Evaluation of the accuracy of four structured light facial scanners through an experimental study.

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1) Introducción & Objetivos

Facial scanners provide a tridimensional reconstruction of the patient's face. The objective of this study was comparing through precision and trueness four structured light scanners, Eva and Spider (ARTEC, Luxemburg) and Arc1 and Arc4 (Bellus 3D, USA), depending on the scanned zone and using a best-fit algorithm.

2) Metodología & material

14 reference points were placed on a head model (Professional makeup and face student practice head; Mehron Makeup, Spring Valley, USA) which we scanned with an industrial grade scanner (GOM Atos Q 3D 12 M; Carl Zeiss Industrielle Messtechnik GmbH) to obtain a digital reference model (DRM). Four different facial scanners were used to digitalize the model 30 times each, adding up to 120 archives. 10 areas were demarcated on CAD objects and DRM then superimposed with Geomagic (Geomagic Wrap 2021, 3D Systems, USA). Analysis of the Root Mean Square and its standard deviation gave us the discrepancy between the DRM mesh and each scan. Accuracy was obtained for both each of the areas and as a whole.

3) Resultados

We observed statistically significant differences between the studied scanners (Eva, Spider, Arc1 and Arc 4) in terms of precision and trueness ($p < 0,001$). Midline areas shown the worst accuracy. Differences between areas can also be seen depending on their specific location, as midline areas shown the worst accuracy.

4) Conclusiones

Technological evolutions in medical field allow the creation of the so called virtual patient. Structured light acquisition being harmless, adding tridimensional face scans to dental data set enable complete planification with sufficient precision and trueness. Nevertheless, its clinical use is still limited due to experimental protocols (described in the literature). Face scanners are a suitable technology to reproduce accurately a patient's facial structures, but . Localization of these structures influence greatly the scanners accuracy, with central zones showing more discrepancies. Best accuracy values were obtained with the Spider scanners while the Arc4 acted the worst. However, the values obtained do not allow us to recommend its use for high precision aesthetic work.