https://doi.org/10.54361/ajmas.269436

Case report

Retention of Digitally Duplicated Maxillary Denture After Clinical Relining: A Case Report

Jamila Almuhamadi*, Rayan Aljama, Malak Nesrat, NajmUdin Nusrat

Department of Dental Technology, Faculty of Medical Technology, Alzawia University, Alzawia, Libya
***Corresponding email.** j.almuhamadi@zu.edu.ly*

Abstract
Retention of maxillary complete dentures is critical for prosthetic success and patient comfort. Recent advancements in digital technology, particularly intraoral scanning and 3D printing, have introduced denture duplication as a promising alternative to conventional techniques. However, clinical evidence regarding its impact on denture retention remains limited. To evaluate the retention of a digitally duplicated maxillary complete denture fabricated using intraoral scanning and 3D printing, with particular emphasis on the effect of incorporating a clinical relining step into the digital workflow. This case report describes the digital duplication of an existing maxillary complete denture in a 57-year-old patient. The patient presented with an old denture that was clinically acceptable. Initially, duplication was attempted by scanning both the denture and a dental cast obtained before relining. However, the software failed to achieve accurate alignment between the scans. Consequently, a conventional clinical relining impression was performed before repeating the digital workflow. The digitally duplicated and relined maxillary denture demonstrated satisfactory clinical fit, retention, and adaptation. Incorporating the conventional relining step before scanning improved scan alignment and enhanced the overall accuracy of the digital workflow, resulting in acceptable denture retention. This case demonstrates that integrating conventional clinical relining with digital duplication techniques can overcome current limitations in scan alignment. Digital duplication of maxillary complete dentures using intraoral scanning and 3D printing represents a promising and effective approach to improving denture retention, particularly when combined with established clinical procedures.
Keywords. Digital Denture Duplication, Maxillary Complete Denture, Denture Retention, Intraoral Scanning, 3D Printing.

Introduction

Retention in prosthetic dentistry, defined as the resistance of a denture to displacement in the occlusal direction, is a key determinant of patient comfort and satisfaction, as well as clinical success. Multiple factors influence retention, including adhesion, cohesion, interfacial surface tension, gravity, intimate tissue contact, peripheral (border) seal, atmospheric pressure, and neuromuscular coordination [1]. Optimal retention requires precise adaptation of the denture base to the mucosa [2].

Clinically successful complete dentures (CDs) can be duplicated to preserve essential diagnostic information such as tooth size and arrangement, occlusal schemes, denture extension, and morphology of the denture-bearing area [3,4]. The copy denture technique also serves as a customized tray for definitive impressions, recording maxilla-mandibular relationships, and transferring aesthetic details to laboratory technicians [5,6]. This approach provides a cost-effective solution for replacing worn or lost dentures [7].

Conventional duplication involves creating a physical mold from the existing denture using elastomeric impression materials or irreversible hydrocolloids, followed by pouring wax or acrylic to replicate the prosthesis [8]. While effective, these methods are labor-intensive, time-sensitive, and prone to distortion if irreversible media are used [9].

Digital techniques, including intraoral scanning and 3D printing, offer an alternative for accurate denture duplication. However, challenges remain, including difficulties in aligning scans with master casts and uncertainties regarding the impact on denture retention. Limited clinical evidence exists on whether integrating conventional clinical relining into the digital workflow can overcome these issues. Therefore, this study aims to evaluate the feasibility and clinical outcomes of digitally duplicating maxillary complete dentures using intraoral scanning and 3D printing, with specific emphasis on the effect of clinical relining on retention.

Methods

Study Design

This investigation was conducted as a single-patient clinical case report aimed at evaluating the feasibility of digitally duplicating a maxillary complete denture using intraoral scanning and three-dimensional (3D) printing. The objective was to assess whether a digitally duplicated denture could reproduce the retention and clinical performance of an existing clinically acceptable denture. The workflow involved cleaning and stabilization of the existing denture, an attempted digital relining approach, subsequent conventional clinical relining, digital denture base modification, and qualitative clinical evaluation of the denture retention.

***Received**: 21-02-2026 - **Accepted**: 19-04-2026 - **Published**: 25-04-2026*

Patient selection

A 57-year-oldcompletely edentulous patient wearing a clinically acceptable maxillary complete denture was selected for this case report. The patient did not report dissatisfaction with denture retention, stability or comfort. The denture demonstrated acceptable aesthetics, occlusion, and functional performance. The case was undertaken to evaluate the accuracy and clinical feasibility of a digital duplication workflow rather than to address a clinical complaint. Written informed consent was obtained prior to treatment and publication.

