

# COMPARISON OF DIGITAL VS CONVENTIONAL IMPRESSION TECHNIQUES PRECISION: A REVIEW

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## Abstract

**Background and Aim:** Accuracy and Fitness of a restoration is a valuable Advantage regarding to the tooth Long-term Survival. The aim of this study is to compare the Accuracy of Digital and Conventional Impression methods.

**Materials and Methods:** An electronic literature search was conducted from these 4 datasets: PubMed, Web of Science, Cochrane library and Google Scholar with the help of Boolean Operators for eligible articles. The search strategy used a combination of controlled vocabulary [Medical Subject Headings (MESH)] and free text words and different combination of them. To ensure reliability, a calibration exercise with two reviewers was conducted prior to commencing screening

**Results:** The search yielded to 8 Articles from all of the databases after Excluding the articles which were identified in more than one of the databases.

**Conclusion:** The findings of this review indicated poor homogeneity of the study designs populations. Based on the finding of this study, additional laboratory and clinical research is s appraise the accuracy and validity of digital implant impression technique in the prosthodontic

**Keywords:** CAD/CAM, Conventional impression, Intraoral digital impression

## Introduction

Accuracy and fitness of a restoration is a valuable Advantage regarding to the tooth long-term survival. Impression making is one of the most important steps in producing an exact working model which could lead to an accurate restoration.<sup>1-3</sup> With introducing the additional silicones and poly ether materials to conventional final impression in fixed-prosthodontics, they show excellent dimensional stability and precision and have been used successfully for a long time since then.<sup>4-6</sup>

The Accuracy of dental impressions has been defined by ISI 5725-1:1994 by two terms "Trueness" and "Precision". Trueness is determined by the deviation of the tested impression method from the original geometry. The Difference between trueness and precision is that precision indicates the deviations between the impressions within a test group.<sup>7,8</sup> There are 3 different methods that has been used in the literature to measure impression techniques accuracy. Linear distance measurements are the most commonly used method for accuracy of conventional intra oral impressions with gypsum casts and they are restricted to a few measurements points. The other two methods are Measuring 3D or 2D Dimensional discrepancies and marginal and internal fit of restorations.<sup>9-12</sup>

CAD/CAM is abbreviation of the word Computer-Aided Design and Computer-Aided Manufacturing which Consists of three main Sections:

1. Data Acquisition
2. Data Proccession and
3. Manufacturing.

Intra Oral Scanning (IOS) is playing its part as the first section in CAD/CAM technology.<sup>13</sup>

Nowadays, IOS and CAD/CAM provide easier planning of treatment, case acceptance, communication with laboratories, reduced operative time, storage requirements, and reduced treatment times.<sup>14,15</sup> However, the conventional impressions have shown high detail accuracy and are currently and successfully used.<sup>16</sup> The last decade has seen an increasing number of optical IOS, and these are based on different technologies; the choice of which may impact on clinical use.<sup>15,17</sup>

Clinical studies comparing these 2 different techniques are rarely find in the literature, although there are few reviews trying to answer to the dilemma which could not find enough evidence to do so.<sup>7,10,16</sup>

The aim of this study is to compare the Accuracy of Digital and Conventional Impression methods.

## Materials and Methods

An electronic literature search was conducted from these 4 datasets: PubMed, Web of Science, Cochrane library and Google Scholar with the help of Boolean Operators for eligible articles. The search strategy used a combination of controlled vocabulary [Medical Subject Headings(MESH)] and free text words and different combination of them. The following keywords were included: [(Digital Teeth impression technique) Or (Intra-Oral Digital Scanners) Or (Conventional teeth Impression technique) Or (Conventional Versus Digital)] AND (Accuracy OR Precision or Framework Misfit Or Gap Or Trueness). Articles Were Collected in reference manager software (Endnote, Thomson Reuters), and Duplicates were discarded by the software electronically.

To ensure reliability, a calibration exercise with two reviewers (MTB and Sh Sh) was conducted prior to

commencing screening. Using the inclusion criteria, a random sample of 10% of citations from the search were screened independently by both reviewers. Screening only began when percent agreement was >90% across the two reviewers.

A similar calibration exercise was completed prior to screening full-text articles for inclusion. Two calibrated reviewers (MTB and Sh Sh) initially screened titles and abstracts for potential inclusion. If no abstract was available in the database, the abstract of the printed article was used. If the title and abstract did not provide sufficient information regarding inclusion criteria, the full article was obtained. All titles and abstracts were selected by the 2 reviewers and were discussed individually for full-text reading inclusion. Selected articles were then obtained in full text, and the 2 reviewers independently carried out full-text reading of related publications. The electronic search was supplemented by a manual search of the bibliographies of all the full-text articles selected from the initial search. In cases where information was not clear, the authors of the pertinent study were contacted by email to elucidate the issue. Data collection was done using a standardized electronic spreadsheet.

Inclusion Criteria	Exclusion Criteria
Studies Should report accurate Quantitative results for their measurements	Articles Written in other languages except English
Articles Should be in English	Studies Based on charts and Questioners
Clinical and In-Vitro Studies	No author Response
	Not Case and Control Groups
	Studies Experimenting in other fields than Prosthodontics
	Articles Published in not peer reviewed journals

Table 1: Inclusion and exclusion criteria.

