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## Research Article

# SYSTEMATIC ANALYSIS ON THE CONVENTIONAL AND DIGITAL IMPRESSION TECHNIQUES FOR SUCCESS IN FIXED DENTAL PROSTHESIS

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### ABSTRACT

**Abstract:** Impression making is one of the most important steps in constructing a dental prosthesis. For this conventional and digital impression techniques are used. Though the digital impression technique is growing in the field of dentistry, there is always a controversy between the digital and conventional impressions as to which method provides a better fixed dental prosthesis with accurate fit, as the fit of the prosthesis is important for the success of a prosthesis.

**Objectives:** This systematic review was to compare the conventional and digital impressions in providing better reproduction of details and hence a better fit of the prosthesis.

**Materials and Methods:** The MEDLINE–PubMed database was searched from May 2018 to 10 years previously. Several journals were hand searched and cross references were done. The following data were extracted from the studies included for review. Publication, study design, sample size, prosthesis given, observations including marginal fit, dimensional accuracy, patient perception and ease of use and inference.

**Result:** The search yielded 208 articles. Ultimately 24 articles were selected based on the eligibility criteria. The analysis shows that Digital impression method is better than Conventional impression technique in providing better reproduction of details and hence better fit of the prosthesis.

**Conclusion:** Based on the current existing data, it can be summarized that digital impressions are better than conventional impressions.

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## INTRODUCTION

Impression making is one of the most important steps in constructing a dental prosthesis. For this conventional and digital impression techniques are used. Conventional impression materials used may be alginate, polyether or polyvinylsiloxane, among which polyether impression material was reported to produce better marginal accuracy<sup>1</sup>. The digital impression technique is either direct or indirect method<sup>2</sup>. Direct methods employ intraoral scanner systems<sup>3</sup> such as CEREC, iTero, TRIOS, Lava C.O.S. Most commonly used laboratory scanner is Lava scan ST. Though the digital impression technique is growing in the field of dentistry, there is always a controversy between the digital and conventional impressions as to which method provides a better fixed dental prosthesis with accurate fit, as the fit of the prosthesis is important for the success of a prosthesis. The purpose of this systematic analysis was to compare the conventional and digital impressions in providing better reproduction of details and hence a better fit of the prosthesis.

## MATERIALS AND METHODS

The following analysis was performed according to the guidelines and the principles of the PRISMA statement for a systematic review.

### Focused Question (Patients, Intervention, Comparison and Outcomes)

The review is focused on: “Which is the impression technique that leads to a better fit of a fixed dental prosthesis success?”

The following medical subject heading terms: “tooth”, “mouth”, “impression”, “intra-oral”, “extra-oral”, “digital impression” and their related entry terms were used in different combinations using the Boolean operators “AND” and “OR” for the research. In addition, manual search was made [Figure 1].

Search ((((((teeth) AND tooth) AND oral) AND mouth)) AND impression)) OR (((((intraoral) OR extraoral) AND dental)) AND digital impression) Sort by: [pubsolr12]	1541
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Figure 1 Keywords for article search

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### Search Strategy

The MEDLINE–PubMed database was searched from May 2018 to 10 years previously [Figure 2].

### Study Inclusion Criteria

The studies were analyzed according to the following inclusion criteria:

1. In vivo and In vitro studies.
2. The language of an article should be in English.
3. Article should have compared digital and conventional impressions.
4. Articles published in the last 10 years.
5. Studies should report either of the following features:
  - a. Marginal fit
  - b. Internal fit
  - c. Dimensional accuracy
  - d. Patient perception
  - e. Ease of use by dentists.

