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## Review Article

### RECENT ADVANCEMENTS IN IMPRESSION TECHNIQUES

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#### ABSTRACT:

A good quality impression is only obtained when we have a thorough knowledge of materials, their properties, and techniques for their best manipulation. Several impression techniques have developed be it for complete denture, removable partial denture, fixed partial denture or implant to produce duplications as accurate as possible. Each technique has got its own advantages and drawbacks. Dental implants have emerged as the treatment of choice for restoring missing teeth in situations that require functional and aesthetic replacements. The introduction of intraoral scanners has radically changed the way in which the dentists approach the restorative workflow.

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#### INTRODUCTION

A useful tool for dental procedures is dental impression. Over the years, different impression techniques were developed, however the success of these impressions can be determined by the patient's needs, the type of material used, and the techniques used<sup>1</sup>. Its very important to select a suitable impression technique for a dentist using appropriate materials to get a model as accurate as possible. An challenging environment to make a precise impression is patient's mouth. With proper material selection and manipulation, accurate impression can be obtained. It should include sufficient unprepared tooth structure that is immediately adjacent to the margins along with all prepared surfaces in order to identify the contour of the tooth. Each technique has its own advantages and drawbacks. There has been many studies conducted to develop more accurate techniques with various combinations of materials. But the technique providing 100% accuracy is yet to be developed<sup>2</sup>. Dental implants are considered as the "solution of choice" as they provide excellent support, function and aesthetics for fixed as well as removable prosthesis, when compared to conventional complete and partial frameworks.

Although, variety of techniques have been evolved for making impressions of implant retained prosthesis, each one has got their hindrance. Therefore the selection of a specific impression technique, which exceptionally affects the outcome of the treatment, still remains as a tedious task. Since past few decades, conventional impression techniques were used to register the teeth and surrounding soft tissues. To get over certain difficulties, digital impressions were developed that led to significant changes in impression making. Intraoral scanner(IOS) was developed in the field of dentistry<sup>3</sup>. Presently, the combination of IOS and CAD/CAM have provided ease for laboratory communication, easier treatment planning, acceptance of case, reduced chair-side operator time and final reduction in time of treatment<sup>4</sup>.

#### CLASSIFICATION

##### 1. Impression techniques in Complete Denture:-

Impression techniques may be classified depending upon-

A. Amount of pressure (based on theories of impression)

- Pressure technique- based on mucocompressive theory.
  - Minimal pressure technique- based on mucostatic theory.
  - Selective pressure theory- based on selective pressure theory.
- B. Depending upon impression technique
- Open.
  - Closed mouth.

#### Other techniques-

1. Dynamic impression methods.
2. Klein's technique.
3. Flange technique.
4. The neutral zone technique.

5. Functional technique.
6. Cocktail impression technique.
7. Elastomeric technique.
8. Modified fluid wax impression technique.

#### 2. Impression techniques used for Removable Partial Denture:-

- McLean's technique
- Hindel's technique
- Functional relined technique
- Fluid wax technique - Altered cast technique
- Selected pressure technique- Altered cast technique

#### 3. Impression techniques used for Fixed Partial Denture:-

##### Impression techniques

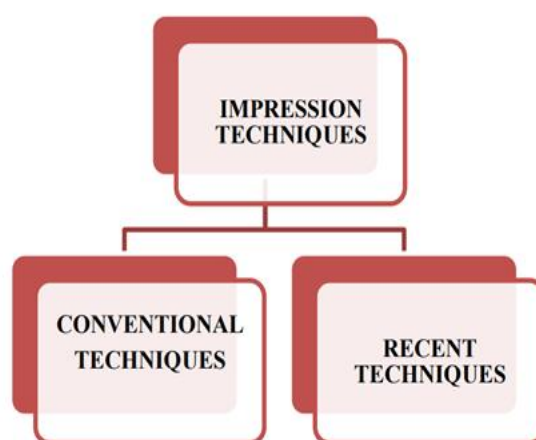


CHART: 1

#### I. CONVENTIONAL TECHNIQUES

- A. Putty- wash Technique.
- a) Relieved putty impression technique.
  - b) Simultaneous/ Squash technique.
  - c) Injection Moulded putty wash technique.
- B. Controlled putty wash impression technique
- C. Copper tube/Resin coping system
- D. Monophase/Single viscosity technique
- E. Dual viscosity technique
- F. Dual arch impression technique
- a) Dual-arch multiple mix technique
  - b) Dual-arch monophase technique
  - c) Laminar impression technique
  - d) Hydraulic pressure technique
- G. Segmental impression technique
- H. Wet technique
- I. Hydrocolloid laminate technique
- J. Impression using polycarbonate crown
- K. Functional check-bite technique
- L. Sectional impressions and 'every other tooth' technique in FPD
- M. Matrix impression system

