosis of the jaw (MRONJ), PPE, Low Level Laser (LLT).

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INTRODUCTION

One of the biggest challenges an orthodontist faces is the prevention of post-treatment relapse. Various methods are advised to address this issue includes, a) attachment of fixed lingual retainers that often requires careful maintenance so as to prevent unwanted side-effect including detachment of lingual retainers, fractures leading to unwanted tooth movements. periodontal complication secondary to plaque accumulation due to poor oral hygiene. b) removable retainers that need patient compliance and long-term patient commitments.[1]

So as to address these issues alternative methods are being investigated. In this article, we took an initiative to overview of some of the recent methods.

BIOLOGICAL APPROCHES TO REDUCE ORTHODONTIC RELAPSE

During orthodontic treatment the alveolar housings of the moved teeth tends to remodel. On the pressure side there will be resorption that occurs rapidly which allows the movement of the teeth through the alveolar bone. After the movement is completed, on the pressure side the periodontal ligament and the alveolar housing re-established, similar as of an unmoved tooth. On the tension side re-establishment of the alveolar housing occurs comparably slower where new bone formation is required and on the bone periodontal ligament maintains tension, seeking to move the tooth back to its initial position. The challenge faced by an orthodontist is to establish a conditions so that the periodontal ligament (PDL) and alveolar bone housing get sufficient time to remodelled, so that it can preserve the moved tooth in to its new position.[1]

Use of biological agents that can alter the bone remodelling process have been studied by conducting various experiment in animals which shows various success rates. These biological agents include bone morphogenetic protein, osteoprotegerin gene transfer, administration of various pharmacological agents such as statins, bisphosphonates and antibiotics locally or systemically and the use of cytokines, hormones, LLT (Low Level Laser) and mechanical vibrations. However, fixed retainers are needed during the initially application of those external agents, and these applicative procedures are invasive and sometimes lead to risk systemic effects.[2]

BIOLOGICAL APPROACHES ON THE HORIZON

Schlerostin[3] and Regulatory extracellular vesicles (EVs)[4] are two factors that feels promising and can help the orthodontist to prevent orthodontic relapse but not much clinical trials are not done yet Sclerostin a osteocytic protein[5,6,7] plays a vital role in bone remodelling and play a role in inhibiting the osteoblastic lineage from forming new bone. (Fig 1)

