Case Report: Digitally Milled Complete Denture

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***Abstract*—Digitally milled complete denture has made revolution in prosthodontics which focused on manufracture and design. This case report discusses a combination of conventional and digital approach for making a complete denture, aiming to improve both time and cost. The digital workflow is a clinical and laboratory process that starts with making impression digitally of edentulous jaw and construction of denture using CAD/CAM software. The main goal is to focus the benefits of digital dentistry in relation to complete dentures. Conventional materials used in making complete dentures, such as monomers, can cause hypersensitive reactions in some patients regardless of how they are cured, due to the potential cytotoxicity of residual monomer.**

I. INTRODUCTION

Digital technologies have become an integral part of complete denture restoration. With advancement in computer-aided designand computer-aided manufacturing (CAD/CAM), tools such as intraoral scanning, facial scanning, 3D printing, and numerical controlmachining are reshaping the workflow of complete denture restoration**.** Intra oral scanners are used for recording edentulous rigdes and supporting structures after which occlusal vertical dimension is assessed.

With this CAD/CAM technology, only 2 appointments are needed forpatients to get their complete dentures. After impression taking we can use CAD/CAM software for jawrelations, occlusal plane orientation, tooth mold and shadeselection, and maxillary anterior tooth positioning could befinished for the fabrication of complete denture [1]. The milling approach is a method of fabricating dentures by removing materials from prepolymerized PMMA block to form the desirable shape. Milled dentures possess has superior mechanical qualities over conventional complete dentures due to the absence of polymerized shrinkage resulting in better retention [2]. The residual monomer content of PMMA block was lower than that of heat-polymerized PMMA because the block was completely polymerized in a high-pressure condition [3]. Milled maxillary complete dentures have been reported to be preferred by both dentists and patients.[4]. The principal disadvantage of milling is a waste product, as a large portion of the blank is left unused and wasted during the process.

II. CASE PRESENTATION

A 60-year-old female patient who was completely edentulous visited the Department of Prosthodontics.Her teeth had been removed four years ago due to dental caries, and she had been using a complete removable denture since then. No systemic pathologies were reported, and clinical examination showed a significantly reabsorbed residual ridge with no other mucosal changes. Based on clinical and radiographic evaluation, a digitally milled complete denture was chosen as the treatment plan. Preliminary impressions were made using impression compound and stock impression trays. Gypsum type III was poured to create preliminary casts. The preliminary casts were scanned; custom trays were designed and 3D printed using light-polymerizing PMMA resin. The clinician performed border molding with impression compound and the final impression with zinc-oxide eugenol paste. After boxing the impressions, master casts were made in gypsum type III and digitally scanned. Palatal sealing was done on the cast before scanning the definitive cast. Then, baseplates were

designed and 3D printed using light-polymerizing PMMA resin, and wax occlusion rims were made with modeling wax. The patient's labial fullness and occlusal plane were assessed, aesthetic lines were drawn on the wax rim, and the occlusal vertical dimension and jaw position were recorded. This allowed for the completion of the occlusal registration, preserving the existing occlusal vertical dimension. The teeth try-in was sent to the laboratory, where the jaw relation record was scanned using the Zirkonzhan scanner. Teeth were selected from a digital library, and the lines drawn on the wax rims were set using a modulation software program. A facial scan was also taken using a facial scanner with the patient at rest, smiling, and in occlusion. The facial scan provides information about the size and shape of the teeth, the amount of tooth exposure, the midline, and the correct buccal corridor. After obtaining the facial scans, the master casts and jaw relation records were superimposed. Using another 3D printer, a teeth try-in was produced with a light-cure resin. After printing, the try-in was ultrasonically cleaned with 99.5% isopropyl alcohol for 15 minutes and placed in the LC-3D Print Box for final photopolymerisation.