#### II. RECENT ADVANCES

- A. Digital impressions

- a) Chairside production
- b) Laboratory production
- c) Centralised fabrication in a production centre

#### 4. Classification of implant impressions:

The techniques for implant impressions are largely classified on the basis of:

1. The type of tray used or Impression coping:
  - a. Open-tray (Pick-up) Impression
  - b. Closed-tray (Transfer) Impression
2. The objective of making an Impression:
  - a. Primary Impressions
  - b. Secondary Impressions
3. By Impression level:
  - a. Fixture level Implant Impression
  - b. Abutment level Implant Impression

#### DIGITAL IMPRESSIONS

Digital intraoral imaging represents an innovative method that helps the dentist to construct a virtual computer-generated copy of the hard and soft tissues with the use of lasers and other optical scanning machines.

**TABLE-1**

<b>Advantages of Digital Impressions<sup>5</sup></b>	<b>Disadvantages of Digital Impressions<sup>5</sup></b>
1. Comparative accuracy with conventional impressions.	1. Lack of dentist's familiarity with the concept.
2. Discomfort for patient is reduced.	2. High initial cost of purchase.
3. Simpler to use after a period of learning.	3. Complex digital equipment.
4. Eliminates the need to articulate the casts.	
5. Eliminates the need for stocking materials and trays.	
6. Tasks of pouring the impression, making the base, and trimming are eliminated.	
7. No risk of cross infection.	

**Two types of systems are available on the market today:**

1. CAD/CAM Systems Example: The CEREC Acquisition Centre (AC) (Sirona Dental Systems) and E4D Dentist™ system (D4D Technologies).
2. Dedicated Three Dimensional Digital Impression Systems Example: Lava™ Chairside Oral Scanner C.O.S. (3M ESPE) and the I Tero™ system (Cadent)<sup>6</sup>.

**TABLE 2: The comparison between 3 scanner systems**

<b>Features</b>	<b>3 M LAVA C.O.S</b>	<b>S. CEREC AC</b>	<b>CADENT ITERO</b>
Visual Technique	Wave front sampling techniques (3D in motion)	LED/Laser collection	Parallel confocal/telecentric
Focal Depth	Extent from 5 mm to 15 mm	Extent from 5 mm to 15 mm	13.5 mm 1:1 exact focus
Powder Required	Yes	Yes/opti spray	No
Models	Added ingredient/SLA in blue resin. One solid model and one working model	Added ingredient/SLA; not tissue	Milled/Polyurethane. Soft tissue profile, Removable dies
Indications	Upto 4UB, and singles	All	All
Export for Digital Interface	LAVA	CEREC Connect	Major CAD front end systems-Dental wings, CEREC In-Lab, 3 Shape, Standard STL binary file.
Articulator	Articulated; Centric and lateral excursions	Hinge-Only	All directions, attachment system to whip mix full articulator for complex cases

**CEREC**

The camera records the image data reflected from the surface of the teeth and soft tissues. When the camera is used in the automatic mode, it is unable to record data while the camera is moving or shaking. This prevents the capture of blur inaccurate<sup>7,8</sup>. Several image views are made from an occlusal orientation assuring capture of the tooth or teeth being restored, as well as of the adjacent and opposing teeth. The preparation is shown on a touch screen allows the dentist to view the prepared tooth from every angle and to focus on magnified areas of the preparation. (FIG 1)

The camera must stay a working distance of between 5 mm and 15 mm from the surface being recorded and

the operator has a field of view of approximately 10 mm × 13.5 mm. Scan Rewind function allows the user to rewind and delete 10-s portions of the scanned video rather than delete the entire scan<sup>9</sup>. The software recognizes data that is already in the computer and resumes scanning without the need for pressing any buttons<sup>10</sup>. To help the dentist maintain the wand at a proper distance from the teeth, a target appears on the monitor to indicate whether the wand is too close or too far away from the teeth. If there are holes in the scan in areas where data is critical, such as cusp tips or the selection of a specific impression technique, which exceptionally affects the outcome of the treatment, still