Denture Cleaning and Stabilization

Before digital acquisition, the patient's existing maxillary complete denture was thoroughly cleaned (Figure 1.a) to remove plaque, debris, and surface contamination. To stabilize the denture and facilitate accurate scanning of the denture surfaces, the denture was positioned in a silicone mold (China), and the intaglio surface was poured with Type III hard dental plaster (MoldanoWhite, Kolzer, Germany) (Figure 1.b). The plaster was allowed to be set for approximately 15 minutes before removal. This procedure provided stable support for the denture and facilitated accurate handling and scanning.

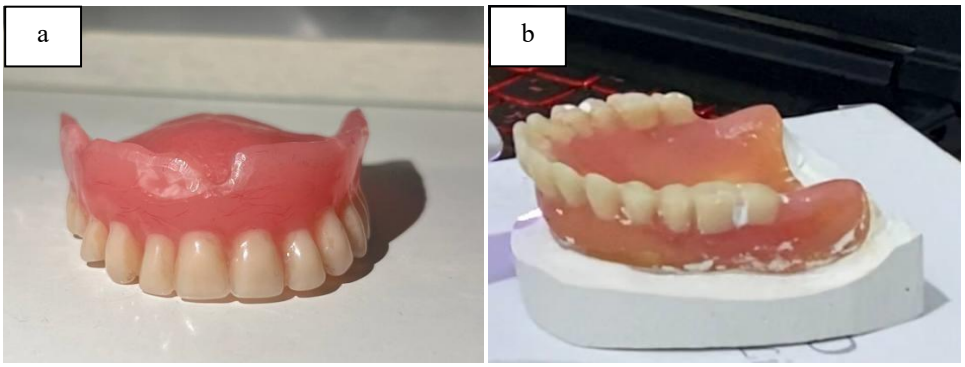

Figure 1. (a) Patient's original Maxillary complete denture, (b). The cast was poured with Type III dental plaster.

Attempted Digital Relining

An initial attempt was made to perform digital relining by scanning the cleaned denture using a Medit i700 intraoral scanner (Medit Corp, Seoul, Republic of Korea), (Figure 2a), and the corresponding plaster cast separately. This scanning process took approximately 30 minutes to complete. The intention was to digitally align and superimpose the denture and cast database to correct the intaglio surface without using a conventional impression. However, the scanned database could not be accurately aligned within the CAD software (Exocad Elefsina 3.2 software, Germany), as the denture scan and cast scan appeared as independent objects without reliable spatial correspondence (Figure 2b). Due to this limitation, digital relining was not feasible using this approach

