

## Overview of Comparison Between Digital and Currently Used Methods

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**Summary:** As we live in this advanced age of technology, everything is progressing in a fast pace, this conclude medical industry too. These process new and old will collaborate with each other. With developing new methods and techniques, we can overcome problems in our field of work, but with that being said , it doesn't mean all the current methods are outdated and inefficient , each progress has its own advantages and disadvantages . digital dentistry (CAD/CAM) can be consider one of those breakthroughs in dental field. with introduction of CAD (computer aid design)/CAM (computer aid manufacture) around 1980s, this system has made so much progress and still developing in a promising way. with CAD/CAM we are able to manufacture better and more accurate prosthetic frame work and dental restorations, consider to current method designs. CAD/CAM system functions in three steps (scanning, design, milling unit). each of these sections carry a specific duty that with combination of all of them leads to a dental restoration. current method of impression making still consider efficient in our field but with intra oral scanners (IOS) we are able to get better & more accurate copy of the oral cavity and dentition compare to current impression techniques. CAD/CAM not only focus on accuracy of the design and planning but it also consider to be cost efficient and less time consuming compare to the current methods and considerably more comfortable for the patient during the impression making period. Further in this article we will discuss about the process of this system, comparing it with current available methods , advantages & disadvantages of it and our outcomes.

**Key words:** digital dentistry, restorations, CAD/CAM, impression, scanning, 3D design

### Abbreviations:

CAD: computer aid design

CAM: computer aid manufacturing

IOS: intraoral scanners

### Feedback:

Before we start comparing these methods together its better we create image of what they actually made of and how they process, because understanding these factors can make us assess which of them can be more accurate and easy to handle.

**Digital:** CAD (computer aid design)/CAM (computer aid manufacture) is introduced to the world by 1980 by the first commercially available system called CEREC. This chairside system allows the dentists or clinicians to independently design and also manufacture ceramic restoration in matter of hours in their own office with only one or two visit. Since, its first introduction to dentistry field as CEREC 1, this system has evolved through series of upgrade to CEREC 3. CEREC 1 wasn't so much advanced it was only limited in 2D designing and scanning, it was only able to fabricate exclusively inlay for immediate cementation but by time passing this system got upgraded to CEREC 3, that function with advanced 3D scanning and design (Siorna.,2021). CEREC 3 got equipped with OMNI SCANNER camera, has expanded capability significantly so that can almost design any restoration, such as inlay, onlay, veneers, crown, as well as three unit bridges and custom lithium desilicated implant abutment. latest models of CEREC were equipped with a prime scanner that can get applied more deeply in the oral cavity and can detect tooth color (TRIOS 3,.2021) .in dental field there are also different brands of CAD/CAM systems that have similar functions as CEREC such as (3M True Definition, 3M True Definition, PlanScan/E4D NEVO, iTero). Basically this system function in three stages (scanning, design, milling unit), we can defined the process easily as scanning the oral cavity with intraoral scanners (IOS) and transport the scan to the specific design app provided by the company choice in the guideline, designing our plan on the dentition via the app design and the last stage is crafting and manufacturing it with the milling unit same as simple or 3D printer (Fasbiner J D 2006).

**IOS:** there are many commercially intraoral scanners exists lately that they are able to collect information on the shape and size of the dental arches through the emission of a light beam (Siorna.,2021), by reflecting laser or light beam onto the tooth surface and capture and replicate the dentition and oral cavity by hitting the structure and create exact image of the structure with help of high resolution camera. The information collected by these cameras is processed by powerful

