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LETTER TO THE EDITOR

Four-dimensional scanning approach to obtain surface data of the face

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Dear Editor

Digital scanning of a face is useful for head and neck surgery as well as prosthetic rehabilitation.[1] Although three-dimensional (3D) facial scanners have been used to digitize faces,[2] they usually require patients to remain motionless during scanning, and it can be difficult for some patients, especially children and the elderly, to keep their head still. Recently, four-dimensional (4D) scanners have started to be used to capture the motion of the face during everyday functioning. The captured movie data consist of multiple 3D data. This study aimed to use a 4D scanner to capture and evaluate the accuracy of 3D face data.

A head model made with a soft material (PVC Female Mannequin Head #3; Vococal, Shenzhen, China) was used as the scanning object in this study (Fig. 1). First, it was scanned with an industrial scanner (ATOS III Triple Scan 8MP; GOM, Braunschweig, Germany, measurement inaccuracy = .001 mm) as a reference scan. Then, the head model was scanned with a facial scanner (PVC Female Mannequin Head #3, Vococal, 3dMD Face, Atlanta, GA) in 4D mode for 20 s. A total of 200 imageswere captured and 10 of them were randomly selected. The images were saved in Standard Triangulated Language (STL) file format and matched with the reference scan, using the best-fit algorithm of a 3D evaluation software (spGauge 2018; Armonicos, Shizuoka, Japan). The 3D deviation was numerically examined, and the color mapping was also observed.

The overall mean 3D deviation ± standard deviation for trueness of the captured 10 images were 196.8 ± 6.1 μm. The color mapping showed that most parts of the face data had smaller differences compared with the reference data within the range of ± .100 mm except for the eyeballs and nostrils. The eyeballs showed the minimum distance, while the nostrils showed the maximum distance (Fig. 2).

A 4D scanning approach was used to capture a face model, and the overall mean 3D deviation showed a comparable value of deviation to the conventional impression of a model as well as the digital

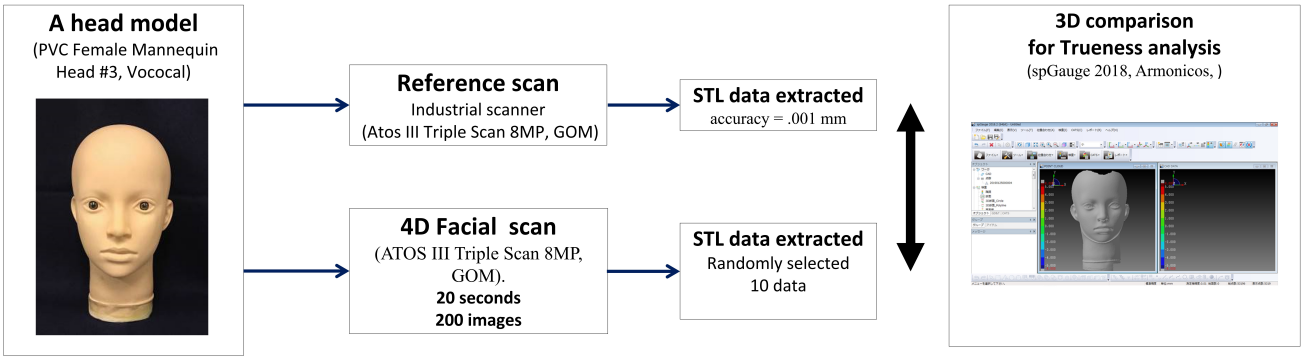


Fig 1. Illustration of the data-acquisition process.

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impression using intraoral scanner.[2] This finding suggests that a 4D scanner may be useful for acquiring the face data of infants and elderly patients with postural instability. Further research is needed toevaluate the effects of head movement and facial expressions on the accuracy of this approach.

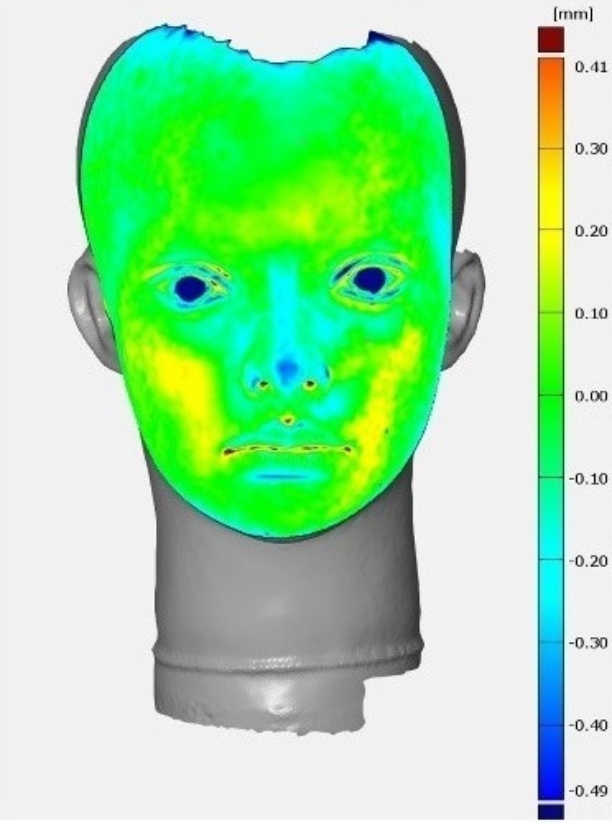


Fig 2. Example color mapping of the trueness analysis.

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