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Editorial

Malocclusion and orthodontic tooth movement

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Malocclusion of teeth has been a well-documented problem since antiquity, and attempts to correct this disorder go back at least to 1000 BC. Orthodontics evolved in the late 19th and early 20th century as a distinct specialty and it primarily deals with the treatment of malocclusion in order to achieve structural balance, functional efficiency and aesthetic harmony amongst the hard and soft tissues of the orofacial region. By applying appropriate forces, it is possible to move the teeth through the alveolar bone of the jaws. Dr. William R Proffit [1] stated that malocclusion can cause three types of problems for the patient:

1. Social discrimination leading to psychological trauma.
2. Problems with various oral functions.
3. Greater susceptibility to caries, periodontal diseases and trauma.

Over the years, several studies have been conducted in order to understand and analyse the biological mechanisms underlying tooth movement. The landmark, pioneering works of Sandstedt, Oppenheim, Schwarz, Reitan, Storey and Masella laid the foundation of understanding this phenomenon and paved the way for further research in the field of orthodontics. [2] Tooth movement involves the complex procedure of bone and periodontal remodelling. Tooth movement occurs as a result of a sequence of tissue reactions and it involves highly organized interactions at the molecular level. These reactions involve cells of a number of different tissues which include the periodontal ligament, the cementum and the alveolar bone. Various chemical and biological agents are responsible for facilitating tooth movement.

Different molecules have also been identified which act as signalling messengers and initiate this process. Therefore, it is of prime importance from an orthodontic point of view to know and understand these underlying mechanisms.

Teeth can be repositioned and retained in a new position in the jaw using orthodontic appliances. An orthodontic appliance functions by creating mechanical stresses via teeth onto the periodontium. This results in the generation of an array of physical, chemical, and electrical signals to the periodontal cells that eventually cause tooth movement through active remodelling. The biological response must be clearly understood in order to determine the type and design of an orthodontic appliance.

The clinician can control the degree, distribution, direction and duration of the forces employed. Optimum application of orthodontic forces results in bone remodelling within a short duration, resulting in quicker tooth movement with minimal pain and causing minimal trauma to the surrounding tissues. [3]

Therefore, merely understanding the mechanical principles involved in orthodontics is not sufficient. Even after a careful application of forces in terms of their magnitude and direction through orthodontic appliances,

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the traumatic effects on the periodontium cannot be totally prevented and certain amount of periodontal injuries occur during the routine orthodontic treatment. This could be due to lack of complete cellular understanding.[4]

The understanding of cellular and molecular biology will surely help a clinician in designing mechanics that will produce maximum benefits during tooth movement with insignificant tissue damage. The rate of bone remodelling determines the rate of tooth movement and hence, it will provide a key to predict how well teeth responds to mechanical forces. It is important that one realizes the fact that the adaptation of the dento-alveolar system is not restricted to the periodontal space around the teeth, but also occurs in the marrow spaces and on the external surfaces. Tooth movement occurs owing to external forces which modify the supporting structures of the tooth.

We live in an era where science and technology know no boundaries. Advances in the studies of human genetics, stem cell biology & molecular biology have allowed for the application of tissue engineering to clinical problems in orthodontics including the various techniques to accelerate tooth movement.[5] The journey of accelerated tooth movement which started in 1893, has now gained significant popularity in the last decade and newer techniques are evolving to reduce the disadvantages and improve the acceptability of these treatment modalities by patients and clinicians.

Although mediators of orthodontic tooth movement have been widely studied, however, their exact role & space and time dependent up or downregulation in different orthodontic interventions still needs to be further studied.

Conflict of Interest

None.

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