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Department: Department of Biomedical and Neuromotor Science, Division of Prosthodontics
Area of interest: Computer assisted technology, Biomechanics, Imaging and Diagnostic Systems.
Title: Accuracy of the intraoral scanners in dental vertical preparation: an in vitro study.
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Objective: The aim of this study is to evaluate the sulcus impression accuracy of five different intraoral scanner devices of tooth with vertical preparation.

Material and methods: A resin first molar of a training model was prepared with a finish line simulating a complete crown coverage. The model was then impressed by an intraoral scanner. The digital impression was manipulated in a CAD software to create two virtual models with different sulcular depth around the prepared tooth. In the model A the artificial gingival sulcus had 0.3mm apical width, 0.6mm coronal width and a depth of 1mm. The sulcus in the model B was the same of the model A but its depth was 2mm. Starting from models A and B, two stereolithographic model (H1 and H2) were fabricated through digital light processing (DLP) and their sulcular dimension were verified by a profilometric analysis. Five different intraoral scanners (3Shape-Trios, 3M-TDS, DensplySirona-Omniscam, Planmeca-Emerald, Condor Intra Oral Scanner) were used to execute 10 digital impression of H1 and H2 models with a total of 100 digital impressions. Every digital impression was exported and analysed through a specific dental software (3Shape-3D Viewer) to evaluate the apical width (AW), the coronal width (CW) and the depth (D) of the impressed sulcus. The artificial gingival sulcus around the teeth was analysed in 120 different points with a total of 6000 measurements.

Essential Results: Trios recorded: in H1 model AW 0.300 ± 0.027 mm, CW 0.600 ± 0.033 mm, D 1.000 ± 0.033 mm and in H2 model AW 0.300 ± 0.048 mm, CW 0.600 ± 0.03 mm, D 1.953 ± 0.032

mm. TDS recorded in H1 model AW 0.257 ± 0.028 mm, CW $0.600 \text{ mm} \pm 0.032$ mm, D 1.000 ± 0.072 mm and in H2 model 0.254 ± 0.038 mm, CW 0.600 ± 0.034 mm, D 1.981 ± 0.078 mm. Omnicam recorded in model H1 AW - 0.281 ± 0.065 mm, CW - 0.600 ± 0.065 mm, D - 0.943 ± 0.108 mm and in model H2 AW - 0.276 ± 0.045 mm, CW - 0.600 ± 0.104 mm, D - 1.888 ± 0.164 mm. Emerald recorded in model H1 AW - 0.214 ± 0.082 mm, CW - 0.600 ± 0.08 mm, D - 0.862 ± 0.169 mm and in model H2 AW - 0.199 ± 0.14 mm, CW - 0.600 ± 0.077 mm, D - 1.719 ± 0.3 mm. Condor Intra Oral Scanner recorded in model H1 AW - 0.262 ± 0.062 mm, CW - 0.600 ± 0.082 mm, D - 0.643 ± 0.18 mm and in model H2 AW - 0.274 ± 0.065 mm, CW - 0.600 ± 0.108 mm, D - 0.456 ± 0.159 mm.

Conclusions: The intraoral devices used in this study showed different levels of accuracy, this could be explained by the different technologies. The procedure used in this in vitro study showed to be a reliable and repeatable method to evaluate the sulcus impression accuracy captured by different intraoral digital scanners.