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Anterior Tooth Segment Static Strength: Conventional, Milled, 3D Printed Dentures

Objectives: Denture tooth separation from bases commonly occurs clinically. This research measured the static strength of anterior denture teeth to denture bases made using 3 different methods: conventional processing, milling, or 3D printing.
Methods: A wax-up of the desired gingival contour of an upper anterior segment (Cuspid-Central) was made including carded teeth (DENTSPLY Portrait Inspired IPN, 3D mold 163SP, A2) and scanned. A cylindrical form was added to the digital file to secure the specimen in a universal testing machine (Model 5544, Instron). A commercial dental lab (Drake Precision Dental Laboratory) provided 10 replications of each type material using the digital file: Conventional (Base was milled from Ivoclar ProArt CAD Wax disc, then processed to single carded teeth with Lucitone 199 denture base acrylic); Milled (DENTSPLY multilayer PMMA disc for teeth and Lucitone 199 puck as base); Printed (Lucitone A2 for the teeth and Lucitone base for the denture, all on a Carbon printer). For milled and printed specimens, 3-tooth segments were made and bonded using DENTSPLY Sirona Lucitone Digital Fuse Steps 1/2. The outer surfaces were polished and returned dry. A dimple was made on the lingual of the lateral incisor where the vertical load was applied. The specimen was firmly held horizontally while a downward force was applied to the lingual dimple (1mm/min) until the tooth or tooth segment separated. Maximum load at failure was recorded. ANOVA compared fracture loads among product types. Tukey's post-hoc test compared values between group pairs. N=10, pre-set alpha 0.05.
Results: The Printed group (562 ±35N) demonstrated significantly higher debond load ($p<0.001$) than either the Milled (305 ±133N) or Conventional (289 ±136N) products, which were not significantly different.
Conclusions: In the dry state, the printed denture/teeth demonstrated significantly higher debond failure strength than did milled dentures or conventional heat-processed PMMA dentures having carded teeth.

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