Available CAD/CAM System Concepts for the Fabrication of Digital Dentures

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Abstract: The remunerations of utilizing the Computer Aided Design (CAD) and Computer -Aided Manufacturing (CAM) have long been a historic success and established in fabricating dental prosthesis. The fabrication of complete dentures from CAD/CAM technology was introduced following the success of this advanced technology in the implant and fixed prosthesis. The comparative review of the four CAD/CAM technologies such as Dentca™CAD/CAM Denture (Dentca, Inc), Ceramill® Full Denture System (Amann Girrbach), Zirkonzahn Denture system (Zirkonzahn, Inc), and Baltic Denture System (Merz Dental GmbH) were scrutinized, tabulated and compared. The manufacturing concepts and clinical methods are distinct for each system, which facilitates the dental practitioner's ability to choose their preferred system for digital denture fabrication. In choosing which system to follow, consideration should be paid to aesthetic requirements, chair time and laboratory costs, number of visits and convenience and return on investment associated with CAD / CAM equipment should be addressed. The CAD/CAM complete dentures manufacturers' protocols are reported as either additive or subtractive manufacturing concepts, and each system has a different number of specified clinical appointments with various clinical laboratory workflows for the patients. The findings of the review revealed that this use of CAD / CAM in the manufacture of full dentures has had an obvious impact in practice of removable prosthodontics. The four technological digital denture approaches showed that working time for laboratory procedures is significantly reduced relative to the fabrication of conventional complete dentures. In addition, the clinical aspect of digital dentures is also shortened. This can be indicated that the manufacture of complete dentures using CAD / CAM innovation has increased remarkable in the age of digitized dentistry, even for dentists who have less denture experience, due to several inherent advantages such as storage capacity of the denture digital data in CAD. The continuous futuristic vision of digital technology in the field of dentures is important to improve the clinical and laboratory performance of denture fabrication and to provide more convenience for both dentists and patients.
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1. Introduction

With the continuous evolution of dental care and a number of clinical trials have been observed, several options are available to treat the edentulous patients (relative to, e.g. conventional complete dentures) With regard to patient outcomes and standard of living. However, the great majority of edentulous patients will be treated with complete dentures, currently considered the primary option due to the obstacle of low socioeconomic status [1, 2]. Internationally, the percentage rates of completely edentulous arches are estimated to affect 7-69% of the population among countries and increase in the elderly population [3, 4]. In European countries, a review of studies found a wide variability in prevalence, ranging from 3% to 80% among the population aged 60 or above [5]. According to the third German oral health study in 1997 (DMS III), the rate of edentulism in both jaws was 24.8% among 65-year-olds in Germany [6]. In 2005, a further study (DMS IV) published that 22.6% of the German population aged 65 years or older are edentulous in both jaws [7].

Several strategies for manufacturing complete dentures (CDs) have already been presented in the dental literature. The most common and favorable methods used to treat edentulous patients with CDs are the conventional method (T) and the simplified method (S). The traditional manufacturing method of CDs incorporates two impressions and jaw records using the face bow, setting of artificial teeth, try-in, delivery, and adjustments. Additionally, it is considered one of the academic methods taught in most dental schools. The simplified method includes just one alginate impression and occlusal registration without even using a face-bow transfer [9, 10]. Moreover, most general dentists prefer the simplified method of complete dentures for the treatment of edentulous patients relative to the conventional method due to its improved time and cost factors [11]. A comparison of the fabrication of conventional

complete dentures by the T or S techniques showed no evidence that the traditional method is more efficient based on the patient satisfaction levels, chewing abilities, and even the quality of a denture [12].

Digital dental technology using of computer-aided design/computer-aided manufacturing (CAD/CAM) has had historical success in fabricating dental crowns, bridges, implant abutments, partial dental prostheses, and maxillofacial prostheses [13]. The rapid expansion and development of CAD/CAM technologies has not been limited to fixed dental prostheses (FDPs), but is also currently widespread in the fabrication of removable dentures [14]. In dentistry, the most widespread additive technique is SLA, which builds up three-dimensional objects by joining small-volume elements together, layer by layer [15]. In contrast, the subtractive manufacturing technique (such as computerized numerical control machining) is the process of using an order file from CAD to create the object by milling material away from a solid block to achieve the desired finished work [16]. Additionally, the CAD / CAM system can be used with a subtractive method to manufacture a full resin denture base with artificial teeth fused to the denture base utilizing resin cement. [17].

