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ADVANCING COMPLETE DENTURE REPLICATION WITH CAD/CAM TECHNOLOGY

Dentistry

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ABSTRACT

The replication technique is a method for replacing complete dentures as a therapeutic solution for elderly patients, where there are imposed requirements for a specific approach in rehabilitation. Replica dentures are most advantageous for physically-frail elderly patients, as their adaptive potential and neuromuscular coordination decrease with age. Replicating the polished surfaces and contours of the existing denture is a favorable aspect of this technique, facilitating adaptation and contributing to an easier transition to the new dentures. This case report details the application of Computer-aided design/Computer-aided manufacturing (CAD/CAM) technology to fabricate new complete dentures for a 72-year-old female patient, effectively replicating her familiar existing dentures while enhancing retention, stability, and occlusal vertical dimension. The digital workflow significantly reduced clinical time and allowed easy adaptation by replicating the patient's familiar denture surfaces. This approach demonstrates the advantages of CAD/CAM technology in prosthodontics, providing a better-fitting, stable prosthesis with high patient satisfaction in fewer clinical visits.

KEYWORDS

complete denture, CAD/CAM, replication technique

INTRODUCTION

Despite the availability of other treatment options, complete dentures (CDs) remain the preferred solution for edentulous patients, particularly among the elderly. The challenge of adjusting to new dentures in older adults is often linked to established reflexes and muscle memory, which become more challenging to adapt with age[1,2]. Studies show that patients who have worn the same dentures for many years, even when they no longer fit well, tend to rely on them due to the muscular control they have developed over time[3]. In this regard, the copy-denture technique presents a significant advantage for elderly patients. By replicating the polished surfaces and contours of their existing dentures, this approach preserves familiar elements, making adaptation smoother and increasing acceptance of the new dentures[4].

In recent years, digital technologies such as Computer-aided design/Computer-aided manufacturing (CAD/CAM) have revolutionized prosthodontics by providing more efficient and precise methods for replicating and customizing dentures[5-9]. Digital technology greatly aids in producing duplicate dentures by streamlining the manufacturing process and enabling rapid reproduction using a digital data repository in case of denture loss[10,11].

This case report describes the application of CAD/CAM technology to fabricate new dentures for a 72-year-old female patient who presented with well-worn dentures. The goal was to replicate the existing dentures using digital technology to preserve her preferred aesthetics while improving the prosthesis's fit, stability, and functionality.

Case Report

A 72-year-old female patient presented to the Department of Prosthodontics at the Faculty of Dentistry in Skopje, seeking a replacement set of complete dentures. She had worn her current dentures for 14 years and was generally satisfied with their aesthetics and function. However, she expressed concerns about the poor retention of her upper denture.

During the clinical examination, a decreased occlusal vertical dimension (OVD) was noted, primarily attributed to denture wear. The intraoral assessment revealed reduced retention and stability in both dentures, a lowered OVD, and a midline discrepancy. The upper and lower arches were significantly and uniformly resorbed, yet no intraoral pathology was present.

Given these findings, the treatment plan was to fabricate new complete dentures using the digitally replicating technique with CAD/CAM technology. This approach, except for reduced clinical chair side time, aimed to improve retention and fit, increase OVD, and preserve the patient's preferred aesthetics.

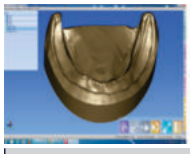
At the initial appointment, wash impressions and occlusal records were obtained using the patient's existing dentures. Wash impressions were made with a thermoplastic border molding material (Kerr Impression Compound – Green, Kerr, Switzerland) and a low-viscosity elastomeric material (Xantopren L blue, Heraeus Kulzer GmbH). Due to the instability of the existing dentures, a modified protocol was implemented, where the maxillomandibular relationship record was taken after completing the impressions. During this evaluation, the occlusal plane, OVD, horizontal jaw relationship, and midline alignment were carefully reviewed. A 2 mm layer of wax was added to the lower occlusal surfaces to achieve the predetermined OVD increase. The maxillomandibular horizontal relationship was recorded in a manually guided retruded contact position.

In the laboratory, the dentures were prepared for scanning with a scan spray (MASTERmill CAD/CAM Scanning Spray, Talladium, INC, USA) (Figure 1).

The dentures were scanned in a lab scanner (Model Smart, Open Technologies Srl.), with files converted to Standard Tessellation Language (STL) format. Additionally, the technician poured plaster into the patient's dentures to create definitive casts, which were prepared with scan spray and scanned. STL files from both the dentures in the maxillomandibular relationship and the maxillary and mandibular casts were imported into a CAD software program (Exocad, Full Denture Module) (Figure 2,3,4).

Figure 1. CD with wash impressions prepared for scanning
Figure 2. Imported scanned data into the EXOCAD software

Files from the maxillary and mandibular casts and dentures' files were aligned and superimposed digitally and combined using best-fit matching (Figure 5).



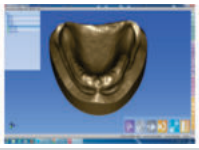


Figure 3,4. Imported scanned from the casts
Figure 5. Superimposed files

Using Exocad software, the digital dentures were virtually designed, and a 3D preview was shared for evaluation. After minor adjustments to the tooth positioning, the design was approved for fabrication.

