Author’s response to reviews

Title: Applying intraoral scanner to residual ridge in edentulous regions: in vitro evaluation of inter-operator validity to confirm trueness

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Reviewer reports:

Francesco Mangano, DDS, PhD
(Reviewer 1): the authors have made considerable efforts to improve the quality of their paper. However, still there are a few limited issues to be solved.

1. You did not insert, in the abstract, the name of the software used for superimpositions. I have already asked you to insert it. Please do it.

Thank you very much again.

We have added the name of the software.
P2L9: The intraoral scanner data was overlapped with the reference data (Dental System, 3Shape A/S).

2. A statement of clinical relevance is not required for BMC Oral Health; please erase it from your abstract

Thank you very much.

We have deleted the clinical relevance.

3. Still in the intro/discussion the concept of the difficulty with capturing edentulous areas with intraoral scanners should be expanded and better treated, there are papers recently published about the possibility of fabricating digital dentures, i suggest the authors to refer to some of those papers

Thank you very much for your suggestion.

We have added the description and reference in introduction and discussion.

P3L26: The fabrication of removable dentures using an intraoral scanner has many advantages, such as reducing patient discomfort of impression taking, eliminating rubber allergies, the distortion of impression material and storing the scan data [11].

P7L14: Similar results were obtained in an in vitro study of repeatability of intraoral scanner for the partially edentulous [30]. Kim et al. reported that trueness and precision of intraoral scanner were improved using an artificial landmark in the long edentulous region [31].

P7L22: No significant differences were observed between conventional impression and intraoral scanner, and there were no clinically significant effects on fabrication of removable denture [11, 34, 35]. This suggests that intraoral scanning of edentulous areas could achieve satisfactory capture by the operator.

4. Please re-in force your conclusions. this study focuses on inter-operator validity, but you forget to report on this that is the core of the study. the conclusions should be expanded by adding at least 1-2 new sentences that report exactly on the results of this study, the reliability of the technique, after this you can focus on the problems or limits when scanning edentulous regions

Thank you very much for your suggestion.

We have corrected our conclusions.
The present study demonstrated satisfactory trueness of intraoral scanning of residual ridge in edentulous regions during in vitro evaluation of inter-operator validity. The difference between the intraoral scanner data and reference data were the same or lower than the amount of tissue displacement. However, it was revealed that the lack of traceable structures and smooth surfaces, such as the palatal region, and/or long free end saddles, affected the trueness. If care is taken regarding these issues, the present study shows that optical impressions can be applied to the residual ridge of edentulous regions.

5. Please revise the English form of your paper with the help of a proficient English speaker, still there are some sentences that are not properly readable and the overall quality must be improved

Thank you very much for your advice.

This manuscript has been checked by an English speaker. (Yellow and green line)

Florian Beck (Reviewer 2):

* Line 19-20/p2: be more precise…Trios2 was not the reference data!!! -> The intraoral scanner data (Trios 2, 3Shape A/S) was overlapped with the reference data.

Thank you very much.

We have corrected this description.

P2L7: Five dentists used an intraoral scanner (TRIOS 2, 3Shape A/S) five times to capture intraoral scanner data, and the “zig-zag” scanning technique was used. They did not have experience with using intraoral scanners in clinical treatment. The intraoral scanner data was overlapped with the reference data (Dental System, 3Shape A/S).

* Copyediting of the whole manuscript is still lacking!!!

E.g. Line 26/p2: this sentence is hardly to understand…as edentulous requires a noun! Please revise this sentence! Line 31/p2 should be: …in the premolar region, respectively, and 0.18mm and 6.82mm2 in the molar region

Line 37/p2 should be: No significant difference was observed between those two values.

Thank you very much for your suggestion.

We have corrected this sentence
P2L13: In terms of the maximum distances of the difference on the maxillary model, the means of five operators were as follows: premolar region, 0.30 mm; molar region, 0.18 mm; and midline region, 0.18 mm. The integral values were as follows: premolar region, 4.17 mm2; molar region, 6.82 mm2; and midline region, 4.70 mm2. Significant inter-operator differences were observed with regard to the integral values of the distance in the premolar and midline regions and with regard to the maximum distance in the premolar region, respectively. The maximum distances of the difference in the free end saddles on mandibular model were as follows: right side, 0.05 mm; and left side, 0.08 mm. The areas were as follows: right side, 0.78 mm2; and left side, 1.60 mm2. No significant inter-operator differences were observed in either region.

