**Reviewer’s report**

**Title:** Simultaneous, radiation-free registration of the dentoalveolar position and the face by combining 3D photography with a portable scanner and impression-taking

**Version:** 0  **Date:** 19 Jul 2019

**Reviewer:** Christoph Runte

**Reviewer's report:**

The authors state: "Such approaches are lacking in recent literature" (line 23):

The concept of matching intraoral surfaces with a facial scan is not new. One reference to a similar publication was given by the authors themselves (Bechtold et al. 2012). In fact, different techniques with and without ionising radiation have already been subject to a review (and clinical study) in 2018 by Managno C et al. (Combining Intraoral Scans, Cone Beam Computed Tomography and Face Scans: The Virtual Patient. J Craniofac Surg 2018; 29: 2241-2246). With hollow spherical marks on an intraoral wax rim (e. g. Schweiger J et al.: Virtual evaluation for CAD-CAM-fabricated complete dentures. J Prosthet Dent 2017; 117: 28-33) or visible dental or prosthodontic surfaces (e. g. Hassan B et al.: A digital approach integrating facial scanning in a CAD-CAM workflow for complete-mouth implant-supported rehabilitation of patients with edentulism: A pilot clinical study. J Prosthet Dent 2017; 117: 486-492), matching intraoral and facial 3D-surfaces has also been performed before.

A Scanbody similar to the one the authors used with spherical marks has been described by Bechtold in 2012 (see above) and patented in 2017/2018 by K. Tegtmeyer (who also used a mobile scanner and a smartphone). (https://patents.google.com/patent/WO2018172263A1/de)

Using spherical target marks to match scanned surfaces is also a well-known procedure. "Spherical targets are widely used because of their unique benefit that they can be viewed from any angle and always provide a homogeneous reference surface" (Brazeal R: Low cost spherical registration targets for terrestrial laser scanning. https://www.researchgate.net/publication/265014634_LOW_COST_SPHERICAL_REGISTRATION_TARGETS_FOR_TERRESTRIAL_LASER_SCANNING; 2013), further explanation of algorithms and a study on the impact of target mark geometry on accuracy can be found in Elkhrachy, I and Niemeier, W: Fitting sphere targets and their impact on data registration accuracy for terrestrial laser scanner. https://www.researchgate.net/publication/270565358_Fitting_sphere_targets_and_their_impact_on_data_registration_accuracy_for_Terrestrial_laser_scanner

So the radiation-free data acquisition in dentistry, the use of an extraoral scanning target fixed to the dental arches, the advantages of a spherical target over other geometries, the matching procedure for the surfaces and the use of a portable surface scanner have all been studied and published before. I would therefore strongly recommend pointing out more clearly what was essentially new in the manuscript. As I understand it, the main difference to the procedure
Bechtold described is the reduction of ten to six steps. The authors forewent an additional facial scan without the target marks in place, Bechtold et al. performed this second scan to get a facial surface with lips closed and undisturbed by the device. Bechtold also used plaster models and scanned them with the target marks and without and in occlusion (three steps), whereas the authors used an impression scan with normal inversion. Therefore, as a consequence of the reduction of steps, there is also a reduction of information.

I would also recommend revising the text with respect to the instructions for authors, especially the references list, e.g:

Line 283: The Author "A. Gerber" should be named correctly.

Line 344: The Journal of Orofacial orthopedics/Fortschritte der Kieferorthopädie is abbreviated J. o. O. O. d. K. in the manuscript and placed between the authors. This should be changed according to the Instructions for authors.

Line 351: The title of the journal (Behaviour research methods) is missing. Same is true for line 353.

Line 380: The reference Bechtold obviously appears twice in the list (see line 343).

Level of interest

Please indicate how interesting you found the manuscript:

An article of limited interest

Declaration of competing interests

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Within the field of symmetry analysis, I have been part of a working group where facial scans were analysed and also combination with intraoral surfaces have been studied.

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