After acquiring the virtual cast and articulated at the Occlusal Vertical Dimension (OVD) and digital teeth selection and setting is done. The collected information were introduced into CAD/CAM software for making digital oThis program processed the occlusal adjustment using a virtual articulator. It increasingly enabled the creation of more precise denture teeth by simulating mastication with the virtual articulator.Subsequently, the resulting data were exported to a 5-axis milling machine for the denture fabrication process. The denture base was milled from a Pink Polymethyl Methacrylate (PMMA) disk. The denture teeth were also milled from PMMA disks using the same milling device and fine milling tools. Following their separate fabrication, the milled teeth were securely affixed to the milled denture base sockets using a PMMA-based bonding material (Ivotion Bond Kit 10, Ivoclar Vivadent).The try-in was evaluated in the patient, and a few minor clinical adjustments were made, particularly in occlusion. Once the try-in was aesthetically and functionally validated, the tooth color was selected with a conventional tooth shape guide (Vita Zahnfabrik), and the try-in was sent to the laboratory to finish the denture. In the laboratory, the try-in was scanned, and the dentures were printed using a resin for crowns and color A2. After cleaning, the dentures were exposed to a final photopolymerization in an LC-3D Print Box for 10 minutes [5].

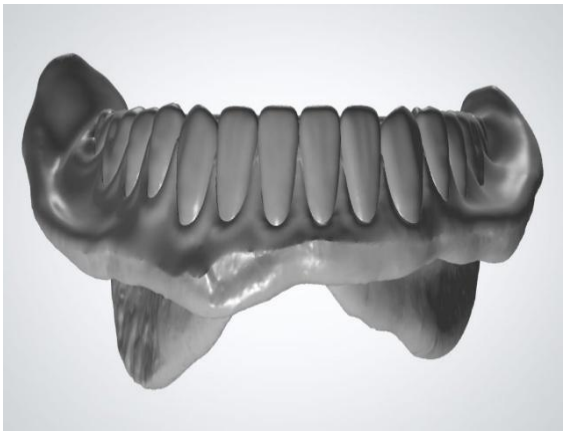
After the denture fabrication, the digitally fabricated maxillary and mandibular denture was inserted. Only minimal chairside adjustments needed for the internal surface, borders, and undercut areas of the denture,and it can also be lined with a soft tissue conditioning material (Coe-Comfort). The denture base exhibited excellent retention. The patient experienced no difficulty with mastication and expressed satisfaction with the esthetic outcome of the denture.

PRIMARY IMPRESSION

SECONDARY IMPRESSION

DIGITAL MAXILLARY DENTURE

DIGITAL·MANDIBULAR· DENTURE¶



DIGITALLY MADE COMPLETE DENTURE

POST OPERATIVE VIEW

III. DISCUSSION

Recent advances shows that CAD/CAM technology may offer or betterresults than conventional methods, including better fit of theintaglio surfaces, improved mechanical TRIALproperties, and higherpatient satisfaction[6].However, complications such as pain or tenderness are similar to those in traditional dentures[7].Milled CD bases offer better tissue surface adaptation and less tooth movement compared with conventionally fabricated ones, as they are not affected by polymerization shrinkage[8].This leads to higher retention, fewer traumatic ulcers, and reduced monomer release. Improved resin properties like increased density, flexural strength, color stability, stain resistance, and reduced *Candida albicans* adherence[9].Compared to conventional dentures, CAD-CAM dentures have been found to have reduced resin volume and weight, which can increase patients' comfort and adaptability[10].The disadvantage of milling a denture is that a large portion of the blank remains unused and is wasted during the process and they are more expensive compared to 3D-printed dentures[9].However, it has been reported that

CAD/CAM denture base resins do not generally have a higher fracture tolerance than manually processed heat-polymerizing resins[10].This denture system is presently applicable only to patients with a favorable Class I maxillomandibular relationship, which is another limitation when compared with conventional techniques [11].

IV. CONCLUSION

With the rapid advancement of digital technologies, completedenture restoration has entered a new era characterized byprecision, efficiency, and enhanced patient-centered care. Digitalprotocols have reduced clinical chairside time and elevated theoverall patient experience, marking clear progress compared totraditional methods. This expert consensus provided a structuredframework and practical recommendations regarding indications,key procedural steps, quality control, and assessment methods toassist clinicians in optimizing the application of digital completedenture restoration techniques in clinical practice[5].The present care report combines the advantages of traditional clinical methods and CAD/CAM technology for the fabrication of a complete denture[12].Digital fabrication reduces patient visits and chairside time, enhancing comfort and convenience[13].

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