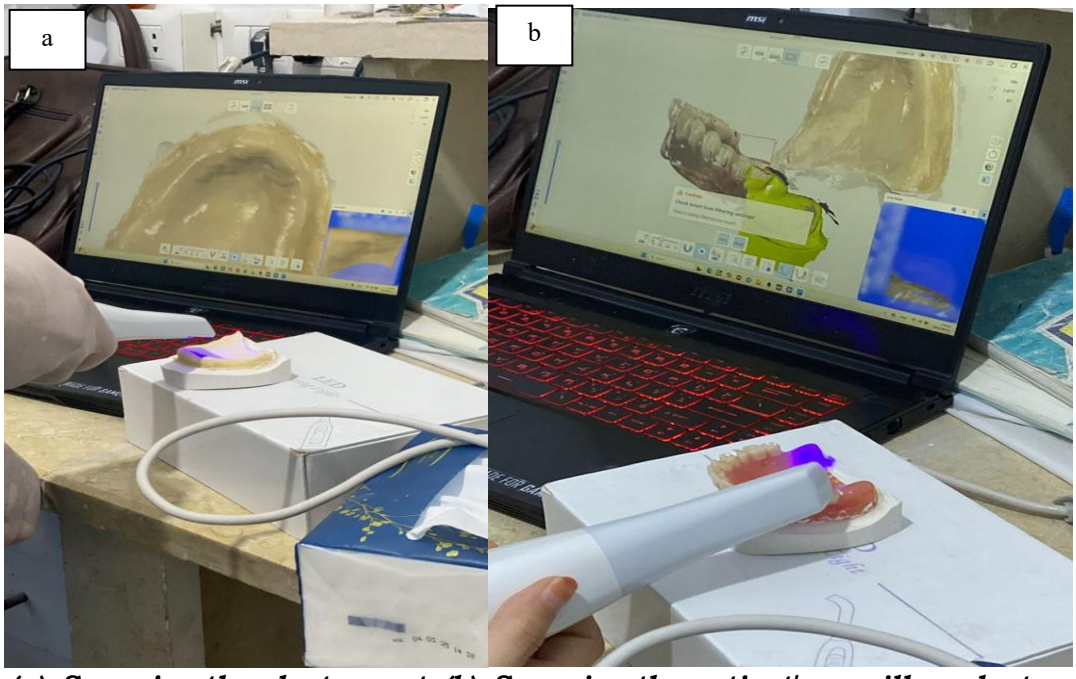

Figure 2. (a). Scanning the plaster cast, (b). Scanning the patient's maxillary denture with the plaster cast for attempting digital relining.

Received*: 21-02-2026 -* ***Accepted****: 19-04-2026 -* ***Published****: 25-04-2026*

Initial Denture Duplication and Fabrication Without Relining

The maxillary complete denture was scanned and digitally duplicated without modification, reproducing the existing denture geometry as received (Figure 3a and b). The scanned database was transferred into Exocad Elefsina 3.2 software (Germany). The artificial teeth were fabricated first using an Asiga 3D printing machine (China, Figure 4a and b)**,** with a printing time of approximately 35 minutes. This was followed by fabrication of the acrylic denture base**,** which was printed separately using Freeprint denture base material (Detax, Germany) (Figure 5a and b), requiring approximately 50 minutes of printing time. After printing (Figure 6a), the artificial teeth were cemented to the denture base using a compatible Freeprint® denture material (Figure 6 b and c).

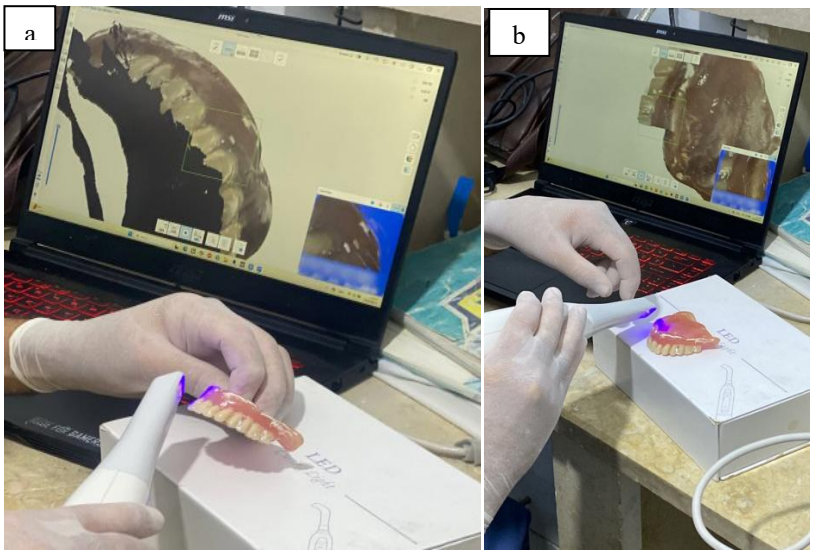

Figure 3 (a). Scanning the maxillary complete denture with existing denture geometry; anterior surface, (b). Palatal side.