software that reconstructs the three dimensional (3D) model of the desired structures (TRIOS 3, 2021). By achieving 3D model of the structure with specific details in the software, we are able to start the design program on the model (like a diagnostic cast in impression technique). Also these scanners can be used as implantation and surgical guides in some cases (Imburgia M. et al., 2017). Impression making technique and diagnostic cast: for us to create any dental prosthesis, we need exact replica of the dentition and its surroundings. For achieving this exact copy, we use what so called impression materials. These materials will get applied in specific trays, these trays come in many different size and shapes that fit in any oral cavity of any individuals. We use many different type of impression materials due to their specific use (Fujimoto J. et al., 2006). These materials can be "Irreversible hydrocolloid – alginate, Reversible hydrocolloid-agar, Condensation silicone, Addition silicon, Polyether, Polysulfide polymer irreversible hydrocolloids, or alginates and reversible hydrocolloids or silicon. After impression material got pour into the trays they will get applied in the dental jaw, each material has its own setting times, after the material got set, we remove them out of the oral cavity and we pour dental stone (gypsum) in the impression to create the diagnostic cast. when the stone got set, we mount it on a device called articulator that can mimic the movement of the jaw. We have three types of articulator (non-adjustable, semi-adjustable, fully-adjustable). Due to which treatment we doing we chose one of these types. After the cast got mounted, now the process of the planning starts (Fujimoto J. et al., 2006).

### **Introduction:**

In Prosthodontics dentistry, accuracy of the design is one of the most crucial factor to make a perfect prosthesis esthetically and functionally. With digital dentistry (CAD/CAM) creating flawless design with considerable reduction in human error is more promising compare to current impression making techniques and crafting methods. Computer aid design (CAD) can help us through illustration and replicating the design of the oral cavity or the dentition with intraoral scanners (IOS) and computer aid manufacturing (CAM) will help the technician or the doctor to finalize and create the prosthesis in more time/cost efficient and in more accurate manner. Current methods of impression making and casting still count as sufficient and ideal methods of approach and till now consider to be desirable to many dentist around the globe.

### **Comparison:**

Creating a prosthesis is a complicated process with many elements to consider such as patient factor, design, crafting technique and long term endurance. Each of these elements have their own challenges that us dentists must overcome to achieve our goal without failure. Either with digital method or currently used impression techniques measurement these factors stay the same, for us to eliminate the future adversities and complication we must assess each step thoroughly. These factors will get effected in each methods differently.

### **Patient factor:**

Treatment planning consists of formulating a logical sequence of treatment designed to restore the patient's dentition to good health, with optimal function and appearance. The plan should be presented in written form and should be discussed in detail with the patient. Good communication with the patient is essential when the plan is formulated. for achieving the best outcome and accuracy of the prosthesis, patient must be involve directly in every step of the process, they should come for measuring, re-measuring, fitting the prosthesis in the oral cavity and checking all the angles of this process on hand. So this eventually can be time consuming and devastating process for the patient and the doctor. Also, patients must be free of any existing diseases or complications in their oral cavity and also in their whole body, to prevent future complications. Two main chief complaints of these patients have when they came to us for any treatments are discomfort and pain or esthetical problems. These individuals demands must be made in short period of time. For these patients having many visits can be a torment and uncomfortable so they resent these appointment. With digital system (IOS & CAD/CAM) this process reduce dramatically in duration and time (Yuzbasioglu E. et al., 2014). Patient can finish its diagnosis or even applying the prosthesis in only one visit comparing to impression taking techniques. In impression taking technique individuals going through an uncomfortable process and these impressions must be taken in each step of the way, so in other words it means more appointments. Time is always a crucial factor in any process, it's our job as dentist to try to create a flawless prosthesis for the patient in considerably short period of time. With that being said, digital system can be cost efficient for the clinician and the patient too. When the process of time reduces, the amount of visits reduces and these can conclude to reduction of cost. With all this being said, one of the factors that shouldn't be

ruled out is that patient in digital design they can see the actual prosthesis and how it look on them, basically it can show the future of the definitive treatment and patient can see the exact outcome (Fujimoto J. et al., 2006).

