

An in vitro comparison of accuracy between three different face scanners

Objectives: To measure accuracy (trueness and precision) of three facial scanners for the complete face and for separate horizontal facial thirds.

Methods: A mannequin head was digitized using a reference scanner (Scan in a Box;Open Technologies SLR) to acquire the reference mesh. Subsequently it was scanned with a structured light scanner (Einscan Pro HD;SHINING 3D), a stereophotogrammetry scanner (RayFace100;Ray Co Ltd) under different ambient lighting and a laser scanner (Proface 3D Mid;Planmeca) to acquire the test meshes.Resulting meshes were delineated in four areas and discrepancies calculated for the complete face and different facial partitions.One-way Anova and pairwise comparisons tests were used to compare trueness and precision between scanners across different areas.

Results:Significant differences were detected among scanners both for complete face ($F(3, 27) = 776, P < 0.01$) and for delineated face areas ($F(11, 99) = 200.1, P < 0.01$). Einscan had significantly higher accuracy for the complete face ($P < 0.01$) and significantly higher trueness for the facial partitions compared to other scanners.RayFace had significantly higher trueness at 400 lux compared to 800 lux and when scanning the middle part of face compared to other facial parts.Proface had significantly lower upper facial third trueness compared to other facial parts. All scanners had accuracy levels below the 2.00mm clinical threshold.

Conclusions: Facial scanning accuracy was influenced by the scanner used. Scanning trueness per device was influenced by location of surface area.Ambient lighting conditions influenced trueness of the stereophotogrammetry device.All scanners had accuracy levels within the clinically acceptable accuracy threshold.

Keywords: face scanner, accuracy, stereophotogrammetry, laser scanner, structured light scanner.