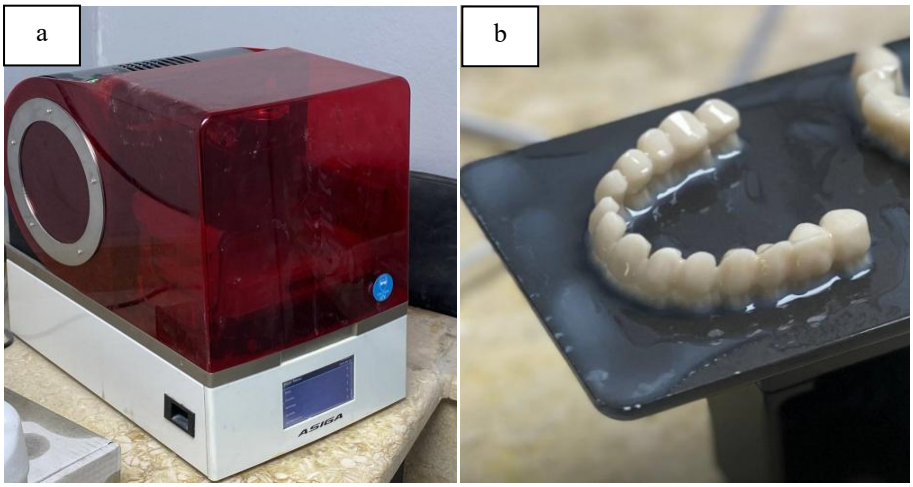

Figure 4 (a). Asiga 3D printer, (b). 3D printed teeth for the duplicated maxillary denture.

Received*: 21-02-2026 -* ***Accepted****: 19-04-2026 -* ***Published****: 25-04-2026*

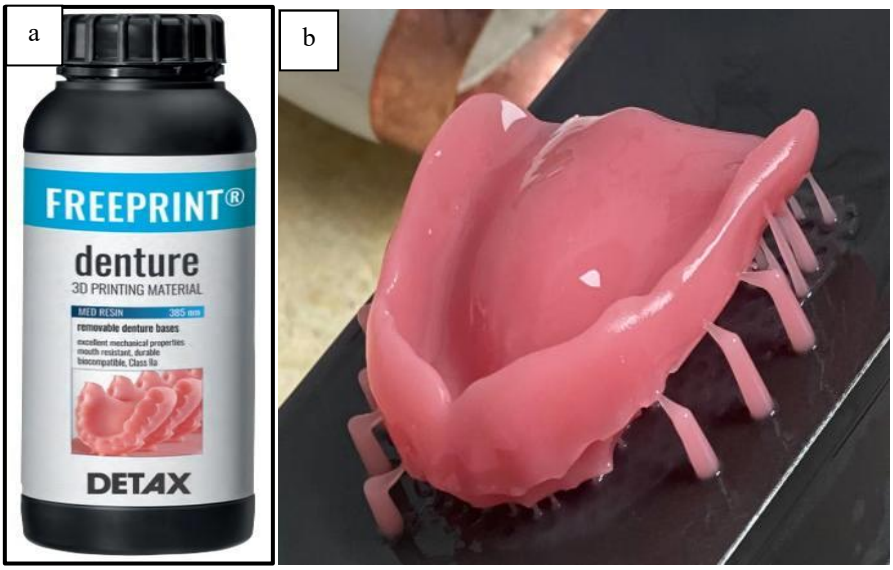

Figure 5 (a). FreePrint® denture 3D printing material, (b). 3D printed acrylic denture base.

