Summer Research 2024 Abstract—

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Assessing Precision: Comparative Analysis of AI-Generated Crowns through Advanced Digital Dentistry Software

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Objectives: This study evaluates the quality of AI-generated digital crowns by comparing the marginal and proximal fit of three crown preparations: supragingival, equigingival, and subgingival.

Methods: Using a Kilgore stock #30 all-ceramic preparation, three typodont preparations were created and modified for three finish lines. Specifically, the subgingival margin finish line required a base alteration of the typodont tooth and tissue management using Ultrapak™ retraction cord with Aquasil® light body polyvinyl siloxane. The following steps were completed: (1) preparations scanned with Planmeca Emerald® scanners and Romexis® software, (2) digital STL files imported into 3shape Automate software for design, (3) AI-generated designs exported, (4) milled using IPS e.maxCAD blocks and a Planmill 40S mill, (5) marginal gaps measured at five points (Buccal, Mesial, Lingual, Distal, and Sprue) using an Opti Spec microscope, (6) interproximal contacts measured in Newtons using a digital force meter, and (7) statistical analyses performed using R statistical software with $p < 0.05$ indicating significance.

Results: All crown marginal gaps were clinically acceptable (<120 microns). Statistically significant differences were found between supragingival and subgingival margins for most measurements (mesial, lingual, buccal, sprue margins, and mesial and distal contacts), except the distal margin. The ideal contact strength was measured at 0.53 Newtons, with results for all samples within 0.2 Newtons of the ideal. Statistically significant differences in mesial and distal contacts were found among the groups.

Conclusion: AI is more accurate with supragingival margins but can design clinically acceptable subgingival and equigingival margins. Differences in margin accuracy exist between groups. Most interproximal contacts are present and easily adjusted manually. AI-generated crowns by 3shape Automate are sufficiently accurate for clinical use.