The final dentures were fabricated from high-quality, pre-polymerized PMMA discs (Pink CAD/CAM Disc Basic, Polident, Slovenia). The selected teeth from the Exocad denture library were milled from a monocolor polymer block with retentive forms for interlocking with the denture bases. The teeth were manually bonded into the milled recesses in the denture base (Figure 6.).

Figure 6. Definitive complete dentures

Upon placement, a comprehensive clinical evaluation was conducted, assessing fit, retention, stability, occlusal alignment, aesthetics, and phonetics. Occlusion was verified with articulating paper, and minor chairside adjustments corrected a few premature contacts. The excellent fit was confirmed using pressure-indicating paste, and the digital dentures met all clinical expectations.

On routine follow-up appointment after two days post-placement, the patient expressed satisfaction with the aesthetics, function, and comfort of her new dentures from the first moment, affirming a successful outcome.

DISCUSSION

The objective of replacing the complete dentures with enhanced versions of the existing well-worn ones using CAD/CAM technology was successfully met. The result was a set of complete dentures that offered increased retention, restored OVD, enhanced aesthetics, a minor correction of the midline discrepancy, improved chewing efficiency, less clinical chair time, and fewer visits for fabrication.

Lately, there has been a rise in reports detailing digital methods for producing duplicate dentures in the literature[12,13]. Dental cone-beam CT imaging, portable optical scanners, and intraoral scanners were introduced to replicate complete dentures[7,8]. The presented method combines the conventional impression-taking method with CAD/CAM technology. By scanning the existing dentures, the CAD/CAM process allowed precise replication of polished surfaces and tooth positioning, along with controlled adjustments to tooth arrangement and increased OVD.

Further studies are needed to confirm the potential benefits of the duplication technique in reducing chair time and lowering costs, which could benefit patients, their families, and general dentists. While digital methods promise to create precise duplicate dentures efficiently, challenges remain. As innovations in digital technology continue, digital methods could become the preferred standard for denture replication, offering improved reproducibility and ease of use[14]. Ultimately, these improvements would make high-quality denture duplication more accessible and practical across a broader range of dental practices.

CONCLUSION

Introducing digital workflow in replicating complete dentures offers several benefits over traditional methods. It reduces the number of patient visits and the time spent in the dental chair. Additionally, storing digital data in the database enables quick fabrication of spare or replacement dentures. The outcome of the present technique demonstrates the effectiveness of digital denture replication in achieving high patient satisfaction and improved clinical results.

REFERENCES

1. Clark RK, Radford DR, Fenlon MR. The future of teaching of complete denture construction to undergraduates in the UK: is a replacement denture technique the answer? Br Dent J 2004;196(9):571-5.
2. Panchevska S, Elenchevski S, Janeva N, Mijoska A. Satisfaction of complete denture wearers; Med Pregl 2018; LXXI (7-8):247-249.
3. Habib, S.R.; Vohra, F.A. Replacing existing dentures by copy-denture technique for geriatric patients: A case report. J Pak Dent Assoc 2013; 22:265–270.
4. Yemm R . Replacement dentures: no friends like old friends. Int Dent J 1991; 41: 233–239.
5. Fekri LK, Abdelaziz MS. Digital duplication of maxillary complete denture: a dental technique. J Esthet Restor Dent 2023;35:1139–43.
6. Yang Y, Yang Z, Lin WS, Chen L, Tan J. Digital duplication and 3D printing for implant overdenture fabrication. J Prosthodont 2021;30(S 2):139–42.
7. Ammoun R, Bencharit S. Creating a digital duplicate denture file using a desktop scanner and an open-source software program: a dental technique. J Prosthet Dent 2021;125:402–6.
8. Kurahashi K, Matsuda T, Goto T, Ishida Y, Ito T, Ichikawa T. Duplication complete dentures using general-purpose handheld optical scanner and 3-dimensional printer: introduction and clinical considerations. J Prosthodont Res 2017;61:81-6.
9. Oyamada Y, Yonezawa Y, Kondo H. Simple duplication technique of completedenture using an intraoral scanner. J Prosthodont 2021;30:458–61.
10. Goodacre CJ, Garbacea A, Naylor WP, Daher T, Marchack CB, Lowry J. CAD/CAM fabricated complete dentures: concepts and clinical methods of obtaining required morphological data. J Prosthet Dent 2012;107:34–46.
11. Infante L, Yilmaz B, McGlumphy, Finger I. Fabricating complete dentures with CAD/CAM technology. J Prosthet Dent 2014; 111:351-355.
12. Takeda Y, Lau J, Nouh H, Hirayama H. A 3D printing replication technique for fabricating digital dentures. J Prosthet Dent 2020;124:251–6.
13. Yoda N, Yoda N, Abe M, Yamaguchia H, Tanoue N, Yamamori T. Clinical use of duplicate complete dentures: A narrative review. Japanese Dental Science Review 2024; 60:190–197.
14. Baba K. Database-driven prosthodontics-future of digital dentistry. J Prosthodont Res 2021; 65:vi–vii.