In 1994, the world's first technique for fabricating a complete denture using CAD was three-dimensional laser lithography [18]. To duplicate the shapes of complete dentures, this process uses a computerized numerical control (CNC) processor and ball-end mills with diameters of 6 mm and 1 mm to mill out modeling wax. This demonstration established that it is possible to duplicate complete dentures using CAD/CAM, but the process still required some improvement [19]. In 2009, a model of removable complete dentures was designed using CAD software, rapid prototyping (RP), and finalizing with a traditional laboratory method [20]. In 2012, the process of fabrication the complete dentures using CAD/CAM technology were commercially available. Furthermore, the denture base can be scanned and tooth morphology, import the data into a CAD system, and export the resulting design data to a CAM system for milling [21]. The main advantages of digital complete dentures versus the conventional, which has facilitated the data acquisition (impression, occlusal relation records) of the edentulous patient and reduced the insertion of dentures in two visits [18, 21].

Nowadays, there are multiple concepts of digitally supported processes of manufacturing complete dentures. The aim of this review is to describe the various methods available in the clinic and laboratory that implement CAD/CAM technology in the manufacturing of complete dentures.

2. Material and Methods

This study reported the results of standardized English-language electronic mail inquiries sent to manufacturers of CAD/CAM complete dentures. Information regarding the clinical and laboratory workflow for each system was collected, scrutinized, and organized. The fabrication techniques for complete dentures included the descriptions of the various concepts, both additive and subtractive manufacturing techniques: Dentca™CAD/CAM Denture (Dentca, Inc), Ceramill® Full Denture System (Amann Girrbach), Zirkonzahn Denture system (Zirkonzahn, Inc), and Baltic Denture System (Merz Dental GmbH). In order to ensure appropriate data outcomes, the validation techniques and approval were obtained directly from the manufacturers.

3. Results

Based on the digital workflow system (Figure 1) provided by the manufacturers, the four technological digital denture approaches showed that both working times for laboratory procedures and clinical appointment were significantly reduced relative to the fabrication of conventional complete dentures. The Dentca CAD/CAM was the only one out of four systems can fabricate the digital dentures in additive manufacturing by 3-D printing concept, the insertion of dentures can be made in 2 clinical sessions the same with Baltic Denture System. In addition, Ceramill and Zirkonzahn have at least 3-4 visits. The patient data acquisition (impressions, jaw relation, etc.) recorded in the 1st patient appointment were applicable in all systems except in Ceramill that needed the 2nd visit to finish the procedure.

In the Dentca system, making of definitive impressions, occlusal vertical dimension and Maxillomandibular relationships (MMR) makes the patient data acquisition possible in a single clinical appointment. These data collections are still using conventional techniques and material for complete dentures fabrication. The digital procedures begin in the laboratory by scanning the definitive impressions to the manufacturing process. The Dentca is the only one out of four systems can fabricate the digital dentures in additive manufacturing by 3-D printing concept. Without the try-in denture optional visit, the insertion of dentures can be made in 2 clinical sessions.

The patient data acquisitions in Ceramill FDS are recorded as the traditional method in 2 dental visits, which consists preliminary impressions, fabricate custom trays, border mold with functional impressions, construction of occlusal rims and create jaw relationship. In addition, bonding the artificial teeth into the sockets of the denture base is still in the

conventional step in the laboratory workflow. While other workflows are made in digital method.

Regarding to Zirkonzahn CDs the manual steps are registered until the master models. After fabricated the master models, the clinician has 2 options to continue the procedure for complete denture fabrication either in a traditional method or digitally. The technician in the laboratory makes designing and subtractive milling technique of the dentures. Final fabrication of the dentures is made in two separated parts, which are the base of the denture and the artificial teeth.

Subsequently, the bonding agent between the two construction parts is still traditional. The insertion of the dentures requires 3 clinical sessions included the optional try-in denture visit. The Baltic Denture system has ability to fabricate the base of dentures and artificial teeth in one part. In the 1 clinical workflow session, the functional impressions and the jaw relation records are registered in the conventional method. The insertion of dentures needs 2 clinical visits in this system.