**FIG-1**

### **LAVAC.O.S.**

The Lava C.O.S. unit consists of a mobile cart containing a computer, a touch screen monitor, and a scanning wand, which has a 13.2-mm wide tip and weighs 14 oz (about the size of a large power toothbrush). The end of the scanner that enters the mouth is the smallest of all the systems. The camera at the tip of the wand contains 192 LEDs and 22

lenses. There is no need for a keyboard or mouse, as the monitor displays a keyboard for all data input. Disinfection involves a simple wipe down of the monitor with an intermediate level surface disinfectant designed for use on nonporous surfaces along with the replacement of the plastic sheath on the wand.



**FIG-2**

The camera must stay a working distance of between 5 mm and 15 mm from the surface being recorded and the operator has a field of view of approximately 10 mm × 13.5 mm. Scan Rewind function allows the user to rewind and delete 10-s portions of the scanned video rather than delete the entire scan<sup>9</sup>. The software recognizes data that is already in the computer and resumes scanning without the need for pressing any buttons<sup>10</sup>. To help the dentist maintain the wand at a proper distance from the teeth, a target appears on the monitor to indicate whether the wand is too close or too far away from the teeth. If there are holes in the scan in areas where data is critical, such as cusp tips

or contact points, it is not necessary to redo the entire scan. (FIG-2)

### **ITERO**

The operator has to record a series of scans from the occlusal, facial, lingual, mesio-proximal, and disto-proximal angles of the prepared tooth and additional scans for adjacent teeth. The opposing dentition is scanned separately. The scanned series of images aren't continuous, so individual images may be retaken until adequate data is obtained. A total of 15–30 scanned images may be required to record the preparation, opposing teeth, and occlusal relationships<sup>11</sup>. (FIG-3)



FIG-3

### E4D DENTIST

The E4D Dentist IntraOral Digitizer is a single-image camera that uses a red laser light to record intraoral images. It also works by recording reflected data from the hard and soft tissues. It requires the use of a reflective medium (E4D Accent liquid) when scanning through a thin, transparent area of the cavity preparation<sup>9</sup>. The camera can be used either in a manual image capture mode or automatic image capture mode with Rapid Scan. A series of separate

images are recorded from the occlusal, lingual, and facial views for a true 3-D capture. The software provides immediate feedback on each scanned image to ensure all images are accurately scanned<sup>8</sup>. The design system of the E4D Dentist is capable of auto detecting and marking the finish line on the preparation. After the dentist approves this landmark, the software uses its Autogenesis™ feature to propose a restoration, chosen from its anatomical libraries, for the tooth to be restored.(FIG-4)



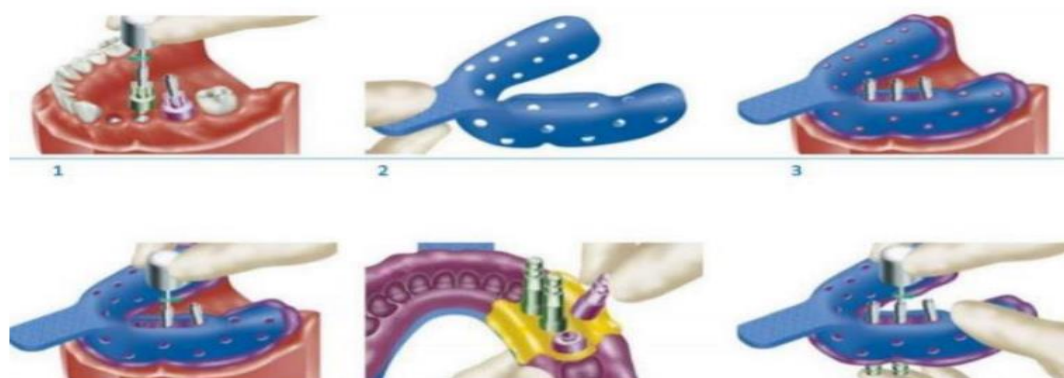
FIG-4

### TECHNIQUES FOR IMPLANT IMPRESSIONS

#### 1. Open tray/ direct/ pick-up impressions-

It is the one of the commonest impression methods used. This method helps in connecting the impression coping to the fixture in the oral cavity. After the impression material hardens, unfasten the impression coping's screw procedure from the open tray. Remove the impression body, and the impression coping is removed together with the impression body from the oral cavity. It tends to reduce the effect of implant angulation, removes the extra concern of replacing the copings into the impression and deforming the impression material upon recovery

