Tarek Elshazly et al., Oral Health Dent Manag 2018, Volume 17
DOI: 10.4172/2247-2452-C9-090

Applicability of shape memory polymer in orthodontics

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One of the important drawbacks of commercially used orthodontic aligner is the change regime (14 days) due to the rate-limiting step. Therefore, investigators are working on doing improvements to aligner materials, force systems, staging of tooth movements, and treatment planning. One of these trails is the incorporation of shape memory polymers (SMPs), a type of important stimuli-responsive smart polymers, which can recover their original shape upon exposure to external stimuli. The purpose of this presentation is showing how far our research is going regarding producing an active orthodontic aligner made up of shape memory polymer, through a 3D finite element simulation model and experimental testing.

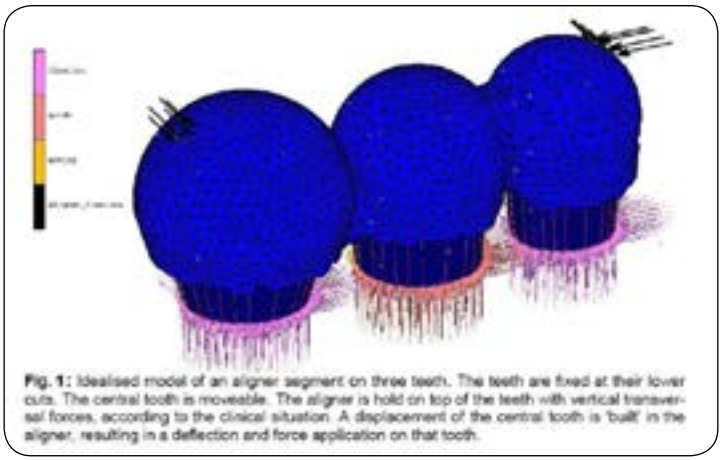

Fig. 1: Idealised model of an aligner segment on three teeth. The teeth are fixed at their lower cuts. The central tooth is moveable. The aligner is hold on top of the teeth with vertical transversal forces, according to the clinical situation. A displacement of the central tooth is 'built' in the aligner, resulting in a deflection and force application on that tooth.

Recent Publications

1. Simon M, Keilig L, Schwarze J, Jung B A and Bourauel C (2014) Forces and moments generated by removable thermoplastic aligners: incisor torque, premolar derotation, and molar distalization. Am J Orthod Dentofacial Orthop. 145(6):728-736.
2. Simon M, Keilig L, Schwarze J, Jung B A and Bourauel C (2014) Treatment outcome and efficacy of an aligner technique-regarding incisor torque, premolar derotation and molar distalization. BMC Oral Health. 14:68.
3. Favino M, Gross C, Drolshagen M, Keilig L, Deschner J, Bourauel C and Krause R (2013) Validation of a heterogeneous elastic-biphasic model for the numerical simulation of the PDL. Com-put Methods Biomech Biomed Engin. 16(5):544-553.
4. Keilig L, Drolshagen M, Tran KL, Hasan I, Reimann S, Deschner J, Brinkmann K T, Krause R, Favino M amd Bourauel C (2016) *In vivo* measurements and numerical analysis of the biome-chanical characteristics of the human periodontal ligament. Ann Anat. 206:80-88.
5. Konermann A, Al-Malat R, Skupin J, Keilig L, Dirk C, Karanis R, Bourauel C and Jager A (2017) *In vivo* determination of tooth mobility after fixed orthodontic appliance therapy with a novel intraoral measurement device. Clin Oral Investig. 21(4):1283-1289.

Biography

Tarek Elshazly has completed his Graduation in the Faculty of Dentistry at Ainshams University, Cairo, Egypt in 2010. Currently, he is pursuing his master's degree programme in Dental Biomaterials at Ain-Shams University and also a Doctoral study in the Department of Oral Technology at University of Bonn. He has already been trained on Marc/Mentat Finite Element Analysis Program. As well, he is familiar with using some other mechanical and chemical testing machine. In addition, he was a Demonstrator of Dental Biomaterials at the Egyptian Russian University in Cairo, Egypt.

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