Final Selection of Articles was based on full text readings and studies which have met inclusion and exclusion criteria were included. [Table 1]

## Results

Author/Year Published	Sample Size	Study Type	Die Material	Fabrication	Crown material	Conventional material	Results	Restoration Type	Impression Technique
Almeida et al 2014	1:12 2:12	In-Vitro	1: Stone 2: digital	CAD/CAM	Zirconia	Poly Ether	1: 65.33±37.27 2: 63.50±36.75	FPD	1: Conventional 2: Digital
An et al 2014	1:10 2:10	In-Vitro	1: Stone 2: digital	CAD/CAM	Zirconia	PVS	1: 92.47±13.94 2: 103.05±14.67	Single	1: Conventional 2: Digital
Anadioti et al 2015	1:15 2:15 3:15 4:15	In-Vitro	1: Stone 2: Stone 3: Stereolithographic 4: Stereolithographic	1: Press 2: CAD/CAM 3: Press 4: CAD/CAM	Glass-Ceramic	1: PVS 2: PVS	1: 40.00±9.00 2: 76.00±23.00 3: 75.00±15.00 4: 74.00±26.00	FPD	1: Conventional 2: Conventional 3: Digital 4: Digital
Kent et al 2014	1:12 2:12 3:12 4:12	In-Vitro	1: Stone 2: Stone 3: Digital 4: Digital	1: CAD/CAM 2: CAD/CAM 3: CAD/CAM 4: CAD/CAM	1: Metal 2: Zirconia 3: Metal 4: Zirconia	1: Polyether 2: Polyether	1: 90.64±90.81 2: 141.08±193.17 3: 56.90±27.37 4: 127.23±66.87	FPD	1: Conventional 2: Conventional 3: Digital 4: Digital
Ng et al 2014	1:15 2:15	In-Vitro	1: Stone 2: digital	1: Press 2: CAD/CAM	Glass-Ceramic	PVS	1: 74.00±47.00 2: 48.00±25.00	Single	1: Conventional 2: Digital
Seethi et al 2013	1:10 2:10 3:10 4:10 5:10 6:10 7:10	In-Vitro	1: Stone 2: Stone 3: Stone 4: Stone 5: digital 6: digital 7: digital	1: Metal 2: CAD/CAM 3: Cast 4: CAD/CAM 5: CAD/CAM 6: CAD/CAM 7: CAD/CAM	1: Metal 2: Zirconia 3: Metal 4: Zirconia 5: Glass-ceramic 6: Zirconia 7: Zirconia	PVS	1: 38.00±25.00 2: 33.00±10.00 3: 68.00±29.00 4: 60.00±30.00 5: 30.00±17.00 6: 48.00±25.00 7: 41.00±16.00	Single	1: Conventional 2: Conventional 3: Conventional 4: Conventional 5: Digital 6: Digital 7: Digital
Svanborg et al 2014	1:10 2:10	In-Vitro	1: Stone 2: digital	CAD/CAM	Metal	PVS	1: 69.00±12.40 2: 44.00±8.20	FPD	1: Conventional 2: Digital
Tidberg et al 2014	1:9 2:9 3:9 4:9 5:9	In-Vitro	1: Stone 2: Digital 3: Digital 4: Stone 5: Stone	1: Press 2: CAD/CAM 3: CAD/CAM 4: CAD/CAM 5: CAD/CAM	1: Glass-Ceramic 2: Zirconia 3: Zirconia 4: Zirconia 5: Zirconia	1: PVS 2: PVS 3: PVS 4: PVS 5: PVS	1: 187.00±89.00 2: 195.00±69.00 3: 176.00±62.00 4: 190.00±54.00 5: 195.00±50.00	Single	1: Conventional 2: Digital (Tera) 3: Digital (Lava) 4: Conventional 5: Conventional (Lava)

Table 2: Accuracy of restorations fabricates in digital and conventional.

The search Yielded to 8 Articles from all of the databases after excluding the articles which were identified in more than one of the databases. [Table 2]

## Discussion

First Step to reach and accurate restoration is an accurate impression technique. Clinical studies comparing Digital and Conventional impression techniques are rarely find in the literature but the expansion of the use of digital workflow make this comparison necessary. From 8 articles which we include in our study there were no clinical and in vivo studies at all and all of them were done in-vitro. Most of the articles evaluated in this study showed that both digital and conventional techniques have marginal gaps that are under 120 micrometers which make them clinically acceptable. Results describing the difference of digital and conventional impressions vary. In the study of Anadioti *et al* the conventional techniques presented more accurate results rather than digital technique which led to concluding that indirect digitalization results are clinically acceptable. Trueness and accuracy contrasts altogether between the computerized impression frameworks and impression techniques. Nearby deviations more than 100 micrometers can prompt erroneous fitting, in this way causing issues in expansive prosthetic rebuilding efforts. Impression exactness and the attack of the conclusive prosthesis rely upon each period of the procedure. In regular strategies each progression, including impression, stone throws, wax examples, venture and throwing, must be done exactly to accomplish the best fit. Rather dental computer aided design/CAM frameworks for the most part require less advances, where the quantity of blunder source is not as much as the ordinary strategy. Moreover, the processing strategy is institutionalized.

As the administrator discernment computerized procedures are less demanding for unpractised specialists. However, a few thinks that it's trying for distal territories to work with. Advanced strategies are regularly more agreeable and less obtrusive choice for patients with touchy gag reflex and the information transmission is shoddy and quick. Computerized impression information is additionally less demanding to store. An immediate examination of exactness between the diverse computerized impression frameworks couldn't be performed as a result of the constrained research accessible. an extraordinary number of clinical examinations would be required keeping in mind the end goal to have a more authoritative conclusion. However, a very much executed in-vitro studies may even now give important understanding into exactness appraisals. Three unit prosthesis exhibited more attractive inactivity of fit when it experienced advanced technique.

The discoveries of this audit demonstrated poor homogeneity of the investigation plans populaces. Likewise, there are a couple of number of studies available identifying with the exactness of computerized customary embed impression, regardless of whether in vivo or in vitro, so the meta-examination couldn't be performed. In light of the finding of this examination, extra lab and clinical

research is to assess the precision and legitimacy of computerized embedded impression system in the prosthodontic.

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