from mouth<sup>12</sup>. This technique is further sub-divided into splinted or non-splinted techniques. This underlying principle in splinting the impression copings is to connect all the impression copings together using a rigid material to prevent the individual copings to move during the impression-making procedure. Splinting of the transfer copings helps in preventing the rotational movement of impression copings in the impression material during analog fastening, which provides better results<sup>13</sup>.(FIG-5)



**FIG- 5**

### INDICATIONS

1. Non parallel implants.
2. Screw retained restoration.
3. Multi-unit restorations.
4. Full fixed arch mandibular impressions.

### ADVANTAGES

1. Reduce the effect of implant angulations.
2. Minimizes distortion of the impression material.
3. Splinting helps in additional security in pick up of impressions as it prevents stability and rotational movement of copings.
4. The dentist can easily evaluate the laboratory preparation and contour of the provisional prosthesis and specify any changes required.

### DISADVANTAGES

1. The movement of impression copings inside the impression can cause inaccuracy.
2. Rotational movement during attaching of coping to implant analog can occur.

3. Blind attachment can cause misfit of the components.

### 2. Closed tray/ indirect/ transfer type impressions-

The impression coping for a closed tray technique are placed on implants or multi-unit abutments and the impression made. The impression material polymerizes the impression and is dislodged from the closed tray impression copings. The impression copings are removed and implant or abutment analogs are attached to the copings. It then goes into the impression body during transfer process. The combined coping-analog assembly is then inserted into the definitive impression. It is called the closed tray technique since impression is taken through the existing tray or based on the indirect method. Mostly these impressions are utilized for preliminary impressions<sup>14</sup>.(FIG-6)



**FIG-6**

### INDICATIONS

1. Parallel level of fixture insertions.
2. Single tooth cemented type restoration.
3. Fabrication of provisional restorations.
4. When the patient has limited inter-arch space.
5. Gagging tendency.

6. When the superstructure is built with non-hexed components.

### ADVANTAGES

1. Easier to perform.
2. Special/Custom tray not needed.
3. Best to manoeuvre in limited arch conditions.



4. Visual fastening of analogs to coping preventing the blind attachment.

### DISADVANTAGES

1. Deformation of material usually seen in non-parallel implants.
2. Reinserting the copings back to the respective after the impression can cause distortion.

### 3. Fixture level impressions

After a fixture-level impression is taken, the abutment can be selected right on the model where

### 4. Abutment level impressions

It is a method of taking an impression by connecting the abutments to the top of the implant fixture (body)

and subsequently connecting the impression copings to them. Here the connected abutment is not removed. Thus, until the superstructure is completed, the healing cap/gingival former should be placed to protect the connected abutment and to prevent gingival growth, to prevent any discrepancy in the impressions. The abutment-level method showed a better linear accuracy in the case of highly diverged posterior implants. Increasing the angle of implants' divergence from 40° to 60° might not usually lead to a significant increase in the errors, especially when using abutment-level impressions<sup>15</sup>.(FIG-8) the superstructure can also be fabricated. The screw retained type abutment in particular can be connected to the model; the superstructure is then fabricated.(FIG-7)



FIG-7



FIG-8

### MODIFIED IMPRESSION TECHNIQUES ACCORDING TO SPECIFIC SITUATIONS

#### 1. Snap-fit technique<sup>16</sup>:

This impression uses a close tray. Press-fit impression coping is attached to the implant by pressing rather than of screwing or cementing the copings and these are picked up in the impression. These impressions have the synthetic plastic copings being picked up during the procedure.(FIG-9) close tray. Press-fit impression coping is attached to the implant by pressing rather than of screwing or cementing the

copings and t Utilization of the impression as mentioned above techniques can be chosen in different cases according to clinician's experience and knowledge. In removable partial denture, impression need to consider into the harmony between uncompressible hard tissue and delicate structures with variable compressibilities. With availability of various techniques and advancements the operator should select



**FIG-9**

### **ADVANTAGES**

1. Prevents the movement of the plastic coping.
2. Reduces chair side wait time.
3. This technique has an edge because of amalgamation of both the open and closed tray implant impression techniques.
4. Easier for both dentist and the patient.

