Reviewer’s report

Title: Accuracy of four intraoral scanners in oral implantology: a comparative in vitro study

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Reviewer: Miltiadis Mitsias

Reviewer’s report:

This paper is really interesting because it deals with a very hot topic in oral implantology- the accuracy of different intraoral scanners and therefore the possibility of a full digital workflow in implantology.

To my knowledge, this is the second work of the authors on this topic and i believe it is more valuable than the first one (Mangano F. et al, Plos One 2016) for two reasons. First, the present paper compares the accuracy (sum of trueness + precision) of the most important IOS currently available in the market, with the latest software releases. Second, the present paper investigates the accuracy of the different IOS in two different situations - a partially and a totally edentulous model, respectively - and the models of the partially edentulous were in the present work adequately cut and trimmed, in order to perform a reliable evaluation (in the previous study published in the Plos One, the authors did not trimmed the partially edentulous model, and as a consequence, they found no statistically significant differences in the general trueness/precision of the different IOS- that could be considered a bias). For these reasons, i find this study extremely valuable.

I have no specific comments on the design of the study- it is perfectly designed.

The title is appropriate and the Abstract is clear and concise, as it contains all the relevant results of the study.

The Keywords are appropriate.

The introduction is easily readable even for the reader who has no experience in the use of IOS; however, all the most important information are included to provide a background for the study.

The M&M section fully describes the methods of this work- and basically the authors have repeated the design of their previous work and the works of Patzelt and coll., that are correctly cited in the reference list. I understand the use of a powerful industrial scanner as reference- hypothetically, an articulated arm or a cmm machine would be a better choice as reference, but it is clear that these devices can damage the models probing their surface- so i agree with the authors with the choice of a powerful active non-contact scanner for reference. In addition, this section is really informative because it describes all the main features of the different IOS, with order and again it is clear and concise. The superimposition method is described in sufficient details, and the references are pertinent.
It would be great in a future study, to include also the new scanner from Dentalwings - dwio - that is considered really powerful too, but i understand that the preparation of the present work was very long and difficult with so many scans and superimpositions.

The results section is clear, concise, with all relevant information included. Let me say that this information will have an impact in the world of dentistry- to date, there are no high quality comparative studies investigating the performance of different IOS at this level.

The Discussion is well written as it reports the results of the previous studies and then it compares these results with the present outcomes. The authors have underlined here the problem of scanning multiple implants for long-span restorations, and they draw very reasonable conclusions. In addition, the limitations of the present study are clearly stated. A larger sample size would be preferrable, and also it would be very interesting to perform a study on the local accuracy- calculating the linear and angular distances between the different scanbodies. This could be the topic of the next investigation.

The Conclusions are pertinent concise and related to this study.

The reference list is pertinent and it contains all the most important works in the present literature.

The tables are rich of information and easy to read, with a clear representation of the statistical evaluations.

Finally, the pictures are ok- and i have noted that different thresholds have been selected for the colorimetric maps of the partially and totally edentulous models, i agree with this.

The language is clear and it does not need editing or further revision.

**Are the methods appropriate and well described?**
If not, please specify what is required in your comments to the authors.

Yes

**Does the work include the necessary controls?**
If not, please specify which controls are required in your comments to the authors.

Yes

**Are the conclusions drawn adequately supported by the data shown?**
If not, please explain in your comments to the authors.

Yes

**Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?**
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

I am able to assess the statistics

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