

## REVIEW ARTICLE

## DIGITAL IMPRESSIONS IN DENTISTRY

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## ABSTRACT

The quest for innovations and improvisations in all the areas of restorative dentistry includes impression materials as well. Precision and accuracy of master impressions are critical to the overall excellence and marginal fit of definitive fixed restorations & implants. In the present scenario, conventional (traditional) techniques are being replaced by the newer, precise and accurate digital impressions. Chairside digital impression (CAD/CAM) systems create accurate and precise laboratory models and restorations, involving less chairside time, and achieve fine-tuned esthetics. This article gives an insight into the latest impression materials/techniques used to fabricate a fixed partial denture or implant prosthesis.

**Key words:** CAD-CAM Impressions, Digital Dental Impressions.

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## DIGITAL IMPRESSIONS

The key to success in restorative dentistry is the fabrication of a healthy, maintainable, aesthetic and functional prostheses. The long chain of positive and negative dimensional pitfalls between completion of the preparation and cementation of a fixed prosthesis *begins with the introduction.*

What is an impression - Is it an effect? or a belief? or an imprint?....

Innovations and improvisations in all the areas of restorative dentistry include impression materials as well. In the present scenario, conventional techniques are being replaced by the newer digital impressions.

### 1. Impressions with Conventional (traditional) materials

Agar and Alginate hydrocolloids were used initially. But, their usage has been limited due to many drawbacks<sup>(1,5)</sup>. Elastomers have proved to be the successful based on their clinical performance.<sup>(2,3,4)</sup>

Among the rubber base materials, Vinyl Poly Siloxanes (VPS) and Polyethers are recommended materials for FPD and implant impressions.<sup>(6)</sup> Improvements in flow characteristics and hydrophilic properties have made them popular. Polyether materials are ideal in situations where tissue management is difficult.<sup>(7,8)</sup>

Vinylsiloxanether(2009) a hybrid silicone material is a combination of a polyether material and Polyvinylsiloxane having properties equivalent to or superior to those of polyether material.<sup>(19)</sup>

Variability in accuracy has been found in impressions and the resulting casts depending on the technique and material used<sup>(9)</sup>

### 2. Digital impressions

Digital impression is the newest innovation in this field. The dental industry changed when the University of Zurich introduced the original CEREC machine in 1980. It was the first to use digital impression technology to scan a patient's mouth, virtually design a restoration, and then mill it for immediate seating in the patient's mouth.<sup>(10,11)</sup> (Fig-1).

#### Advantages of digital impressions<sup>(12-14)</sup>

- Greater precision and accuracy.
- Can be used in a patient who is a gagger or cannot tolerate impression material in his or her mouth for several minutes
- Takes less time than conventional impressions, including the bite registration (scanning takes only three to four minutes).
- Easy to make impressions when mandibular or maxillary tori or other undercuts are present. Removal of a traditional impression is difficult or impossible without causing the patient discomfort and/or tearing the margins on the impression.

- No need of repeated impressions (no material wastage).
- Shade guide stumps can be photographed overlaid on the tooth, which helps to highlight similarities and differences in areas of the tooth for custom shading and provides information on the initial preparation shade.
- Preparation is instantly visible and enlarged on-screen.
- No disinfection protocol is required before it is sent to a laboratory, as there is no physical impression.
- Compatibility of impression material with specific die materials is not a concern.

#### Disadvantages of digital impressions<sup>(12-14)</sup>

- CAD/CAM scanners require a dry, visible field for scanning (as in a traditional impression).
- Digital scanning must include proper tissue management to ensure accuracy. Soft tissue retraction and moisture control are essential in this process (these are also essential for traditional impressions).
- Expensive - Cost/the initial investment in the machine needs to be considered. (The real savings is in the indirect costs associated with reduced seating time, fewer remakes, and fewer less-than-ideal impressions and subsequent restorations).

CAD/CAM systems are available which either digitally scan and create fixed restorations chairside (in-office CAD/CAM) or capture chairside digital impressions that are then sent to a laboratory.

#### In-office CAD/CAM:

- allows the clinician to provide single-visit indirect fixed restorations that are accurate and esthetically pleasing.
- does not require any communication with a laboratory

#### Chairside digital impression

- allows the creation of accurate models that can then be used for either traditional or CAD/CAM fabrication of restorations, and involves less chairside time.
- They enable seamless communication between the clinician and the laboratory technician.

The procedure for digitizing the impression is:-

- After the tooth preparation, the area is captured with an optical device and displayed on the computer. (Using different technologies, each system uses a camera to capture the desired image.)
- The impression surface is studied and if needed, modification of preparation /additional images can be made.
- The final image is digitally sent to the fabrication center
- The impression is analysed by the technician and he digitally trims the model and the dies.
- Then the actual physical model is made.
- This physical model is sent to the laboratory for fabrication of prosthesis.

Scanning the impression The model and intraoral scanners scan the tooth and model surface contours, regardless of the particular technology employed. Light in one form or another is projected onto a tooth or model surface. One or more cameras record the reflected light, and the sophisticated software interprets the data, producing a digital model on which restorations can be designed.

A digital scan should capture the entire restorative margin as well as approximately 0.5 mm of the tooth/root surface apical to the margin. This information is required by the ceramist or milling machine in order to reproduce the correct emergence profile, or “egression silhouette” for the final restoration.<sup>(15)</sup>

Depending on whether the restorative margin is supracrevicular (above the gingival tissues), equicrevicular (at the free gingival margin) or intracrevicular (in the gingival sulcus), either a tra-

ditional single- or double-cord technique, laser technique, chemical retraction technique, or a combination of these can be used to achieve a dry and visible field. For intracrevicular and equicrevicular margins, a double-cord tissue retraction technique can be used, with the more superficial cord removed gently just prior to scanning. If using a laser to trough the area, thereby creating a space between the preparation margin and the tissue (which will also aid hemostasis), it is important to consider the patient's tissue type and the principles of biologic width first; there must be sufficient horizontal tissue thickness to avoid loss of vertical tissue height.<sup>(16, 17, 18)</sup>

One of the biggest challenges in scanning an impression is the technology's ability to “see” inside the voids that the teeth create in the impression material. Many older model scanners are unable to see inside these voids because the angle between the light source and the camera is too great. So in order to scan impressions, manufacturers decrease the angle between the light source and the camera, giving them a better view inside those voids. Due to their size, intraoral scanners have highly condensed optics and adapt quite well to scanning impressions.

One difference between the various CAD/CAM systems is the requirement for powdering. Some systems require a coating of reflective powder or light powdering on the dry preparation prior to scanning. Whereas, some do not require powdering.

After Capturing the data Next step is to convert the scanned impression data into a physical model so that a traditional restoration or CAD/CAM-based restoration can be fabricated.

Once the virtual model has been created, it still needs to be manufactured. This requires a CAM program to take the model data and a CAM milling or 3-D printing system to produce the physical model. (Fig-3)

CAD/CAM dentistry is changing the way in which clinicians provide indirect restorations to patients, with fabrication of highly precise, accurate models and restorations; increased chairside productivity; and improved clinic-laboratory communication.

## CONCLUSION

Digitizing the oral environment is a recent innovation, both chairside and in the laboratory. CAD and CAM software works with scanned impressions, and model printing and milling systems are being developed. Chairside digital impression systems



(Figure -1).



(Fig-2)



(Fig-3)

allow for the creation of accurate and precise laboratory models and restorations, involve less chairside time, and achieve fine-tuned esthetics. It is a promising future, since the CAD/CAM revolution is in full swing...

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