

e-ISSN:2582-7219



# INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 9, September 2024



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA

Impact Factor: 7.521



6381 907 438



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## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

# Implant Supported Over Dentures & their Impression Procedures – A Review

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**ABSTRACT:** The professionals provide their patients a variety of implant-supported overdenture services, contingent upon the specific clinical circumstances. Clinicians are choosing proper impression techniques and employing appropriate impression materials in order to achieve better results. In order to give their patients better care, this narrative review sought to address various implant supported over denture treatments, adequate impression processes, and appropriate impression material.

### I. INTRODUCTION

In comparison to traditional dentures, implant-supported overdentures (IOD) provide a variety of combinations that integrate implants with overdentures, improving retention, stability, and patient satisfaction. Here are a few typical combinations:

#### 1. Mandibular Overdentures Assisted by Implants

##### \*2-Implant Overdenture (Bar- or Stud-Retained)

This is one of the mandibular configurations that is most commonly utilised. Usually, two implants are positioned in the canine area. Using a bar or stud attachment (such as a ball, locator, or magnetic), the overdenture is held in place.[1]

##### \*4-Implant Overdenture (Bar-Retained)

For edentulous mandibles, a more durable method entails putting four implants with a bar attachment. This makes it possible for patients with more complex bone structure to have better stability and retention.[2]

##### \*Locator Retained Implants

Locator attachments on two or four implants allow patients to easily remove their overdentures for cleaning while also effectively retaining them.

#### 2. Supported with Maxillary Implants for Overdentures

##### \*4-Implant Overdenture (Bar-Retained)

For patients who have severe bone resorption, four implants positioned in the maxilla with a bar attachment offer satisfactory retention.

##### \*6-Implant Overdenture (Bar or Stud Retained)

Six implants can offer improved support in situations when maxillary bone density is lower, resulting in more stability and longer-term success.



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### 3. All-on-4 or All-on-6 Hybrid Overdenture

#### #All-on-4 Concept

o A fixed-detachable overdenture is attached in the anterior region, where four implants are positioned, frequently slanted to avoid anatomical structures. This idea maximises stability while reducing the number of implants needed.[6]

#### #All-on-6 Concept

o Like the All-on-4, but with six implants instead of four. It is applied when a patient need extra support because of excessive bone resorption or other factors.[7]

### 4. Ball vs. Bar Systems for Attachments

#### #Ball Attachment

o Ball attachments provide a more straightforward and affordable solution when utilised in conjunction with two or more implants for mandibular overdentures.[8]

#### #Bar Attachment

o Bar-retained overdentures are preferred for patients with softer bone or for maxillary overdentures because they more equally distribute the load over the implants [9].

### 5. Magnet Retained Overdenture

In situations where bar or ball attachments are impractical, magnets may be utilised to hold overdentures[10].

These several implant-supported overdenture combinations give medical professionals a range of choices to customise treatment regimens according to patient requirements, anatomical limitations, and budgetary restraints.

#### various impression techniques using to each type of implant over dentures

For implant-supported overdentures, impression techniques are essential to guaranteeing the prosthesis's appropriate fit, lifespan, and functionality. Depending on the attachment system (ball, locator, magnet, or bar) and implant count, several techniques are used. Depending on the amount of implants and attachment systems used, these diverse imprint processes guarantee the best results for various types of implant-supported overdentures.

An outline of imprint methods for several implant overdenture types is provided below:

#### 1. Mandibular 2-Implant Overdenture

##### A. Open Tray (Pick-up) Impression Technique

o This method involves using a bespoke tray with perforations and attaching transfer copings to the implants. The transfer copings are absorbed by the impression substance and are retained in the imprint after removal. This method, which guarantees accurate implant position transfer, is very helpful for practitioners with less training. When creating mandibular overdentures with two implants, the open-tray impression approach yielded excellent accuracy.[11]

##### B. Closed Tray (Transfer) Impression Technique

A closed tray is used to make an impression once the transfer copings are fastened onto the implants. The analogues are joined and reinserted into the impression after the impression is removed, leaving the copings in the mouth.

· Easier to carry out on patients with challenging access or limited mouth apertures. For instances when implant alignment is less complicated, such as mandibular 2-implant overdentures, the closed-tray approach proved appropriate. [12]

##### C. Direct (Conventional) Impression Technique

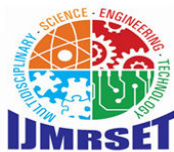
A conventional stock tray with elastomeric material is used to take a direct impression, while ball attachments or locator abutments are left in place. Subsequently, the attachment housings undergo laboratory processing. eliminates the need for abutment removal, simplifying the procedure. Although this method is not as precise as open-tray methods, it is nonetheless often considered clinically appropriate.

