

ACCURACY OF DIGITAL FACE SCANS OBTAINED FROM TWO DIFFERENT 3D SCANNERS: A COMPARATIVE CLINICAL STUDY

Ala'a M. Khalifa ^{1*} MSc, Kamel M. Aboelsayed ² MSc, Rania E. Ramadan ² MSc, Wesam A. El Rashedy ³ MSc, Ahmed M. Abdelhamid ⁴ PhD, Mohamed M. Khamis ⁵ PhD.

1. Assistant Lecturer, Department of Prosthodontics, Faculty of Dentistry, Pharos University, Alexandria, Egypt
2. Assistant Lecturer, Department of Prosthodontics, Faculty of Dentistry, Alexandria University, Alexandria, Egypt.
3. Assistant Lecturer, Department of Prosthodontics, Faculty of Dentistry, Kafrelsheikh University, Kafrelsheikh, Egypt.
4. Professor, Department of Prosthodontics, Faculty of Dentistry, Alexandria University, Alexandria, Egypt.
5. Professor and Chairman, Department of Prosthodontics, Faculty of Dentistry, Alexandria University, Alexandria, Egypt.

*Ala'a M. Khalifa

INTRODUCTION

Using 3D scans of the patient's face significantly enhanced esthetic assessment for accurate diagnosis and virtual treatment planning (1). Commercially available 3D face scanning systems are either static or mobile-compatible scanners. Limitations of the static face scanning systems include the high costs of purchase, the need for a properly-illuminated room, well-trained users and powerful computers to process scanned images. Face scanning using smart phones and tablet devices has therefore become popular due to their user-friendly manipulation, reduced training time and cost-efficiency (2). The objective of the present study was to evaluate the accuracy (trueness, precision) of 3D facial reconstructions performed by 2 facial scanners (Bellus3D, version 2.0.3.25; Bellus3D, Inc. and Carestream face scanner, CS9600) compared to manual measurements.

METHODOLOGY

Twenty dentate, adult, healthy participants were selected. Approval of the study by the Ethics Committee of the Faculty Dentistry, Alexandria University, Egypt (IRB NO: 00010556 – IORG 0008839). Stickers (Online Labels, LLC) were used to mark 9 anthropometric facial landmarks on each participant's face. For all participants linear inter-landmark measurements taken was divided into 3 groups: manual group, bellus group and CS group (Figure 1). Trueness values of each scanner was assessed by calculating the mean differences between manual and digital readings. Precision of (Bellus and CS) was determined by inspecting 5 scans of each scanner for 1 participant. Superimposition of 2 scans of each scanner was performed on the Exocad software by align meshes for qualitative analysis by a color map. (Figure 2) Statistical analysis was done by a statistical software program (IBM SPSS Statistics, v20; IBM Corp).

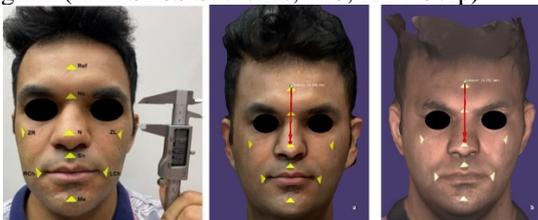


Figure (1): Inter-landmark distances measured using a digital caliper in the manual group(a), and, on the 3D facial reconstructions (b Bellus and c CS) using exocad software with the measuring tool.

RESULTS AND DISCUSSION

There was no statistically significant difference between the manual and Bellus groups in all the inter-landmark distances, as well as between the manual and CS groups in only 3 inter-landmark distances (Ref-Ns, Ns-N, and Ns-

Sn) ($P > .005$). There was a statistically significant difference between the manual and CS groups in the remaining 8 inter-landmark distances ($P \leq .005$). (Figure 3) There was no statistically significant difference among 5 scans for 1 participant by either Bellus or CS ($P = .090, .057$) respectively showing that the precision of both scanners was relatively high.

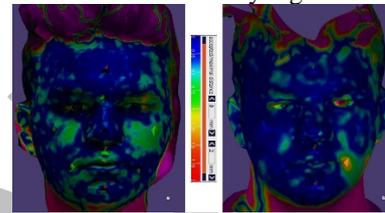
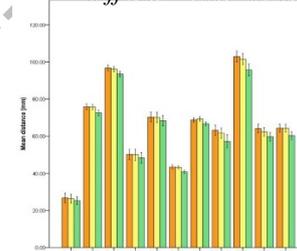


Figure (2): Color maps after superimposition of 2 scans of each facial scanner (a Bellus and b CS) revealed blue color indicating perfect fit matching.

Aung et al clarified clinical deviations less than 1 mm as highly reliable while deviations more than 2 mm were unreliable. Thus, Bellus was highly reliable in 8 inter-landmark distances indicating 72% high reliability. However, CS was unreliable in 7 inter-landmark distances signifying 63% unreliability (3).

Figure (3): Trueness mean values of Bellus and CS versus manual in different inter-landmark distances analyzed.



CONCLUSION

Face scans produced by the Bellus 3D face scan application showed better trueness values than those produced by the CS static face scanner. However, both revealed relatively high precision outcomes. Thus, Bellus 3D face application revealed higher accuracy than CS face scanners.

REFERENCES

1. Russo LL, Salamini A, Troiano G, Guida LJTJopd. Digital dentures: A protocol based on intraoral scans. J Prosthet Dent 2021;125:597-602.
2. Piedra-Cascón W, Meyer MJ, Methani MM, Revilla-León M. Accuracy (trueness and precision) of a dual-structured light facial scanner and interexaminer reliability. J Prosthet Dent. 2020;124:567-74.
3. Aung S, Ngim R, Lee SJBjops. Evaluation of the laser scanner as a surface measuring tool and its accuracy compared with direct facial anthropometric measurements. Br J Plast Surg 1995;48:551-8