

大学院特別講義のご案内

日時： 2026年 12月 22日(月) 17:30~19:00

場所： 大講義室



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演題： The Potential of 3D-Printed Shape Memory Polymers in Overcoming the Biomechanical Limits of Thermoformed Aligners

Despite the rapid global expansion of clear aligner therapy, conventional systems still face justifiable skepticism regarding their biomechanical predictability. This skepticism is largely rooted in the inherent material limitations of traditional thermoplastic sheets. Conventional thermoformed aligners typically exhibit rapid stress relaxation, delivering a high initial load followed by an abrupt decay of force. This mechanical behavior makes precise, high-difficulty tooth movements—such as root torque, bodily movement, and leveling—highly unpredictable and biologically unfavorable due to the lack of continuous force.

To address these fundamental biomechanical limitations, 3D-printed shape memory polymers (SMPs) have been introduced as a novel material approach. Unlike standard thermoplastic materials, SMPs respond to intraoral thermal stimuli, shifting from a temporary deformed shape back to their programmed, original geometry. This thermodynamic transition allows the aligner to deliver a constant, continuous light force over an extended period, closely mimicking the ideal force systems of traditional fixed appliances and respecting optimal periodontal tissue responses. Furthermore, direct 3D printing eliminates the geometric inaccuracies inherent in the thermoforming process, ensuring superior adaptation and more precise expression of programmed orthodontic forces. By analyzing the force-deflection profiles and clinical evidence of this technology, this presentation evaluates how shape memory polymers can overcome the deep-seated flaws of conventional clear aligners. Ultimately, this material advancement demonstrates the potential to bridge the gap between patient demands for esthetics and the rigorous, uncompromising standards of comprehensive orthodontic tooth movement.

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