A-Additive manufacturing of 3-D Printing concept:

Clinic and laboratory workflow of Dentca complete dentures:

1- Patient data acquisition:

For the first part of the process, the proper customized maxillary and mandibular Dentca detachable impression trays are selected for the patient; the next step is making the definitive impressions for both arches with heavy- and light-body polyvinyl siloxane (PVS). Once the definitive impressions are made the posterior detachable parts of the trays need to remove. Measure the upper lip to provide more information in Dentca software to facilitate the location for upper incisal display. The occlusal vertical dimension and centric relation are usually recorded by using maxillary tracing table, mandibular pin and Dentca jaw gauge with the impressions after the posterior section of upper and lower Dentca impression were removed by No.15 scalpel blade. Subsequently, these three processes are transferred digitally.

2- Processing of computer-aided design:

At the laboratory, the definitive impression is scanned using the Dentca CAD software (Pre Form 1.9.1) through the source of the light (Laser) and receptor in the computer. The computer can calculate three-dimensional data from the image of the receptor unit. After recording the impression of both jaws, a 3-dimensional image is generated, and then the practitioner enters data to produce maxillomandibular virtual edentulous ridges using CAD software and at the same time the technician can improve the lip length, as well as teeth arrangement or set up virtually. The program allows protrusive & excursive movements to give the technician ability to deal with occlusal interferences. The CAD software program has supports Library teeth, with which the technician can select the full shape of the teeth. Finally, all the data that is designed can be stored in data file formats.

3- Processing of computer-aided manufacturing:

When the design of the complete dentures is completed, the computer aided design software transfers the virtual dentures to the 3-D printer to fabricate the trial (prototyping) dentures. In the second clinical appointment (optional), it's critical to evaluate the function, phonetic and esthetics of trial dentures in the patient's mouth. Once the dentist approved and the patient was satisfied, the third clinical appointment, to finalizing the definitive digital dentures is used a Dentca 3D printer (Form 1, Formlabs) being joined together layer-by-layer by using stereolithography (SLA) technology. Initial printing the resin bases of Dentca denture (Dentca Inc) by select the proper pink shade after that, the resin Dentca denture teeth are printed individual possible in Vita shades. Once both printed, the denture base and the teeth are bonded using a light-cured bonding agent (Dentca Inc). Finally CAD/CAM complete dentures are delivered and the routine follow-up visits are necessary to evaluate the dentures.

B- Subtractive manufacturing of semi-digital concept

Clinic and laboratory workflow of Ceramill complete dentures:

1- Patient data acquisition:

In the first and second appointments, make preliminary impression then, as the sequence processing the laboratory fabricate the custom trays. Function impressions (Impregum Penta, 3M Espe, Seefeld) are recorded using customised impression trays border molding design for the patient; following step the lab technician will pour the conventional master models to fabricate the wax rims, it's being used to record the vertical occlusal dimension (OVD) as well as the central relationship, along with the midline, the position of the canines, and the smile line. The face-bow is used to transfer the record with wax bite registration, besides the lab technician will mount the master models on an Amann Girrbach articulator.

2- Processing of computer-aided design:

At the laboratory, 3-dimensional (3-D) strip light scanner (Ceramill Map400, Amann Girrbach) is used to scan the definitive master models additionally; another scans for occlusal rims in mounted master models are attached to (Ceramill Transfer-kit, Amann Girrbach). The data is imported to a software program (Ceramill Mind/D-Flow, Amann Girrbach) to design the digital complete dentures. The software virtually shows the master models in Articulator. The design of

the complete dentures begins by identifying the proper anatomical landmarks points, virtually in the model surfaces. The software will be virtually using these landmarks calculated to measure the teeth arrangement lines in both arches. In the model analysis characteristic points and lines like the midline and location of the frontal upper jaw incisors will mark virtually. By sagittal view the labial surface limit is designed and the virtual teeth set-ups are stored in the library of software with several manufacturers. The software setup the virtual teeth by automatic according to space available between the upper and lower alveolar ridge and according to the determined dimensions of each jaw as an output of the virtual model analysis. In the software lab technician has ability to alignment ideal front teeth-to-teeth relationship according to the desired functional and aesthetics. Once the teeth are complete set up, the software performs automatically creating denture bases and gingiva-forming tool. If it's needed any changes like the length of papillae contours of gingival and thickness of denture base by using different setting tool options.