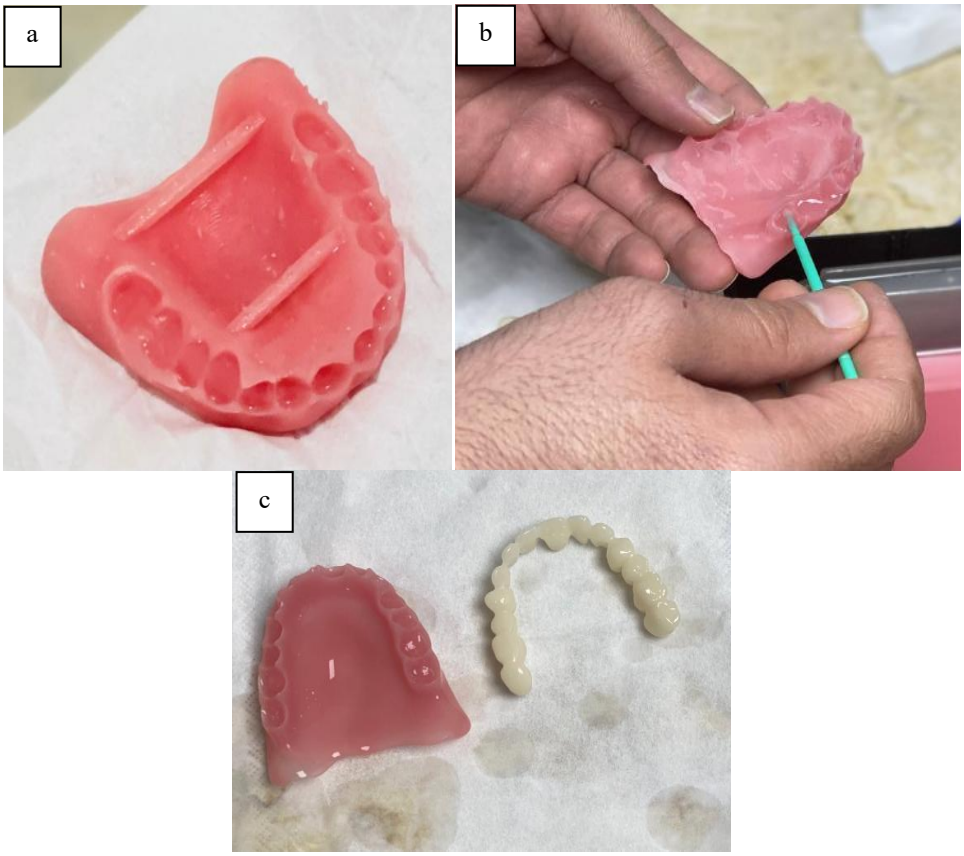

Figure 6 (a). 3D printed denture base showing teeth position and supported sprues, (b). Compatible Freeprint® denture material used for cementation of teeth, and (c). 3D printed denture base and teeth ready for cementation.

The assembled denture was then placed in a photo-polymerization (light-curing) unit (China) for final curing for approximately 5 minutes (Figure 7 a)**.** The completed denture was subsequently finished using tapered sandpaper mandrels bur (Figure 7 b) and then polished using a laboratory polishing lath (Figure 8 a) with pumice (Zhermack, Italy) followed by a fine polishing compound (Figure 8 b) to obtain a smooth and a glossy surface finish using a Hatho polishing disc (Germany).The polished denture was then ultrasonically cleaned for 5 minutes (Figure 9 a) using ultrasonic cleaning machine (China) and the final duplicated maxillary complete denture was produced (Figure 9.b).

Received*: 21-02-2026 -* ***Accepted****: 19-04-2026 -* ***Published****: 25-04-2026*

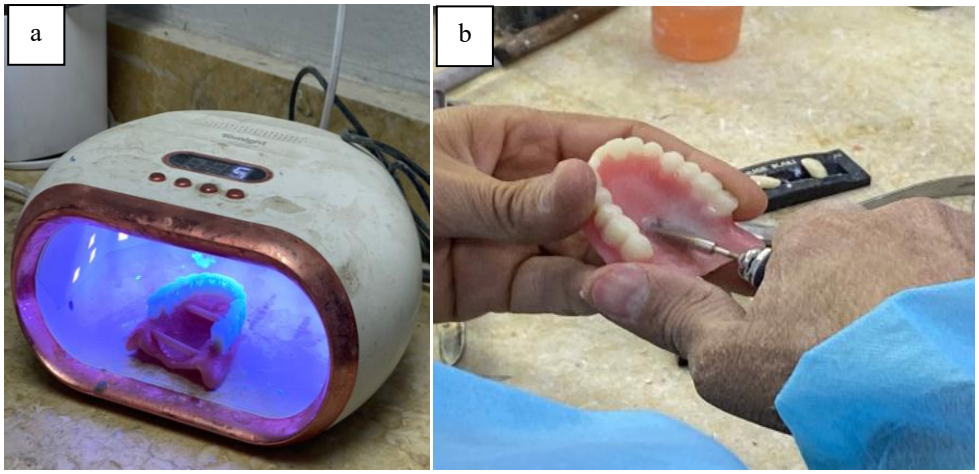

Figure 7(a). Duplicated maxillary denture in a photo-polymerization unit, (b). Finishing the duplicated denture using sandpaper mandrels and bur.

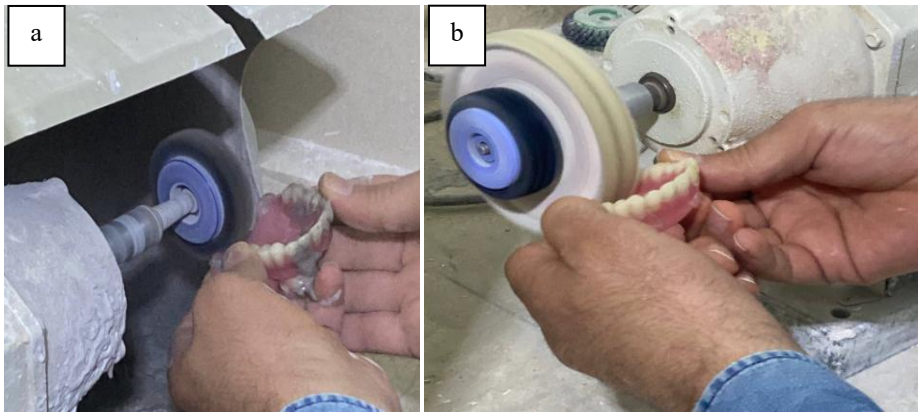

Figure 8 (a). Polishing the denture with pumice, (b). Polishing the denture with hathoa Hatho disc for a glossy look surface.