### **2. Implant retained overdentures**

#### **a. Functional impression technique**

The functional impression technique records the mucosa in a functional state and simultaneously

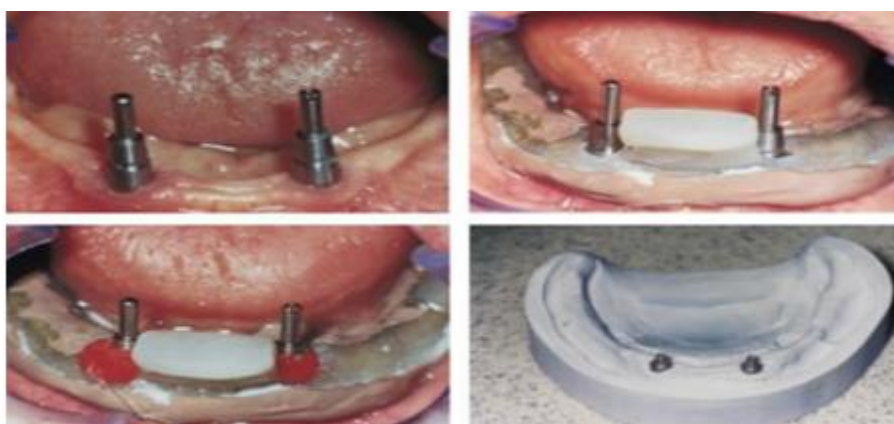
records the implant components in relation to the alveolar tissues. A combination of open-tray and functional impression techniques is described in this method. Border moulding and functional impression procedures are made at the same time with the use of a vinyl polysiloxane (VPS) impression material.(FIG-10) A combination of open-tray and functional impression techniques is described in this method. Border moulding and functional impression procedures are made at the same time with the



**FIG-10**

#### **b. Two step pick up impression technique**

The first is conventional border moulding and impression in an individualized tray that fits over the implant abutments. The second step involves attaching of the impression copings to the tray and picking up the copings from the mouth in to the impression.(FIG-11)

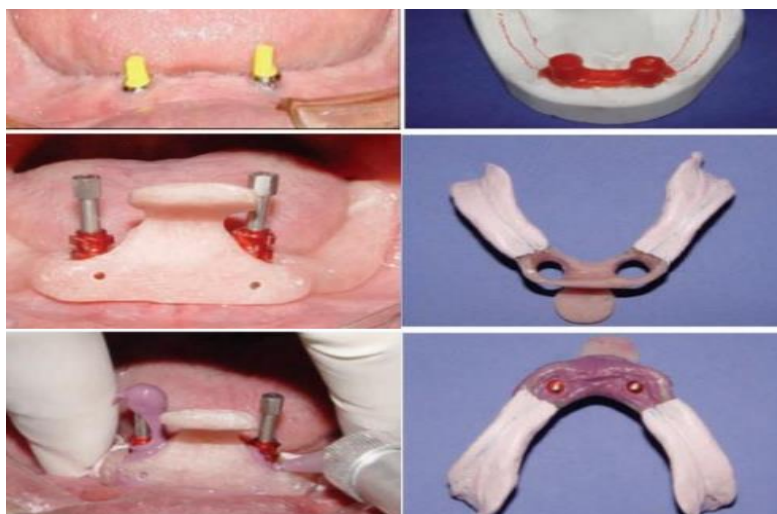


**FIG-11**



### c. Dual Impression Technique

Dual impression techniques were introduced to produce a “corrected cast” so that the teeth are recorded in anatomic and residual ridge is well.(FIG-12)



**FIG-12**

### CONCLUSION

Utilization of the impression as mentioned above techniques can be chosen in different cases according to clinician's experience and knowledge. In removable partial denture, impression need to consider into the harmony between uncompressible hard tissue and delicate structures with variable compressibilities. With availability of various techniques and advancements the operator should select a material and technique which suits best for the particular situation. The introduction of modern dental Implants alongside the foreseeable integration, has led to an emphasis on restorative techniques with added precision in the procreation of tooth comparable restorations for missing teeth. In relation to traditional imprints, intraoral imaging devices can always be employed for diagnosis reasons with narrow screening with confidence.

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