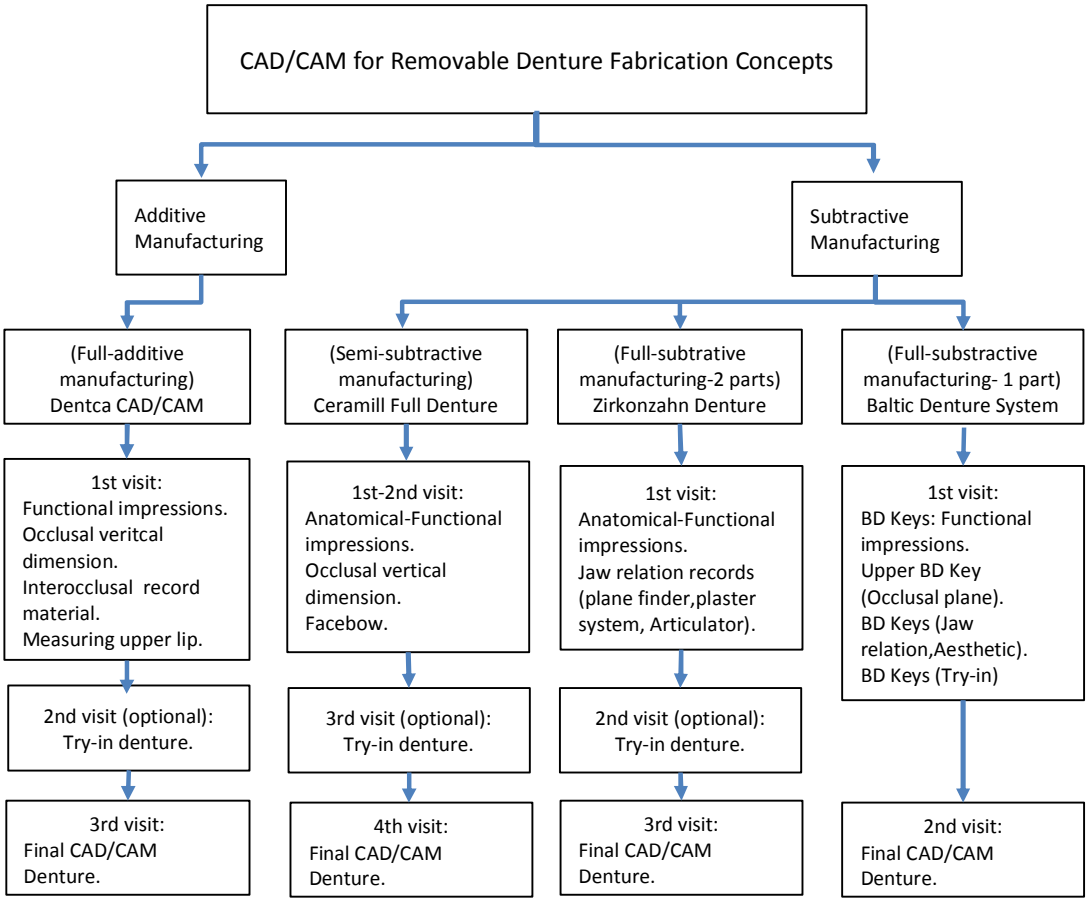

Figure 1. The digital workflow system with the number of patient visits.

Table 1. Overview of CAD/CAM denture systems.