#### 2. Mandibular 4-Implant Overdenture (Bar Retained)

##### A. Splinted Open Tray Impression Technique

This technique involves splinting the transfer copings together with resin to prevent movement while obtaining an impression. The imprint of the splinted copings in position is captured using a bespoke tray. offers the best accuracy possible for overdentures held in place by bars, particularly when several implants are being used.[14]





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### B. Non-Splinted Open Tray Impression Technique

The copings are connected using the same methods as in the splinted approach, but no splinting resin or substance is used in this method. quicker than using a splint and perhaps appropriate when implants are properly positioned. Even while the non-splinted approach was quicker, it resulted in more errors when applied to angulated implants.[15]

### 3. Maxillary Implant-Supported Overdenture (4 or 6 Implants)

#### A. Splinted Open Tray Impression for Multiple Implants

The transfer copings are splinted together and captured using an open tray impression, just as the mandibular version. ensures that there is as little deformation as possible when obtaining impressions of several implants, particularly in the maxilla where implant placement can be more difficult. Using an open tray approach to splint the copings proved very beneficial for strongly angulated implants, which are frequently observed in maxillary overdentures.

#### B. Digital Impression Technique

The implants are digitally imprinted using an intraoral scanner. The lab receives the digital file so that the prosthesis can be made. decreases discomfort for patients, does away with the requirement for tangible imprint materials, and, in some clinical contexts, improves accuracy. When several implants were employed, the digital impressions were just as accurate as the traditional methods for maxillary overdentures; nevertheless, meticulous attention to scanning protocols was required.[17]

Overdentures with a ball or locator attachment

#### A. Locator Attachment with Closed Tray Technique

o Soft tissue and implants are captured using a closed tray, and locator attachments stay in the mouth. simpler to use for inexperienced physicians and compatible with locator systems and ball attachments. For locator-retained overdentures, the closed-tray impressions were appropriate, however cautious handling was advised to prevent errors.[18]

### 4. Ball or Locator Attachment Overdentures

#### A. Closed Tray Technique (Locator Attachment)

Locator attachments remain in the mouth, and a closed tray is used to capture the soft tissue and implants. Easier for novice clinicians and can be used with ball attachments or locator systems. The closed-tray impressions were acceptable for locator-retained overdentures but recommended careful handling to avoid inaccuracies.[18]

### 5. Magnet-Retained Overdentures

#### A. Direct Impression with Magnet Retained Overdentures

Magnet-retained overdenture impressions resemble traditional complete denture impressions; however, following the impression-taking process, the magnets are treated in a laboratory. basic method that very slightly alters accepted practices. Magnet-retained overdentures have a good patient satisfaction rate, and it was observed that the impression method was simple and efficient.[19]

## II. COMPARATIVE STUDIES AVAILABLE ON EACH IMPRESSION PROCEDURE OF IMPLANT SUPPORTED OVER DENTURES

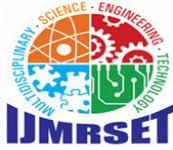
Studies comparing impression procedures for overdentures supported by implants have looked at a number of approaches to assess patient results, accuracy, and convenience of usage. These contrasts are essential for figuring out which methods work best in various therapeutic settings. These studies give clinicians important information about the benefits and drawbacks of each impression technique, enabling them to choose the best approach for a given implant-supported overdenture case.

The comparison studies that are currently available for each kind of impression process are summarised below:

### 1. Mandibular 2-Implant Overdentures

#### A. Open Tray vs. Closed Tray Impression Techniques

In two-implant mandibular overdentures, the accuracy of open-tray (pick-up) and closed-tray (transfer) procedures was evaluated in this study. It was discovered that the open-tray approach was more accurate than the closed-tray approach.