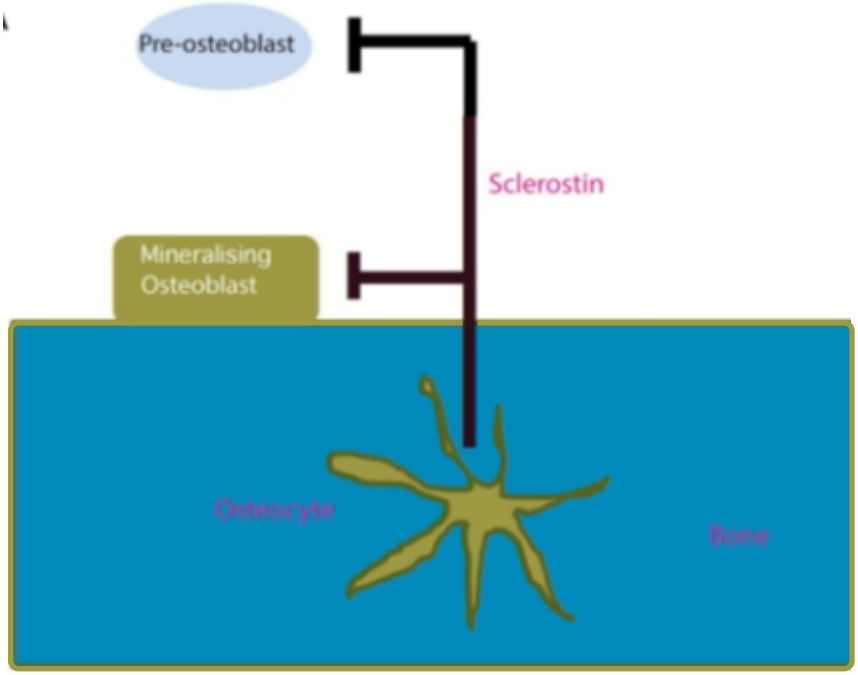

Fig 1: Sclerostin is a protein released by osteocytes and cells of the periodontal ligament, which blocks the maturation of pre-osteoblasts into bone-forming osteoblasts. Pre-osteoblasts also express RANKL, which can stimulate osteoclasts to resorb bone. Sclerostin also regulates mineralisation by late osteoblasts. Therefore, blocking sclerostin activity using romosozumab, a humanised monoclonal antibody that inhibits sclerostin, stimulates bone formation.

Sclerostin is a regulatory molecule secreted by osteocytes and cells of the periodontal ligament, particularly on the compression side, enables bone resorption[7]. During orthodontic tooth movement levels of sclerostin shows variations in the PDL and alveolar Monoclonal humanised antibody called romosozumab a which act, against sclerostin thereby reducing sclerostin activity thereby causing increasing bone formation and this can be used for the treatment of osteoporosis.[8,9] Romosozumab when applied to the tension side it will stimulate bone formation and reduce relapse.

EVs that contains receptor for protein activator of nuclear factor-kappa B (RANK) are released by osteoclasts that can inhibit bone resorption and can also stimulate bone formation (Fig.2).[10,11]

Direct application of RANK-containing EVs tension side can enhance bone formation. EVs are natural regulators of bone remodelling.[4] Application of these therapeutic monoclonal antibodies have the ability to stimulate bone formation and block bone resorption as well.[11] If such agents can be used clinical, they can be expected to stimulate bone- formation on the tension-side and can speed the maturation of the dental alveolar housing post-orthodontically.

LIMITATIONS OF BIOLOGICAL APPROACHES

However, while using these agents, (e.g.: bisphosphonates) precautions should be taken by recognising that some of these agents that are used for