System	Company	Software	Manufacturing
FotoDent Denture	Dreve Dentamid GmbH	Software CAD	Additive-DLP technique
AvaDent Digital Dentures	Global Dental Science	Avadent Connect	Substractive technique
Digital denture	Ivoclar Vivadent AG	3shape	Substrative technique
Vita Vionic	Vita Zahnfarbik	Exocad	Substrative technique
Pala Digital Denture	Heraeus Kulzer	3D Software	Additive-3D printing technique
Digital Dentures	Dentsply Sirona	Avadent Connect	Substractive technique

3- Processing of computer-aided manufacturing:

Once the virtual design for complete dentures has confirmed by a clinician's. The CAM processing begins by send the virtual design data to the 5-axis (5X) milling machine in the wet condition with the (Ceramill Motion 2, Amann Girrbach). The dentures bases were made from gingiva-colored wax blanks (Ceramill D-Wax; Amann Girrbach). Then the denture bases are removed from the blank holder with enlarged recess. Subsequently, the bottom surface of the denture teeth will be milled. For this a special teeth blank (Ceramill D-set) is used. A set of blanks for all 24 teeth were fixed in the milling machine and the teeth at which basal reductions are necessary will milled in accordance to the prior recess milled in the denture bases to be able for adaptation. The denture teeth for Cermill CAD/CAM are removed from the blanks and waxed on sockets teeth of the denture bases. Third appointment the try-in dentures are fabricated in setting-up wax to evaluate the perform, aesthetics and phonetics intraorally. In the fourth appointment, after the production of the final resin prosthesis, insert and control the CAD/CAM complete dentures with follow-up appointments.

C- Subtractive manufacturing of full- digital concept with two separated units construction

Clinic and laboratory workflow of Zirkonzahn complete dentures:

1-Patient data acquisition

During the first appointment at the dental clinic, preliminary impressions are made in order to fabricate custom trays. Then, functional upper and lower jaw negative impressions are made utilizing the custom trays realised beforehand. Once the master models are available, the jaw relation records of the patient can be obtained in two methods: either through the traditional method (by mounting the master models in any laboratory articulator using the face bow) or through the PlaneSystem® by Udo Plaster and the PlaneFinder® to articulate the master models in the articulator PS1.

The PlaneSystem® offers two possibilities as well:

1. Analogue approach (with the PlaneFinder® and the PS1 articulator): The casts are mounted in the analogue articulator and transferred into the virtual articulator by scanning them.

2. Digital approach (with the PlaneFinder®, the PS1 articulator and the FaceHunter): The casts are positioned in the virtual articulator and transferred into the physical articulator for a final check by milling the JawPositioner.

It is also very helpful to scan the patients' face using the Zirkonzahn FaceHunter, which makes the prosthesis design easier and more precise.

2-Processing of computer-aided design:

At the laboratory, the dental technician starts his job with a documentation of the patient's case and creates then a complete denture in the Zirkonzahn. Software. Using the scanner (S600 ARTI, S900 ARTI or S300 ARTI scanner by Zirkonzahn) he scans the master models with and without the PS1 articulator. In the following step, he transfers these virtual models of edentulous ridges and the PS1 articulator to the Zirkonzahn software in order to determine the occlusal plane, which is necessary for the teeth set-up. During the designing phase in the software, (Zirkonzahn. Modifier), the dental technician can personalise many parameters of the models digitalised beforehand. After that, he chooses the full denture's teeth from the Zirkonzahn Heroes Collection virtual tooth library, which also comprises rooted teeth. He performs the set-up based on the AIDA tooth forms by means of the Denture function in the Zirkonzahn software. This function immediately positions the teeth based on the selected Plaster Plane, which is available in three different sizes. For an aesthetic purpose, the dental technician can manually customise the tooth axes and the teeth's contact relationship in the software.

The dental technician also freeform the teeth to get an individual shape or to make some aesthetic corrections.

In this context, it is helpful to have some 2D pictures or some 3D face scans to get aesthetic and high-quality prostheses.

When the teeth are set-up in the proper position, the design software will suggest to mark the denture margin. In the next step, the software incorporates the defined margin automatically and the denture bases and the gingiva are created. In addition, the software allows the user to manually customise gingival characteristics, e.g. gingival strength, smoothness, papillae contours and thickness.

Like the teeth, also the gingiva can be free-formed by the dental technician in order to get a nice anatomic shape.

After that, the software automatically creates the denture base (gingiva) with dies or without dies (alveolus) and according to that it also creates the crowns (artificial teeth). Then, the prosthesis is ready to be milled.

If the user mounted the models virtually, the technician mills also a JawPositioner to find the correct position of the upper jaw in the analogue articulator.

