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Smartphone-Generated 3D Facial Images: Reliable for Cleft Patient Assessment?

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Objectives To evaluate the validity and reliability of smartphone-generated three-dimensional facial images (SGI) for routine evaluation of the oronasal region of cleft patients by comparing their accuracy to that of direct anthropometry (DA) and 3dMD.

Methods Eighteen soft-tissue facial landmarks were manually labelled on each of the 17 (9 males and 8 females; mean age 23.3 ± 5.4 years) cleft lip and palate (CLP) patients' faces. Two surface imaging systems, *3dMDface* and *Bellus3D FaceApp*, were used to perform two imaging operations on each labelled face. Subsequently, 32 inter-landmark facial measurements were directly measured on the labelled faces and digitally measured on the 3D facial images. Statistical comparisons were made between SGI, DA, and 3dMD measurements.

Results The SGI measurements were slightly higher than those from DA and 3dMD, but the mean differences between inter-landmark measurements were not statistically significant across all three methods. In terms of clinical acceptability, 16% and 59% of measures showed differences of ≤ 3 mm or $\leq 5^\circ$, with good agreement between DA and SGI and 3dMD and SGI, respectively. A small systematic bias of ± 0.2 mm was observed generally among the three methods. Additionally, the mean absolute difference between the DA and SGI methods was the highest for linear measurements (1.31 ± 0.34 mm) and angular measurements ($4.11 \pm 0.76^\circ$).

Conclusions SGI displayed fair trueness in contrast to DA and 3dMD. It exhibited higher accuracy in the orolabial area and specific central and flat areas within the oronasal region. Notwithstanding this, it has limited clinical applicability for assessing the entire oronasal region of CLP patients. Ideally, SGI should accurately encompass the entire oronasal region for optimal clinical use. In terms of clinical significance, SGI can be considered for macroscopic oronasal analysis or for patient education where accuracy within 3 mm and 5° may not be critical.