### Study Exclusion Criteria

The studies with following criteria were not included in the review:

1. Studies involving comparison of time consumption on making digital and conventional impressions.
2. Animal study.
3. Articles other than English language.
4. Articles before 10 yrs.
5. Case series
6. Authors opinion

### Data Extraction

All studies which met the inclusion and exclusion criteria for review were obtained and screened independently. The following data were extracted from the studies included for review. Publication, study design, sample size, prosthesis given, observations including marginal fit, dimensional accuracy, patient perception and ease of use and inference. Qualities of various studies, regarding comparison of digital and conventional impressions were considered for quality assessment of accurate fit of fixed dental prosthesis.

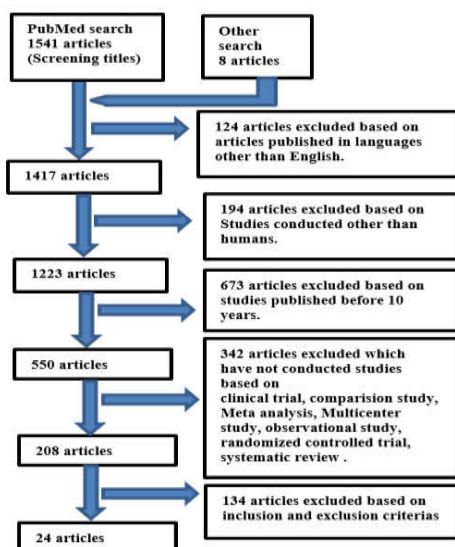


Figure 2 Search strategy

## DISCUSSION

This systematic review tried to compare the dimensional accuracy, marginal fit, internal fit, patients’ perception and ease of use between conventional and digital impression techniques. Conventional/traditional impressions are made directly from the patient’s mouth using custom trays or stock trays. Though conventional impression materials produced good reproducibility of the oral structures, it also has some disadvantages like short working time, tearing of impression during removal, patient movement, time taking and discomfort to the patient. The digital impression concept is emerging rapidly and is believed that digital impressions will solve the difficulties of conventional impressions. The digital impression technique can be of direct and indirect method. Direct method uses intra oral scanners. Intraoral scanner systems available are Lava C.O.S, iTero, CEREC, E4D and TRIOS. CEREC system was the first intraoral digital impressions in market. Various generations of CEREC system are CEREC AC Bluecam, CEREC AC Omnicam, CEREC MC, CEREC In-Lab. CEREC Bluecam captures a single image data collection while the CEREC Omnicam captures continuous images and gives a 3D image on data collection. Lava C.O.S (Lava chairside oral scanner) system works on the principal of active wavefront sampling. This system needs powdering of the tooth surface. iTero system works on the principle of parallel confocal imaging. This system works under the principle of ultrafast optical sectioning and confocal microscopy. TRIOS system works under the principle of ultrafast optical sectioning and confocal microscopy. Indirect digitalization method uses Lava Scan ST. Advantages of digital impressions are accuracy of impressions, saves time, ease of use by the dentist, no physical impression for patient.

Marginal fit and internal fit are important features in success of a fixed dental prosthesis. Ill-fitting margins can cause secondary caries; food accumulation which paves a way for bacterial colonization; periodontal diseases and bone loss. In total 24 articles were included, from which data were collected. Among these, the total numbers of in-vitro studies included were 15 and total numbers of in-vivo studies included were 9. The following data were collected: Publication, study design, sample size, prosthesis given, observations including marginal fit, internal fit, dimensional accuracy, patient perception and ease of use and inference.

### Marginal Fit

Total no of articles: 11<sup>4-14</sup>. In 6 articles researchers found that marginal fit of a fixed dental prosthesis was better in direct digitalization than the conventional impression techniques. In 2 articles researchers found that conventional impression was better than digital impressions in marginal fit. In 3 articles, it was found that Conventional and Digital impression techniques produced similar results.

### Internal Fit

Total no of articles: 6<sup>(6,9,13,15-17)</sup>. In 3 articles, researchers found that internal fit of digital impressions was better than conventional impressions. In 1 article researchers found that conventional was better than digital impressions in internal fit.

