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Printing Orientation Effects on Dual-Indications Photopolymer Compared to Traditional Material

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Objectives 3D printing enables healthcare professionals to create models with multiple applications. Throughout the printing process, and depending on the material, variations in printing orientations can alter the surface of the printed models and their mechanical properties. This study aimed to evaluate the flexural strength (FS) and elastic modulus (EM) of a 3D printing resin with dual indications for fabricating individual impression trays and surgical implant guides, printed in various orientations, compared to a traditional material for manufacturing individual trays.
Methods A DLP 3D printer was utilised to print six specimens using the photopolymer dima Print Guide & Tray (Kulzer) in three different printing orientations of 0°, 45°, and 90°, followed by the cleaning and post-curing protocols. In parallel, six additional samples were prepared with a cold-curing polymer based on methylmethacrylate (Pekatray, Kulzer). All specimens were stored unpolished under dry conditions for 24 hours. Subsequently, a 3-point bend test in dry conditions was conducted to determine the FS and EM, thereby comparing the mechanical properties of printed specimens in different orientations to the cold-polymerised resin. The data were analysed statistically (α=0.05).
Results The values of FS and EM were measured in MPa with their respective standard deviations in parentheses. dima Print Guide & Tray exhibited at 0°, FS 81.6(6.4) and EM 2691(26); at 45°, FS 88.4(13.4) and EM 2613(26); at 90°, FS 107.5(3.9) and EM 2738(34). Comparatively, the traditional material, Pekatray, exhibited FS of 38.4(3.3) and EM of 1967(139).
Conclusions Within the limitation of the study, findings suggest that regardless of the printing orientation, the 3D printing resin dima Print Guide & Tray exhibited superior performance compared to the traditional reference material for its use as individual impression trays.