GEOMETRIC AND ELECTRON-MICROSCOPIC EVALUATION OF IMPROVED CONDITIONING FOR INTRAORAL OPTICAL IMPRESSIONS

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Objectives:
Intraoral optical impressions require surface coatings of the scanning field. After positive biocompatibility testing, a Laponite®-based formulation was compared with commercially available matting agents. It was, therefore, the aim (i) to assess dimensional accuracy, (ii) clinical handling, and (iii) to compare the metric outcome of three standardized tooth preparations for ceramic restorations.

Materials and Methods:
Three extracted human molars were prepared for inlay, overlay and partial crown and mounted to match the clinical setting of a CEREC Bluecam® scanner (SIRONA, Bensheim, Germany). A calibrated operator conditioned test preparations with the coating agents Cerec Powder® (VITA, Bad Säckingen, Germany), Optispray® (SIRONA) and the experimental Laponite® formulation applied by pump-spray aerosol and consecutive air drying. These standardized restorative molar preparations were scanned, resulting in 50 digital models per tooth and per coating agent. Measurements of model dimensions, representing the outlines of restorations, were carried out with CEREC® software 4.2 (SIRONA). Quality characteristics (model surfaces, preparation margins, model artifacts) were assessed by descriptive index scores (1 to 3) and statistically analyzed (U-test, p<0.05). Micromorphology of conditioned tooth surfaces as well as dental restorative materials was evaluated by scanning electron microscopy (SEM).

Results:
All methods of surface conditioning resulted in optical impressions and consecutive tooth models which reproduced the correct anatomical situation. There were no statistical differences in any of the standardized metric model dimensions. However, concerning the scanning of surface roughness, reproduction of preparation margins and model artifacts, there was no significantly better formulation than the Laponite® coating except for the clarity of margin representation of the partial crown preparation. Scanning electron micrographs showed densely coated dental tissues. Dental restorative materials like gold alloys, amalgam, composite, and acrylics were also well coated. Micromorphologically no significant surface differences of the coating layers were detected.

Conclusions:
Thixotropy and adhesion properties of the Laponite®-based scanning liquid may simplify the clinical application and improve the morphological reproducibility of coating agents for intraoral scanning procedures.

Experimental setup:

Descriptive index:

Statistical Analysis:

SEM Analysis: