

Evaluation of Polishing Systems for CAD/CAM Polymer Infiltrated Ceramic Network Restoration

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INTRODUCTION

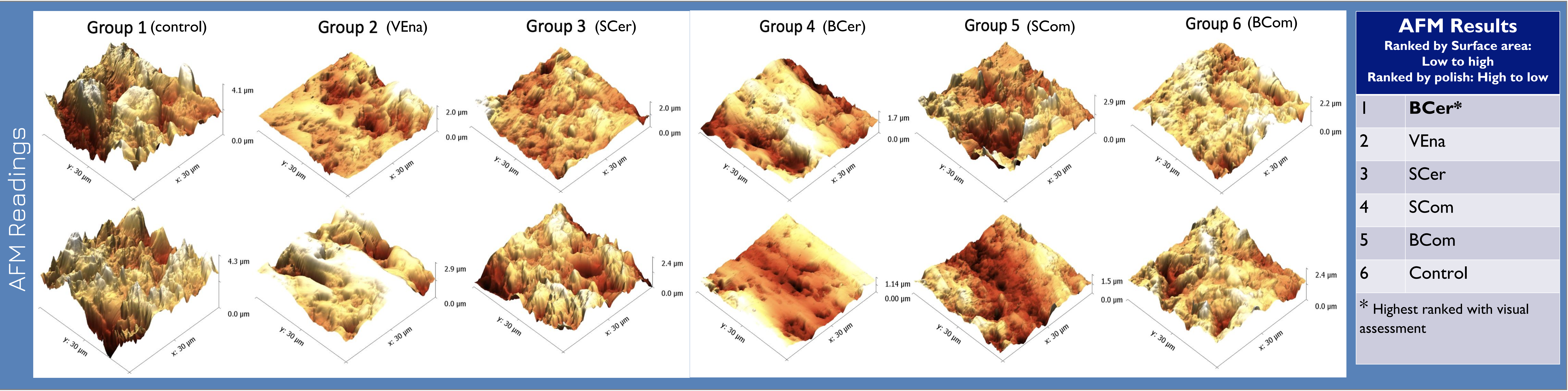
Chairside dental CAD/CAM systems have evolved and improved in all aspects since the introduction of the first CEREC machines in 1985. Because the CAD/CAM milling process does not create a smooth surface ready for clinical placement, milled restorations must be finished and polished, or glazed prior to cementation.¹ A chairside polishing system used for finishing and polishing should create a smooth surface for restorations that will maintain their toughness² and minimize the incidence of biological complications, such as bacterial adhesion and colonization, fracture or chipping of the restoration, and wear of the opposing dental enamel³ and restorations.⁴ A newly developed polymer-infiltrated ceramic-network (PICN) material, Vita Enamic® (Vita Zahnfabrik, Bad Säckingen, Germany) is now available in different shades and translucencies. It is a combination of 86% sintered ceramic matrix and 14% polymer matrix, and recognized as an intermediate material between ceramic and resin composite in mechanical properties as well as physical composition. The aim of this study is to evaluate the effectiveness of five different polishing systems on a PICN material with nanoscale assessment using atomic force microscopy (AFM) and clinical visual assessment by dental students and faculty. The first null hypothesis was that ceramic and composite polishing systems would provide the same surface roughness values and surface area as the Vita Enamic® proprietary polishing system. The second null hypothesis was that all polishing systems would achieve clinically acceptable results through visual assessment.

MATERIALS AND METHODS

A typodont tooth #18 was prepared for an all-ceramic crown restoration with a chamfer finish line (the occlusal clearance for the preparation was 1.5 mm). The prepared tooth and opposing arch were scanned with a chair-side intra-oral scanner (Bluecam, CEREC, Dentsply Sirona, York, PA, USA), and the accompanying software provided an ideal restoration design. Forty-eight PICN crowns were then milled out of Vita Enamic® shade A1 blocks.

The crowns were divided into 6 groups each with eight crowns based on polishing system as follows: (1) control/no polish, (2) Vita Enamic® Polishing Set (proprietary polishing system), (3) Shofu Porcelain Laminate Polishing Kit, (4) Brasseler Dialite Feather Lite All Ceramic Adjusting & Polishing System, (5) Shofu Composite Polishing Kit, and (6) Brasseler Composite Polishing Kit. The polishing procedures were performed by a single prosthodontist following the manufacturers’ recommendations.

An AFM [Agilent 5420 Scanning Probe Microscope (SPM)/AFM] was used to assess and measure the surface topography of the PICN crowns. AFM images were obtained in constant force mode with a silicon nitride cantilever. Surface roughness (Ra), the arithmetic mean of the absolute values of the profile height deviations from the average, was measured and recorded. For the visual assessment, one PICN crown without polish (control) as well as crowns polished with the various systems were visually evaluated by fifteen dental students and fifteen faculty members.



These clinical evaluators were randomly recruited volunteers and were not informed about the polishing method or system applied to each crown. Each of the 30 examiners visually evaluated the restorations under similar lighting conditions and classified the restorations as clinically acceptable or clinically unacceptable. The student and faculty examiners also ranked the crown surfaces from best polish to poorest polish.

CONCLUSIONS

AFM assessment of the polished PICN restorations found that all polishing systems evaluated improved approached the surface roughness of the company’s proprietary system. Lower surface area was found with the company proprietary system and ceramic polishing system as compared to the composite polishing system. Visual assessment of PICN restorations found that the company propriety and ceramic polishing system produced a clinically acceptable surface finish, while the composite polishing systems produced a less consistent finish. Although the company proprietary polishing system is recommended, ceramic and composite polishing systems may also improve the material’s surface polish.

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