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The authors observed that although the closed-tray method facilitated the clinician's work, it led to a decrease in accuracy in implant placement.[11]

### B. Splinted vs. Non-Splinted Impression Techniques

For mandibular two-implant overdentures, this study examined splinted and non-splinted procedures in closed-tray and open-tray impressions. The implant placements were transferred with greater accuracy using the splinted approach. Techniques without splints were quicker but less precise, particularly when implants weren't parallel.[12]

### C. Direct Impression Technique vs. Conventional Closed-Tray Technique

This study contrasted the accuracy of the traditional closed-tray technique with the direct impression method (using ball or locator abutments). The direct imprint approach exhibited worse accuracy compared to the conventional methods because of the possibility of attachment movement during the impression-taking process. But patients found it more comfortable, and professionals found it easier to understand.[13]

## 2. Mandibular 4-Implant Overdentures (Bar Retained)

### A. Splinted Open Tray vs. Non-Splinted Open Tray Techniques

For bar-retained overdentures with four implants, the study evaluated open-tray imprint procedures with and without splinting. The precision of the splinted approach was noticeably greater, particularly when the implants were inclined. Higher deformation was the outcome of non-splinted methods, especially in intricate implant placements.[14]

### B. Splinted vs. Non-Splinted Closed Tray Techniques

For four-implant mandibular overdentures, this study evaluated closed tray procedures using splinting and without splinting. When compared to non-splinted approaches, splinted closed tray techniques yielded more accurate findings. The study brought to light the higher likelihood of positioning errors associated with non-splinted closed tray approaches, which may make them less appropriate for bar-retained systems [15].

## 3. Maxillary Implant-Supported Overdentures (4 or 6 Implants)

### A. Splinted vs. Non-Splinted Open Tray Techniques

For maxillary overdentures with four or six implants, the study compared open-tray procedures with splinted and non-splinted options. Splinted methods were substantially more accurate, especially when the implants had angulations in them. Positional errors were higher when using non-splinted techniques.[16]

### B. Splinted Open Tray vs. Digital Impression Techniques

For multiple implants in the maxilla, this study compared digital imprints with conventional splinted open-tray procedures. For many implants in the maxilla, digital impressions were just as precise as splinted open-tray procedures. The study underlined the benefits of digital techniques, such as patient comfort and workflow efficiency, but it also pointed out that their high cost and learning curve might prevent them from being widely used.[17]

## 4. Ball or Locator Attachment Overdentures

### A. Open Tray vs. Closed Tray for Locator Attachment

In this work, locator attachment overdentures using open-tray and closed-tray procedures were examined. It was discovered that the open-tray approach produced more accurate outcomes than the closed-tray method, especially when implants were angulated. Nonetheless, because of its simplicity of usage in patients with restricted mouth opening, the closed-tray approach was chosen.[18]

### B. Locator vs. Ball Attachment: Direct vs. Indirect Impression Techniques

Direct and indirect imprint methods for locator and ball attachments in mandibular overdentures were compared in the study. With direct impression techniques, both attachment systems functioned well; however, the locator system demonstrated superior stability and retention. Although more convenient for physicians, the indirect approach proved less precise for both kinds of attachments.[19]



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### 5. Magnet-Retained Overdentures

#### A. Conventional Closed Tray vs. Direct Impression Techniques

In magnet-retained overdentures, the study contrasted direct impression and traditional closed tray procedures. While the results from both approaches were satisfactory, the direct approach was easier to use and more effective. Although it took longer and required more expertise, the traditional closed tray method was more accurate—especially when magnets were involved.[19]

### 6. Digital Impression Techniques vs. Conventional Methods

#### A. Digital vs. Conventional Impression Techniques

Digital and traditional imprint methods for mandibular and maxillary overdentures were compared in this study. It was discovered that digital procedures provide benefits in terms of patient comfort, chair time reduction, and enhanced productivity, while maintaining accuracy levels equivalent to traditional approaches. The authors did point out that in situations involving many implants or angulated implants, digital approaches might be less dependable.[20]

#### B. Accuracy of Intraoral Scanners vs. Conventional Splinted Techniques

This study examined the accuracy of multiple implant-supported overdentures using intraoral scanner against traditional splinted procedures. High accuracy was demonstrated using intraoral scanners for both single and numerous implants. Scanners have trouble, though, with deep or angular implants. In these difficult instances, conventional splinted procedures continued to be more dependable.[17]

#### Among all these impression techniques which technique is more popular and reasons

Out of all the imprint procedures available for implant-supported overdentures, The **open tray (pick-up) impression technique** is the most widely used. Because of its increased precision in transferring implant placements, this procedure is highly preferred, especially when several implants are involved or when implants are positioned at angles. Let's dissect the factors that have contributed to its appeal and offer corroborating research.