**Table 1** Characteristics of 24 studies included

Reference	Study design	Sample size		Impression Technique		Prosthesis given		Observation				
		Conv	Digi	Conventional impression	Digital impression	SINGLE CROWN/FIXED DENTAL PROSTHESIS	Marginal Fit (µm)	Internal fit	Dimensional Accuracy (µm)	Patient perception	Ease of use	
Abdel-Azim et al	Comparison study	10	10 each	PVS	i-Tero Lava C.O.S	Single crown	Conv-112.3 iTero-89.6 Lava- 89.8					
Ahrberg et al	RCT		25 25		Lava C.O.S - Direct Lava Scan ST- Indirect	FDP	Lava C.O.S-61.08 Lava Scan ST- 70.40					
Ajioka et al	Comparison study	10	10	PVS	Lava C.O.S(optical impression)			Conv- 65.33 Lava C.O.S- 63.96	Conv- 65.94 Lava C.O.S- 58.46			Conv- 64.5 Lava C.O.S- 22.5
Almeida et al	Comparison study	12	12	Polyether	Lava C.O.S	FDP						
An et al	Comparison study	10	10	PVS	iTero with dies(iP) &iTero without dies(iNo)	Single crown	Conv (with dies)- 92.67 iP- 103.05 iNo-103.55					
Anadioti et al(2013)	Comparison study	30(15-press; 15- CAD/CAM)	30(15-press; 15- CAD/CAM)	PVS	Lava C.O.S	Single crown	Conv (press) 3D- 0.048 2D-0.040 Conv(CAD/CAM) 3D-0.088 2D- 0.076 Digi (press) 3D- 0.089 2D-0.075 Digi(CAD/CAM) 3D-0.084 2D- 0.074					
Anadioti et al(2014)	Comparison study	30(15-press; 15- CAD/CAM)	30(15-press; 15- CAD/CAM)	PVS	Lava C.O.S	Single crown		Conv(press)-0.111 Conv(CAD/CAM)- 0.116 Digi(press)-0.211 Digi(CAD/CAM)- 0.145				
Benic et al	Comparison study	10	10	PVS	Lava C.O.S, iTero, and Cerec	Single crown						Lava C.O.S-71 iTero-66 Cerec-48 Conv-61
Boeddinghaus et al	Comparison study	24	24	PVS	OCam, TDef, CTRIOS	Single crown						Conv-113 Tdef-88 CTRIOS- 112 OCam-149
Boerrendero et al	Prospective study	30	30	PVS	TRIOS		Conv-119.9 Digi-106.9	Conv-185.4 Digi-170.9				
Ender et al	Comparison study	8	8	POE; VSE; VSES; ALG; polyether	CER; ITE; OC; iTero; LAV	Full arch scan						POE-60.2 VSE- 13.0 VSES- 11.5 VSES-dig- 35.1 ALG- 37.7 CER- 29.4 OC- 37.3 ITE- 32.4 LAV-44.9
Gjelvold et al	RCT	42	42	Polyether	TRIOS	FDP/ Single crown						Conv-44.86 Digi- 6.50
Joda et al	RCT	20	20	Polyether	iTero	Single crown						Conv-53.6 Digi- 78.6
Keul et al	Comparison study	12	12	ImpregumPenta	iTero	FDP	DD-C-56.90 DD- Z-127.23 ID-C-90.64 ID- Z-141.08					
Kim et al	Comparison study	15	15	Exafine Putty	iTero							Conv-17.6 Digi-23.9
Lee et al	Comparison study	30	30	Aquasil Ultra Monophase	iTero	Single crown						Conv- 43.12 Digi- 30.63
Lin et al	Comparison study	10	10	PVS	Cadent iTero							Conv-0.084 (zero degree angulation) Digi-0.304 (zero degree angulation)
Ng et al	Comparison study	15	15	PVS	Lava C.O.S	Single crown	Conv- 74 Digi- 48					
Pradies et al	Prospective study	25	25	PVS	Lava C.O.S	Single crown		Conv- 91.46 Digi- 76.33				
Seelbech et al	Comparative study	10	10	PVS(2 step & single step)	Lava C.O.S; iTero; CEREC	Single crown						Conv: single step(lava zirconia)-33 ; single step( cera E alloy)-38; two step(lava zirconia)-35; two step( cera E alloy)-56 lava- 29 iTero- 50 CEREC- 88
Syrek et al	RCT	20	20	PVS	Lava C.O.S	Single crown	Conv-71 Lava C.O.S- 49					
Tingshu et al	Comparison study	10	10	PVS	TRIOS	Single Crown	Conv-76 TRIOS-63	Conv- 134 TRIOS- 110				
Yuzbasioglu et al	Comparison study	24	24	Polyether	CEREC Omnicam	FDP						Conv- 605.38 Cerecinnicam- 248.48
Zeltner et al	RCT	10	10	PVS	Lava C.O.S; iTero; CerecinLab; Cerecinfindent	Single crown	Conv- 90.4 Cerecinfindent- 83.6 Lava C.O.S- 94.3 iTero-127.8 Cerec inLab-141.5					