3- Processing of computer-aided manufacturing:

Once the denture has been designed and virtually approved, the user can mill a wax trial denture to assess the clinical parameter outcomes and make adjustments if needed. Before the milling process, the dental technician positions the denture bases with recesses or dies and the artificial teeth in the Zirkonzahn. Nesting software. The CAD system allows the registration of the tissue- and tooth-cloured blanks in two optional methods, by webcam via the QR code (in this case, the software automatically knows all the blank information) or manually, by typing in all blank information. For the artificial teeth, the Multistratum® Flexible resin, which has a 10-year durability can be used for the patient's mouth.

To fabricate the complete denture, i.e. the denture bases and the individual teeth, in just one milling process, the M4 Wet Heavy Metal milling unit is used, since four blanks can be inserted at once (if both upper- and lower jaw have to be made). Of course, the dental technician can also use the M1 or M5 machines to mill the dentures, but with these machines he has to mill one blank after another.

In the following step, the dental technician checks the occlusion of the CAD/CAM denture in the Zirkonzahn PS1 articulator. Then, he polishes the denture bases and the artificial teeth, usually by using the light-curing unit to bond the individual teeth to the dies or recesses of the denture base.

At the second clinical appointment, the digitally fabricated denture is already placed through the patient's mouth or even fit the denture, its aesthetics, function and the phonetics are checked. The patient needs routine follow-up after the insertion of the restoration.

D- Subtractive manufacturing full- digital approach with single-unit construction:

Clinic and Laboratory workflow of Baltic complete dentures:

1- Patient data acquisition:

The system has special[BD] KEY®Set components (Merz Dental GmbH). These components are available in three adjustable arch trays (Small, Medium and large) fixed to different morphological teeth.

In dental practice the clinician begins the procedure of Baltic denture by selecting the proper size and shape of upper and lower BD KEY then, use a prefabricated record base to determine the vertical occlusal dimension from the patient. The Upper BD key is attached to the BD key plane in the patient mouth to check the parallelism of the occlusal plane with the Camper line and interpupillary line. Vertical line component (BD key Fin) registers the facial midline. In the next step, remove the BD key plane to insert the both upper and lower key to evaluate aesthetic property of the teeth, occlusion relation and lip support. Function impression with interlocked dental arches of upper key and lower BD key can be taken with thermoplastic (BD impress®, Merz Dental GmbH) followed by light-body silicone impression material to reach the ideal fit and bite registration.

2-Processing of computer-aided design:

Once the clinician sent the data acquisition to the dental laboratory. The dental technician begins the digitalize process by scanning the impressions and the bite registration by 3D scanner. Subsequently the data are imported into the [BD]Creator®Plus software then, the computer design begins by mark anatomical landmarks in virtual upper and lower model analysis such as borderline, alveolar ridge line and alveolar midpoint. In the next step, construct the teeth alignment by individual adaptations of the occlusal plane, face center and row of teeth. The technician measures the spacer between upper and lower jaws and thickness of virtual denture. Finally, the BD denture in software generated completely. After the design is approved, the data are transferred to CAM software to begin with milling process.

3- Processing of computer-aided manufacturing:

The base material of [BD]Load (milling blanks) is made of cross-linked polymethyl methacrylate (PMMA) and several sizes and shapes are available. The anterior dental arches consisting four-layer tooth (Polystar® Selection EDITION Merz Dental GmbH) and posterior teeth with three-layer tooth (DeltaForm® -Merz Dental GmbH).

Once the milling blanks are clamped in the CAM machine, the Merz Dental fabricates the CAM denture on a high-performance computerized numerical controlled milling machine.

Follow-up clinical appointments of the CAD/CAM denture in the patient mouth are similar of placement of conventional complete denture.

4. Discussion

The traditional complete dentures concept taught in Prosthodontics curriculum at the Medical University of Freiburg, Department of Prosthodontics, the patients' needs to delivery of complete dentures five clinic visits consists of preliminary impression, definitive impressions, jaw relationship records, try-in and final dentures [22]. When comparing CAD / CAM innovation for manufacturing full dentures seems to have obvious advantages for denture by minimization of treatment appointments, increase in the denture quality due to the improved physical properties of the acrylic resin base, reduced shrinkage during polymerization [23, 24].