### III. REASONS FOR POPULARITY OF THE OPEN TRAY TECHNIQUE

#### 1. Accuracy in Implant Positioning:

Compared to closed tray procedures, the open tray technique offers a more accurate transfer of implant placements, especially when implants are not parallel. This method makes sure that the implants are caught with the least amount of deformation possible by leaving the transfer copings in the imprint.

Assunção WG et al. (2010) showed that, in comparison to the closed tray technique, the open tray technique yields greater precision in mandibular two-implant overdentures. The precision provided by open tray impressions was highlighted in the study, particularly in cases involving several implants.[11]

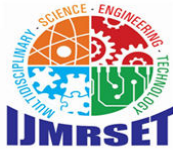
#### 2. Preferred for Multiple Implants:

The open tray technique is frequently utilised with splinting in cases involving many implants (such as maxillary or mandibular overdentures with 4-6 implants) to ensure precise alignment and prevent movement of the transfer copings. For complicated prosthodontic cases like bar-retained overdentures, this makes it the recommended option.

Sorrentino R. et al. (2010) discovered that, especially in situations involving angulated implants, splinted open tray procedures outperformed non-splinted and closed tray techniques. It has been demonstrated that the open tray method yields more accurate results.[14]

#### 3. Reduced Distortion in Impressions:

The open tray technique lessens distortion by enabling the impression to accurately depict the transfer copings' precise location in relation to the implants. This is particularly crucial in situations involving edentulous teeth, as soft tissue compression may present challenges.



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Lee H. et al. (2008) assessed the impact of impression technique and implant angulation, and they came to the conclusion that the open tray technique with splinting gave the best accuracy for both parallel and angulated implants.[16]

#### 4.Lower Risk of Positional Errors::

Although the closed tray approach is quicker and easier to use, there is a greater chance of positioning errors, particularly when implant alignment is not ideal. This is lessened by the open tray technique, which leaves the transfer copings in the impression and eliminates the need to relocate them afterwards.

When Alikhasi M et al. (2011) compared open and closed tray procedures, they discovered that the open tray method was superior for difficult implant cases because it was more accurate in terms of positional transfer.[12]

#### 5.Versatility Across Different Attachments:

For overdentures with different attachment systems (ball, locator, bar), the open tray technique can be applied. Because of its versatility, it is a well-liked option for a range of overdenture designs and patient requirements.

When comparing the open and closed tray methods for locator attachments, Cehreli MC et al. (2004) discovered that the open tray method offered more accuracy, particularly in non-parallel implant scenarios.[18]

#### 6.Preference for Clinical Practice:

The open tray technique is preferred by many clinicians because it yields more consistent results and requires fewer remakes or changes. The method's widespread adoption in prosthodontics education is further supported by the fact that it is frequently taught as the norm. Papaspyridakos P et al. (2016) demonstrated that the accuracy of digital impressions was on par with that of open tray impressions; yet, due to the open tray method's consistency and dependability, many physicians continued to favour it. [21]

### IV. WHICH IMPRESSION MATERIAL IS SUITABLE TO WHICH IMPRESSION TECHNIQUE

Implant-supported overdentures depend heavily on the impression material selected, and certain impression procedures are better suited to a certain material. Depending on the technique being utilised, the most popular impression materials are vinyl polysiloxane (VPS), polyether, alginate, and polyvinyl siloxane (PVS). Each of these compounds has specific advantages.

#### 1. Open Tray (Pick-Up) Impression Technique

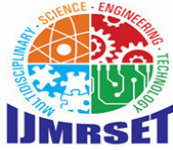
##### A. Polyvinyl Siloxane (PVS)

- Fit for: Open Tray Methodologies
- Justification: PVS has outstanding dimensional stability, tear resistance, and flow characteristics, and it is very precise. It takes accurate, comprehensive impressions of soft tissues and implant components.
- Vigolo P et al. (2003) showed that because PVS could record minute details of the implant's components and abutments, it performed better in the open tray approach. The impression's accuracy during transit is further guaranteed by the material's long-term stability.[22]

##### B. Polyether

- Fit for: Open Tray Techniques (especially when using several implants)
- Justification: Polyether's exceptional rigidity, hydrophilicity, and flow characteristics make it the perfect material for numerous implant impressions when precision is crucial. It offers good stability and dimensional precision when wet (such as when saliva or blood is present).
- In complex, multi-implant situations, polyether performed remarkably well, according to Sorrentino R et al. (2010). This was because of its stiffness, which helped maintain positional accuracy in the open tray approach even when implant placement was deep. [14]