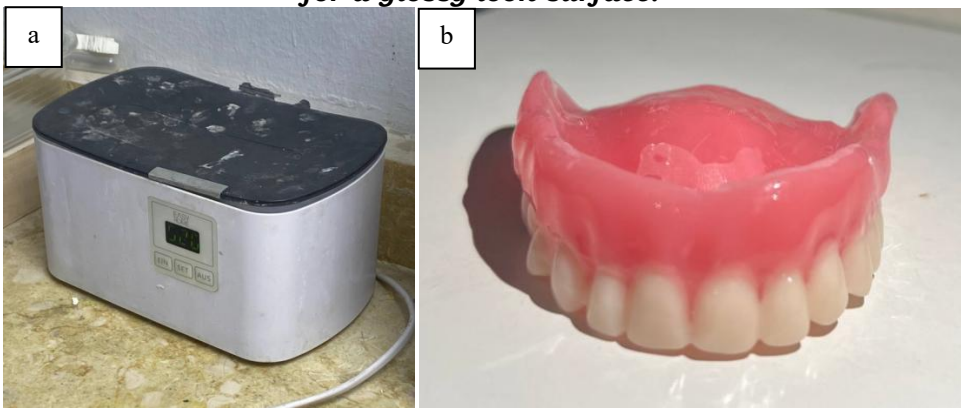

Figure 9 (a). Ultrasonic cleaning machine used for cleaning the duplicated denture, (b).The final produced maxillary duplicated denture.

The duplicated denture was then inserted for clinical evaluation. However, the duplicated denture demonstrated unsatisfactory retention and clinical performance when compared with the original prosthesis. Based on this outcome, further digital denture base modification and clinical relining were deemed necessary to improve tissue adaptation prior to final duplication.

Conventional Clinical Relining and Final Scanning

Although the existing denture was clinically acceptable. Clinical relining was performed to optimize tissue adaptation and standardize the intaglio surface before digital duplication. The intaglio surface was relieved and relined using a chair-side relining c-silicone impression material (Oranwash L (hydro compatible) and Indurent Gel (catalyst), Zhermack, Italy) (Figure 10 a) and was mixed according to the manufacturer's instructions (Figure 10 b). The mixed relining material was loaded onto the intaglio surface of the denture (Figure 11a), and an impression for relining was made intraorally (Figure 11 b). The relined denture was subsequently evaluated intraorally to confirm adequate tissue adaptation, retention, and patient comfort. Following clinical relining, intraoral scanning was performed using a Medit i700 (Medit Corp, Seoul, Republic

Received: *21-02-2026* - ***Accepted***: *19-04-2026* - ***Published***: *25-04-2026*

of Korea). The maxillary denture was scanned, followed by scanning of the relined denture, including both the intaglio (tissue) surface and the Cameo surface (the outer surface of a denture). All scans were acquired using an intraoral scanner and exported as standard tessellation language (STL) files for digital processing

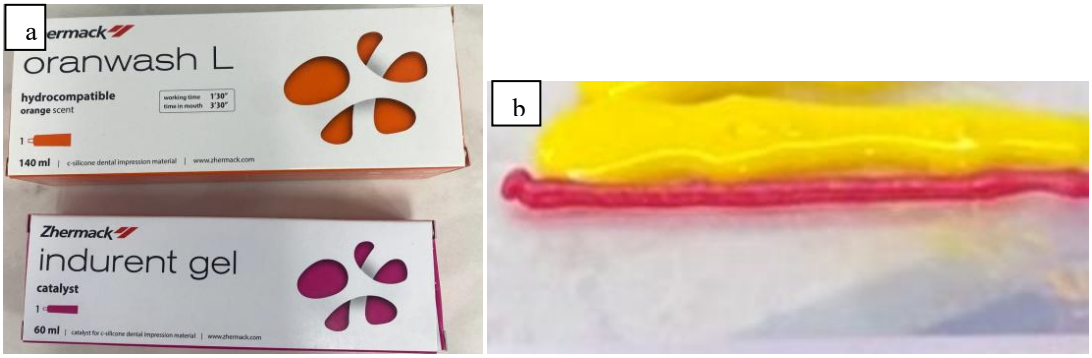

Figure 10 (a). C-Silicone impression material used for relining the maxillary denture, (b). Mixing the materials according to manufacturer's instructions.