Moreover, in the case of denture deterioration, lost or unsatisfactory with parameters of denture quality, the commercial manufacturers of complete

digital dentures, unlike traditional methods for complete denture manufacturing, have an optimal opportunity to adjust and duplicate the dentures from the data stored in the CAD software.

In this investigation of the CAD/CAM complete denture manufacturers; the rubber material only used for digitalization the impressions. This is because the rubber impressions had greater accuracy compared to alginate impressions [25].

In nowadays world, the CAD / CAM companies reported many different concepts to fabricate the digital dentures range either semi or fully digital production with one or two parts. In each system, there are advantages and disadvantages through manufacturing that makes the practitioner confounded by choice. So, it is significant to analyze the clinical and laboratory workflows before the beginning the procedure [26-28].

In our present study, each system has exclusive prepolymerized blocks of acrylic resin for milling process, except the Dentca system, which implements a fabrication protocol from a 3D printing of the denture bases and teeth with available different shades.

In the digital method of Dentca CAD/CAM dentures (Dentca Inc, Los Angeles, CA, USA) require three clinical visits for the production of digital dentures. The second appointment is optional for a try-in denture and dependent on clinician preference, but highly recommended for new clinicians to evaluate the dentures' fit and esthetics. This system provides a kit that includes different sizes of customized impression trays with adaptable pins, tracing table (EZ-Tracer), jaw gauge, and lip ruler. The final impressions, centric relation, vertical dimension, and bite registration should be made in the first clinical session on the same arch trays. For some dental practitioners, it might be difficult to achieve proper records; therefore, clinical training is recommended [15]. One of the advantages of the Dentca denture system relative to conventionally fabricated complete dentures is that all clinical records can be obtained during a single patient visit and the denture can be inserted at the next clinic appointment.

Regarding the Ceramill® Full Denture System (FDS, Amann Girrbach AG, Koblach, Austria), the final denture can be fabricated in four clinical appointments, or in three sessions if the clinician omits the trial denture appointment, which is preferable to increase convenience for both the dentist and patient. Conventionally, the digital workflow from wax-up to try-in begins in the laboratory from scanning to denture design and milling. The machine only fabricates the base of the dentures by milling/cutting to form the desired denture [29, 30]. The setup of the teeth is made using conventional processing techniques, which are not CAD/CAM manufactured. Therefore, this system is easy to learn chairside in the clinic.

For the fabrication of dentures, three clinical visits will be needed the Zirkonzahn Denture System (Zirkonzahn, Gais, Italy). Clinicians can decide whether they would like to use an optional clinic appointment with a simple wax-up denture to evaluate phonetics, esthetics, and function, or whether they prefer to reduce the clinical chair time by the creation of the definitive complete denture in only two clinical appointments. The system offers two techniques (CR and OVD) to facilitate the data acquisition and to transfer the digital data into a software program by either conventional processing or digital records. The two-day course of denture fabrication is recommended by the manufacturer to avoid any misinterpretations. The main advantage in this system is the ability to fabricate the denture using full milling technology, which reduces the laboratory worktime for the dental technician.

In the approach with the Baltic Denture System (Merz Dental GmbH, Lütjenburg, Germany), the clinicians require two clinical visits to fabricate the final digital full denture. The system mills the denture in one piece together with artificial teeth [31]. This can eliminate the disadvantage of the time- and material-consuming stage of bonding commercially obtained artificial teeth into the sockets of the denture base. A significant advantage of this system is that there is no requirement for the clinical trial denture session, which can be evaluated following the measurement of maxillomandibular relationships by ^{BD}keys.

5. Conclusion

Manufacture of full dentures utilizing CAD / CAM innovation has become more remarkable in the age of digitized dentistry, even for dentists who have less denture experience, due to several inherent advantages such as storage capacity of the denture digital data in CAD, reduced or no resin polymerization, and final denture production and delivery in two clinical sessions. In this study, the manufacturing clinical concepts and techniques are distinct for each system, which facilitates the clinicians' ability to choose their preferred system for digital denture fabrication. Continuous futuristic vision of digital technology in the field of dentures is important to improve the clinical and laboratory performance of denture fabrication and to provide more convenience for both dentists and patients.

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