* Line 43-44/p2: I would reconsider the clinical relevance as "a smooth surface such as the palatal region" in vivo on the one hand does not exist (maybe on the reference model in vitro) and on the other hand the palatal region is actually better recognized by intraoral scanning compared to the floor of the mouth; here again it matters whether we scan free end saddles in the upper or the lower jaw and the degree of bone resorption (high-well rounded ridges compared to low-depressed or knife-edged)

Thank you very much for your suggestion.

We have deleted the clinical relevance from suggestion of Reviewer 1.

* Line 39/p2 vs. Line 57/p3: first you demonstrated satisfactory inter-operator trueness (line 39/p2) and later in the manuscript you investigated the trueness of intraoral scanning (line 57/p3 or line31/p8) which actually isn't the same! i.e., the inter-operator comparison could show satisfactory results if their results did not differ too much or … satisfactory trueness was achieved as the results were close to the reference scan!

Thank you very much for your suggestion.

We have corrected the objectives and conclusions of abstract and main text again.

P2L3: The purpose of this study was to investigate the trueness of intraoral scanning of residual ridge in edentulous regions during in vitro evaluation of inter-operator validity.

P2L22: The present study demonstrated satisfactory trueness of intraoral scanning of the residual ridge in edentulous regions during in vitro evaluation of inter-operator validity.

P4L3: The present study investigated the trueness of intraoral scanning regarding the residual ridge in edentulous regions for in vitro evaluation of inter-operator validity.

P8L23: The present study demonstrated satisfactory trueness of intraoral scanning of residual ridge in edentulous regions during in vitro evaluation of inter-operator validity.
* Line 2/p4: it is not clear what kind of (novel?) method you established? I would skip this sentence or explain it into more detail in the m&m/results/discussion section

Thank you very much for your suggestion.

We have deleted this description.

* Line 41/p4: please be more accurate concerning all the technical details provided in the M&M section….stating "3shape. Com" is not sufficient (which should be referenced in the bibliography and not in the main text): either provide the whole URL linking to these data or explain if these facts can be found in the manual, data safety sheet, backside of the scanner…. 

Thank you very much for your suggestion.

We have added the whole URL linking.

* Line35-39/p5: please revise this sentence as it is not clear whether this (precision?) applies to your study and the meaning is hardly to get 

Thank you very much for your suggestion.

We have corrected this description.

P5L21: The vertical maximum distance of the difference and the integral value in each verification region were analysed using the Kruskal-Wallis test, while evaluation of inter-operator validity to confirm trueness was performed with the Steel-Dwass test for multiple comparisons. Statistical analyses were performed using SPSS version 22 (IBM, New York, NY) with significance set at p<0.05.

* Line47/p5: please add that these results refer to the edentulous model!

Thank you very much for your suggestion. This is a good idea.

We have added the refer to the edentulous model and the partially edentulous model in result.

* Line 47-49/p6: I would skip this sentence as it does not provide information for a better understanding and a plane created by three points (top of maxillary tubercles and incisive papilla does not represent the entire dentition if you refer to the occlusal plane)

Thank you very much for your suggestion.

The necessary information is written in the method, so the description has been changed to be simple and easy to understand.
* Line 55/p6: the palate might be smooth on the plastic model, however in vivo it is not...revise this sentence otherwise one could get the impression that it was concluded by Patzelt et al., in fact only the stitching part was from Patzelt.

Thank you very much for your suggestion.

We have changed “smooth surface” to “flat shape”.

* Line 10-19/p7: IQR values should be stated in the results section (at least for the first time)!

Thank you very much for your suggestion.

We have added the IQR values in the results, and deleted them from the discussion.

* Line 24-35/p7: ref. No 30: please state if this study was conducted in vivo or vitro....if it was in vivo you might conclude as in line 33/p7, if not, then you should make clinical recommendation for satisfactory results as you evaluated the trueness in in vitro or provide other ref

Thank you very much for your information.

Ref. no 30 conducted in vivo study.

We have added this information.

* Line 32/p8: I would add that the findings are limited to in-vitro and need to be verified in vivo and thus: e.g. …in edentulous regions in vitro.

Thank you very much for your information.

We have corrected this sentence.

P8L23: The present study demonstrated satisfactory trueness of intraoral scanning of residual ridge in edentulous regions in vitro evaluation of inter-operator validity.