### **Design factor:**

One thing is crucial for us in designing any dental prosthesis and that is “accuracy”. For measuring Accuracy there are two crucial elements that must be consider: “trueness “ and “precision “.trueness can be defined as the ability of a measurement to match the actual value of the quantity being measured and precision is defined as the ability of a measurement to be consistently repeated .For creating a perfect design for any prosthesis these elements must be as close as the real structure , any flaws in crating the replica of the dentition and its structure can lead to failure of the prosthesis. Digital system can make this goal achievable compare to the impression making techniques (Imburgia M. et al., 2017). With intraoral scanners we can nearly bring the human errors to zero and the accuracy of the design way more compare to the diagnostic cast technique. IOS system eliminate usage of the impression material in the process and make the steps much easier and simpler. Clinician shouldn't worry about the material setting time or the quality of it, they process the oral cavity with the scanners without limitations of the time. Due to this the stress of the process will reduce dramatically and this can be crucial for the treatment. These digital units use high quality material such as fedspatic material, zirconia and lithium desilicated that they come in blocks from the manufacturer. These digital systems use these data as digital articulator , so they can apply the design on it. These articulators can be defined as a specific software that is recommended from manufacturer. It's the laboratory of the digital system, simple as that (Yuzbasioglu E. et al., 2014; Joda T. et al.,2017)

In Impression making technique, the accuracy of the impression depends on the materials themselves, impression tray types, and impression techniques. Each step in the process introduces potential human and/or material error. Each of these material have some specific setting time from pouring into the tray to applying it in the mouth of the patient and the removal of it. This process commonly happens in duration of 3 to 4 minutes, the clinician must act fast and make all the steps accurately. Fast pacing work can some time cause some errors and will bring the accuracy of the process low. If these process have any complication or

mistakes, it must be done again and again. These failures costing the clinician time and money, and also more visits from the patient concluding in discomfort (Yuzbasioglu E. et al., 2014; Joda T. et al.,2017). Even if the clinician have accurate knowledge of the process and good work experience still mistakes can be made in casting process and in the laboratory. There are many factors working in hand, so higher rate of error can rise (Fujimoto J. et al., 2006).

### **Storing and communication factors:**

Dentists must be able to create a routine between them and their technician in laboratory. The way to store the data they gather from the patient and how to transfer data from the clinic to the lab. This routine must be accurate and safe without error. These data's should not be effected in any manner between in this process. The way of transport and the way of storing can effect this elements. In digital system (IOS and CAD/CAM) this process can be way more achievable and convenient. Digital impressions offer speed, efficiency, ability of storing captured information indefinitely and transferring digital images between the dental office and the laboratory. Easy as flash drive the data can be transferred to the lab or with a simple Email (Imburgia M. et al., 2017). In the other hand in the cast technique this process can be different. Data are not just some file in a computer, they are real elements such as dental stone or full mounted dental cast. These elements need attention, taking space and they need to be transferred to the lab as soon as possible. Most of these material shrink through passing time and this will destroy accuracy of the replica. this will make clinic to be constantly in a back and force, give and take bases with the laboratory and that's when complication will rise. This process can be costly and time consuming for the clinic (Fujimoto J. et al., 2006).

**Discussion:** we should be open minded to new technology in any line of work. “We should work smarter not harder” that's a good saying. Dentistry and many other field in the world, had a lots of progress through time. Through history many ideas and methods had been used that these days they can be consider “ridiculous” but we evolved and got more mature with our own methods and theories. We are living in an advancing digital world, everything around us is getting compatible with the new technologies. In dental work we should get more open minded with these progresses too. With digital systems we can make better quality prosthesis and cut down most of the hu-

man error. These are number of dentists out there that will go on and debate this process such as the prices of the unit, prices of the material and accessibility of these system. Due to that they can be bit skeptical toward these process but any system can and will have its advantages and disadvantages but the ratio of these pros and cons can evaluate efficiency of a system. CAD/CAM systems may be more expensive compare to impression technique but the accuracy of the design, the comfort of the patient and reduction of time of the process is way more desirable than impression techniques.

**Conclusion:** we can sum up the outcome of this issue in this manner that digital design can be less invasive, more comfortable for the patient, less time consuming and more accurate in design compare to impression techniques. still we can use impression material in so many cases and it can be efficient enough. With these digital system process will be much easier for the patient and the clinician. Much faster and better quality design will be the outcome. With the digital designing we can bring the human errors nearly to zero and achieve extraordinary outcome.

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