In 2 articles, researchers found that internal fit of digital and conventional impressions can be comparable.

**Dimensional Accuracy**

Total no. of articles: 6<sup>(17,18-22)</sup>. In 3 articles researchers found that dimensional accuracy of digital impressions was better than conventional impressions. In 1 article researchers found that conventional was better than digital impressions in dimensional accuracy. In 2 articles, researchers found that dimensional accuracies of digital and conventional impressions can be comparable.

**Patient Perception**

Total no. of articles- 4<sup>(23-26)</sup>. In 3 articles researchers found that digital impression was more convenient to patients than conventional impression. In 1 article, it was found that there is no difference in patient convenience between digital and conventional impression.

**Ease of Use**

Total no. of articles -3<sup>(23, 24, 27)</sup>. In all 3 articles, researchers found that digital impression was more convenient than conventional impressions. **Table 1**

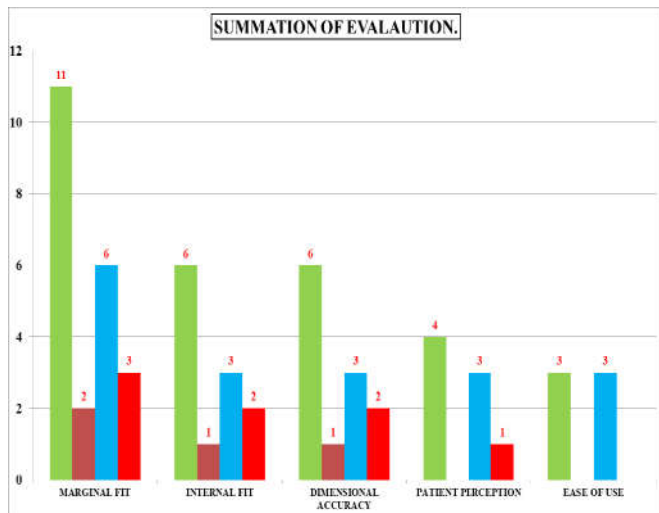


Chart 1 Summation of evaluation

**Summary**

**From the chart we can Observe that**

- Marginal fit is better in fixed dental prosthesis made from digital impression techniques
- Internal fit is better in fixed dental prosthesis made from digital impression techniques
- Dimensional accuracy is better with digital impression techniques
- Patients’ perception is in favor of digital impression over conventional impression.
- Digital impressions are easy and convenient for the dentist’s use.
- On summary, considering all parameters, it can be observed that Digital impression method is better than Conventional technique.

**CONCLUSION**

Digital impression method is better than the conventional impression method. Since impression technique is one of the most important steps in providing better fixed dental prosthesis, the knowledge about the impression technique must be known for the clinicians.

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Nil.

**Conflicts of Interest**

There are no conflicts of interest.

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