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### 2. Closed Tray (Transfer) Impression Technique

#### A. Polyvinyl Siloxane (PVS)

- Fit for: Closed Tray Methodologies
- Justification: Due to its excellent precision and minimal shrinkage, PVS is frequently employed in closed tray procedures. It is perfect in situations involving a single implant or less complexity since it makes it possible to remove the impression with ease and without the possibility of deformation. Assunção WG et al. (2010) attested that PVS's precise detail capture and negligible dimensions changes—both essential for implant transfer precision—made it a better fit for closed tray procedures.[11]

#### B. Vinyl Polysiloxane (VPS)

- Fit for: Closed Tray Methodologies
- Justification: VPS is the perfect material for closed tray impressions because it combines the detail precision of PVS with the flow qualities of polyether. It is more convenient to handle and set up, has superior tear resistance, and is hydrophilic.
- Lee H. et al. (2008) discovered that VPS demonstrated excellent accuracy in both open and closed tray approaches, especially in closed tray operations where precision and tear resistance are crucial for impressions of both single and multiple implants.[ 16]

### 3. Digital Impression Techniques

#### A. No Impression Material Required

- Fit for: Scanning Digital Images
- Justification: By capturing the precise measurements of the implants and surrounding tissues using intraoral scanners, digital impression procedures do away with the requirement for traditional impression materials. Benefits of this method include speed, patient comfort, and the removal of errors based on materials.
- Papaspyridakos P et al. (2016) emphasised the precision of digital impressions in a number of implant cases, demonstrating that digital approaches are equally precise to traditional approaches utilising polyether or PVS.[21]

### 4. Splinted vs. Non-Splinted Techniques

#### A. Polyvinyl Siloxane (PVS)

- Fit for Techniques with and without splints
- Justification: PVS is a recommended material for splinted impressions, where precise implant placement is essential, due to its dimensional stability and resistance to deformation. In non-splinted situations, it performs admirably as well; however, in strongly angulated implants, it is less precise.
- Vigoloso P et al. (2003) showed that PVS was the best option for splinted procedures in open tray impressions, accurately capturing the implant placement even in intricate situations.[22]

#### B. Polyether

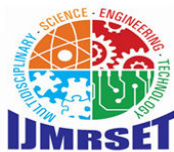
- Fit for: Splinted Procedures (particularly with angled implants)
- Justification: Polyether works well for splinted impressions due to its high rigidity and resistance to moisture, especially when several implants are positioned at an angle. Because of its stiffness, there will be less distortion and improved precision in the finished cast.
- Alikhasi M et al. (2011) demonstrated that due to polyether's greater rigidity and flow qualities, it was a better material choice than PVS for splinted impressions for angled implants.[12]

### 5. Direct vs. Indirect Impression Techniques

#### A. Polyvinyl Siloxane (PVS)

- Fit for both indirect and direct methods
- Justification: PVS is widely employed in both direct and indirect methods because of its capacity to precisely and distortion-free record attachment details (such as ball and location).
- PVS offers accurate reproduction and convenient handling, making it the best material for both direct and indirect imprints of ball and locator attachments, according to Chikunov I et al. (2008).[20]





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### B. Polyether

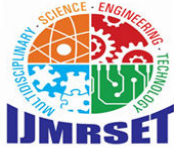
- Fit for: Impression Techniques Direct
- Justification: Polyether is the most accurate material to use for direct impressions, particularly when dealing with deep or angled implants. Because of its stiffness, implant placements can be captured without moving.
- Vahidi F et al. (2012) showed that polyether's capacity to flow into even the smallest cracks while maintaining dimensional stability led to greater accuracy in direct impression techniques for numerous implants [13].

### V. CONCLUSION

Selection of appropriate Impression material to record accurate details and adopting suitable impression technique are very crucial for the success of any dental treatment including implant supported over dentures. The clinician should have proper knowledge about the selection of proper impression material as well as on the type of impression method to be used, to get accurately fitting prosthesis.