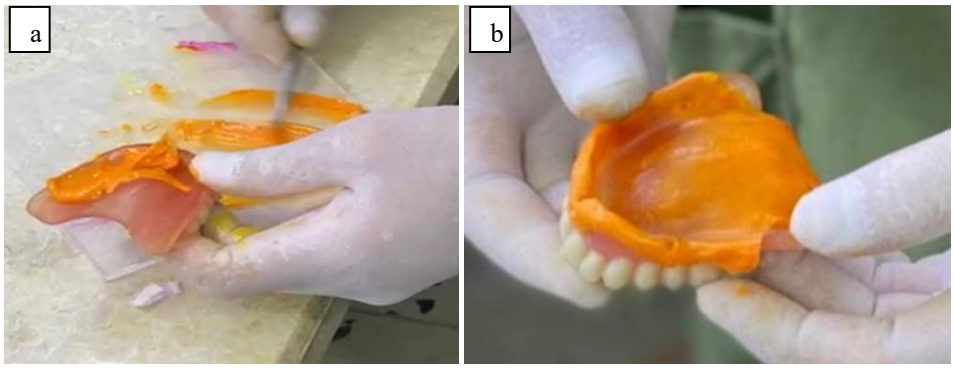

Figure 11 (a). Loading the relining material onto the denture surface, (b). Intraoral impression for clinical relining of maxillary complete denture.

Digital Duplication and Denture Base Optimization

The STL files were imported into dental computer-aided design (Exocad Elefsina 3.2) software. A digital duplicate of the relined maxillary denture was generated. Minor digital denture adjustments for the denture base were performed to refine peripheral borders and palatal adaptation while preserving the original occlusal relationships and aesthetic contours. The denture base was digitally modified using predefined surface design parameters to ensure adequate strength, accurate tooth positioning, and optimal fit. The minimum thickness of the denture base beneath the artificial teeth was set at 0.5 mm to provide sufficient support while maintaining material efficiency. The tooth pocket gap was adjusted according to the arch region, with a value of 0.2 mm in the posterior region and 0.15 mm in the anterior region**,** allowing controlled space for bonding and seating of artificial teeth. The tooth pocket blockout angle was set to 0°, and the maximum tooth pocket depth was limited to 4 mm to standardize tooth accommodation within the denture base. Additionally, undercuts within the tooth pocket were digitally blocked out to facilitate accurate tooth placement and reduce insertion difficulties during fabrication.

Final Denture Fabrication

The duplicated denture was fabricated using 3D printing technology with a denture base resin indicated for complete denture fabrication. Similar processing procedures for denture fabrication were carried out as previously described in section 3.5. Once the duplicated denture was fabricated and cleaned (Figure 12a), it was tried in the patient's mouth and evaluated for tissue adaptation (Figure 12 b and c).

Received*: 21-02-2026 -* ***Accepted****: 19-04-2026 -* ***Published****: 25-04-2026*

Figure 12 (a). Final produced duplicated maxillary denture (b). Maxillary duplicated denture tried in the patient's mouth and (c). Intraoral frontal view of the duplicated maxillary complete denture after insertion.

Clinical Evaluation

The 3D printed duplicated maxillary complete denture was inserted intraorally and clinically evaluated. Denture retention and stability were assessed qualitatively and compared with the original relined denture using the manual dislodgement test and patient feedback during functional movements. Denture stability was evaluated by applying unilateral pressure to the premolar and molar region (Figure 13a); absence of denture lifting on the contralateral side indicated adequate stability**.** A dental floss pull test (Figure 13b) was also performed to assess the retention of the duplicated maxillary denture.