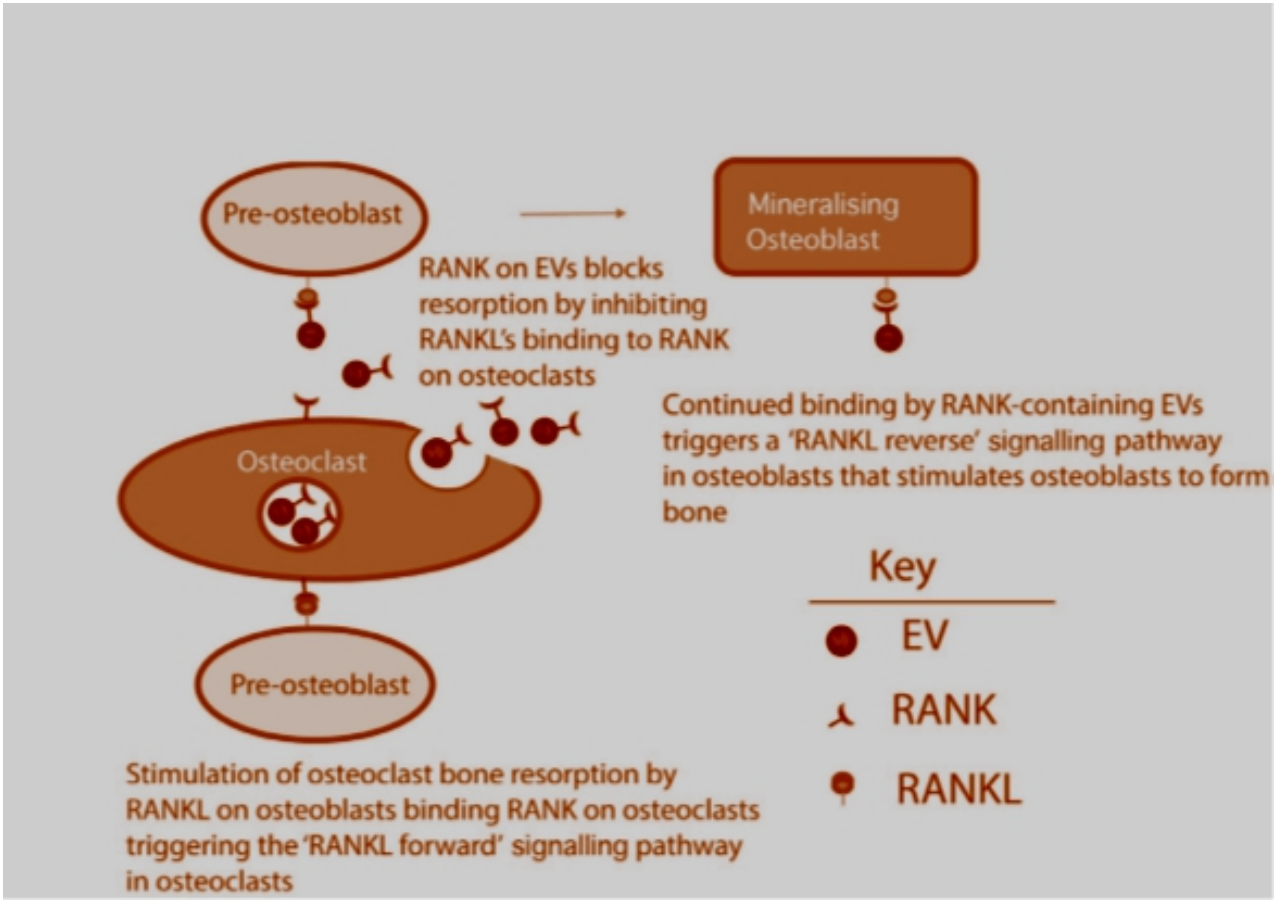

Fig 2 : Stimulation of RANK on the osteoclast surface by RANKL is essential for osteoclast formation and bone resorption. RANK is also packaged into extracellular vesicles (EVs) and released by osteoclasts. These RANK-EVs can interact with RANKL to competitively inhibit the interaction between RANKL and RANK on the osteoclast surface. In addition, when RANK-EVs interact with RANKL proteins on the pre-osteoblast surface, they stimulate a RANKL reverse signalling pathway that promotes bone formation

modifying the remodelling of the alveolar bone housing can cause increased risk of medication-related osteonecrosis of the jaw (MRONJ).[12] During the application these agents care must be taken so that they may exert biological effects on the jaw bone remodelling there by preventing relapse.

IMPACT OF COVID - 19 AND CHANGES IN PATIENTS EXPECTATIONS ON ORTHODONTIC RETENTION

COVID-19 pandemic have a sustained impact on healthcare, which includes orthodontic treatment and orthodontic retention. Although frequent lockdowns, and increased necessity of social distancing and problems associated with personal protective equipment shortages (PPE)leads to accelerated use of telemedicine in healthcare field. As the influence of COVID-19 and lockdown leads to disruptions on regular retention check-ups and inability of patients to report back to doctors with their broken or lost retainers. This situation leads to a scenario that uses digital technologies that allow the clinicians and patients to communicate virtually, as well as there are newer provision for retainers manufactured to fabricate retention appliances by using patient existing digital scans.[1]

PERSONALISED MEDICINE

The concepts of patient-centred care and personalised medicine have become increasingly in recent decades prominent in the field of individualising healthcare, this concept help us to determine and help the clinician to identify and provide individualised retention regimens that will help to prevent the relapse. And patient-centred care provides more holistic view of patients, that will help in taking care of their values, culture and lifestyle. This can help in personalizing what type of retention will be suitable to the patient's according to their expectations, values and lifestyle. This will encourage the patients to participate in their retention protocol by utilising various monitoring approaches including, telehealth and smartphone apps.

CONCLUSIONS

Conventional approaches to orthodontic retention revolved around fixed or removable retainers, which often show lack of acceptance that leads to lack of retention leading to inevitable post-treatment change. Due to advances in biological aspects approaches for orthodontic retention is evolving, Patient-centred care and personalised medicine opens new dawn in terms of approaches in coming decades towards orthodontic retention.

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