### REFERENCES

1. Thomason JM, Feine J, Exley C, et al. "Mandibular two implant-supported overdentures as the first choice standard of care for edentulous patients—the York Consensus Statement." *Br Dent J.* 2009; 207(4): 185–186.
2. Pigozzo MN, Mesquita MF, Henriques GEP, et al. "Mandibular complete denture retained by four implants: a case report." *Braz Dent J.* 2009; 20(4): 346-350.
3. Bilhan H, Geckili O, Sulun T, Bilgin T. "A quality-of-life comparison between self-aligning and ball attachment systems for 2-implant-retained mandibular overdentures." *J Oral Implantol.* 2011; 37(6): 517-525.
4. Naert I, Alsaadi G, Quirynen M. "Prosthetic aspects and patient satisfaction with two-implant-retained mandibular overdentures: a 10-year randomized clinical study." *Int J Prosthodont.* 2004; 17(4): 401-410.
5. Naert I, Gizani S, Van Steenberghe D, et al. "A 10-year randomized clinical trial on the influence of splinted and unsplinted oral implants in mandibular overdenture therapy. Part I: Peri-implant outcome." *Clin Oral Implants Res.* 1999; 10(3): 177–185.
6. Malo P, Rangert B, Nobre M. "All-on-4 immediate-function concept with Branemark system implants for completely edentulous mandibles: a retrospective clinical study." *Clin Implant Dent Relat Res.* 2003; 5(1): 2-9.
7. Zarb GA, Schmitt A. "The longitudinal clinical effectiveness of osseointegrated dental implants: the Toronto study. Part I: Surgical results." *J Prosthet Dent.* 1990; 63(4): 451-457.
8. Wismeijer D, van Waas MA, Vermeeren JI, et al. "Patient satisfaction with implant-supported mandibular overdentures. A comparison of three treatment strategies with ITI-dental implants." *Int J Oral Maxillofac Surg.* 1997; 26(4): 263-267.
9. Slot W, Raghoobar GM, Vissink A, Meijer HJ. "A systematic review of implant-supported overdentures in the edentulous maxilla, compared to the mandible: How many implants?" *Eur J Oral Implantol.* 2010; 3(1): 7-12.
10. Sadowsky SJ. "Mandibular implant-retained overdentures: a literature review." *J Prosthet Dent.* 2001; 86(5): 468-473.
11. Assunção WG, Gomes EA, Barao VA, Delben JA. "A comparison of impression techniques for mandibular implant-retained overdentures." *J Oral Rehabil.* 2010; 37(5): 416-420.
12. Alikhasi M, Siadat H, Hashemloo A, Bassir SH. "A comparison of three impression techniques for single implants." *J Prosthodont.* 2011; 20(3): 233-238.
13. Vahidi F, Pinto-Sinai G. "Accuracy of direct implant impression techniques." *J Prosthodont.* 2012; 21(5): 396-402.
14. Sorrentino R, Gherlone EF, Calesini G, Zarone F. "Effect of implant angulation, connection length, and impression material on the dimensional accuracy of implant impressions: an in vitro comparative study." *Clin Implant Dent Relat Res.* 2010; 12 Suppl 1: e63-76.
15. Al Hamad KQ, Rashdan BA, Abu-Sitta EH, Baba NM, Al-Omari WM. "Comparison of the accuracy of implant impression techniques for mandibular overdentures." *Clin Implant Dent Relat Res.* 2012; 14(Suppl 1): e30-35.
16. Lee H, Ercoli C, Funkenbusch PD, Feng C. "Effect of implant angulation and impression technique on implant position accuracy." *J Prosthet Dent.* 2008; 99(6): 406-414.
17. Mangano FG, Hauschild U, Veronesi G, et al. "Trueness and precision of 5 intraoral scanners in the impressions of single and multiple implants: A comparative in vitro study." *BMC Oral Health.* 2019; 19(1): 101.



## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

18. Cehreli MC, Akça K, Özatay V, Sahin T. "A comparison of 3 different impression techniques in the measurement of strains around implants supporting 3-unit fixed partial dentures." *Int J Oral Maxillofac Implants*. 2004; 19(4): 517-524.
19. Setz I, Engel E, Kopf I, Heiss A, Blaschke C. "Implant-supported overdentures with magnet attachment: a retrospective study." *Int J Prosthodont* 2002; 15(3): 263-268.
20. Chikunov I, Doan P, Vahidi F. "Implant-retained overdenture using the locator attachment system." *N Y State Dent J*. 2008; 74(3): 52-55.
21. Papaspyridakos P, Gallucci GO, Chen CJ, et al. "Digital vs. conventional implant impressions for edentulous patients: accuracy outcomes." *J Prosthodont*. 2016; 25(7): 535-541.
22. Vigolo P, Majzoub Z, Cordioli G. "Evaluation of the accuracy of three techniques used for multiple implant abutment impressions." *J Prosthet Dent*. 2003; 89(2): 186-192.





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