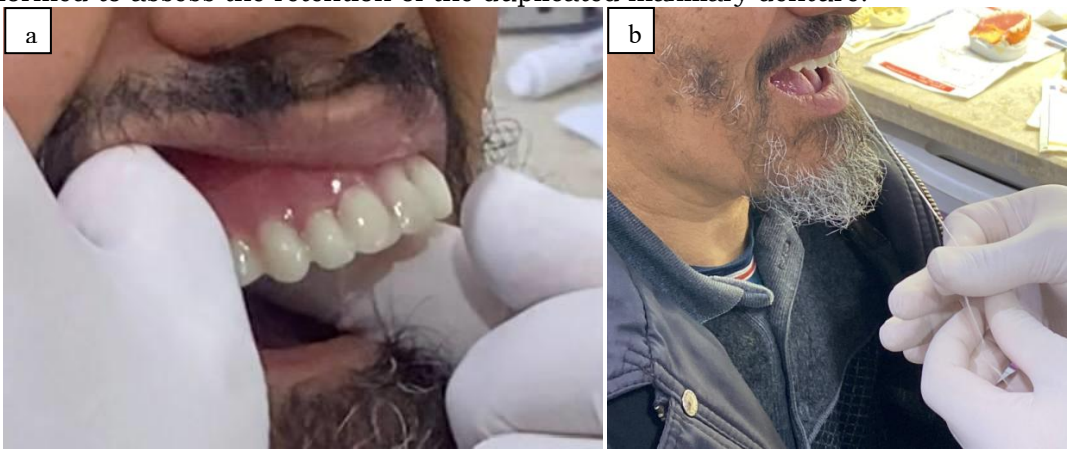

Figure 13 (a). Clinical evaluation of denture stability using unilateral pressure on the posterior region, (b). Denture retention dental floss pull test.

Ethical Considerations

Written informed consent was obtained from the patient prior to treatment and publication. The case report was conducted in accordance with ethical principles for clinical case documentation.

Results

The digitally duplicated maxillary complete denture was successfully fabricated using intraoral scanning and 3D printing techniques. (Figure 14a and b) showed the patient's original maxillary complete denture. During the initial fabrication, the duplicated maxillary denture exhibited poor retention**,** and the patient experienced discomfort during wear, resulting in dissatisfaction with the outcome (Figure 15a and b). Clinical relining of the duplicated denture was completed without complications, and the relined denture demonstrated satisfactory adaptation to the maxillary denture-bearing tissues.

Following relining, an improvement in denture retention was clinically observed (Figure 16a and b), compared with the pre-relining condition. The denture exhibited increased resistance to dislodgement during functional movements, including speech and mastication. Enhanced stability was noted during manual floss pull testing and functional assessment, indicating improved tissue contact and peripheral seal. Intraoral evaluation confirmed intimate adaptation of the denture base to the supporting tissues, with no visible pressure spots or patient-reported discomfort. The patient reported improved comfort and confidence during function when using the relined duplicated denture compared with the original denture. The digital duplication combined with clinical relining resulted in a maxillary complete denture with acceptable fit, improved retention, and favorable clinical performance.

Received*: 21-02-2026 -* ***Accepted****: 19-04-2026 -* ***Published****: 25-04-2026*

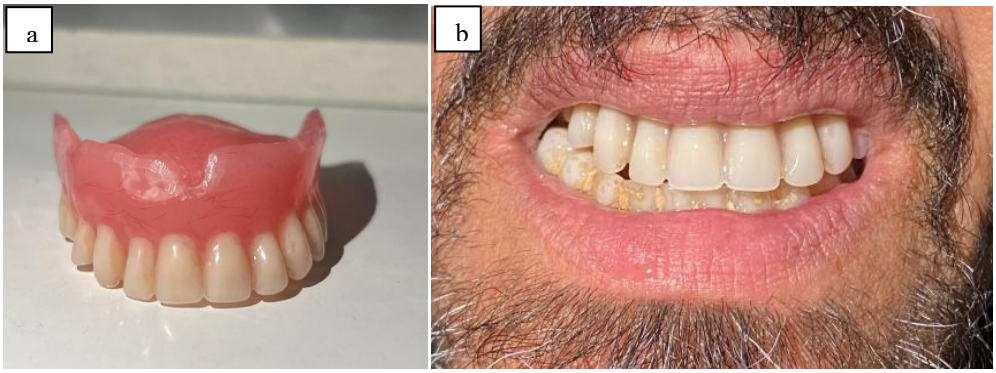

Figure 14 (a). The patient's original maxillary complete denture, (b). Frontal intraoral view of the patient wearing the original denture.

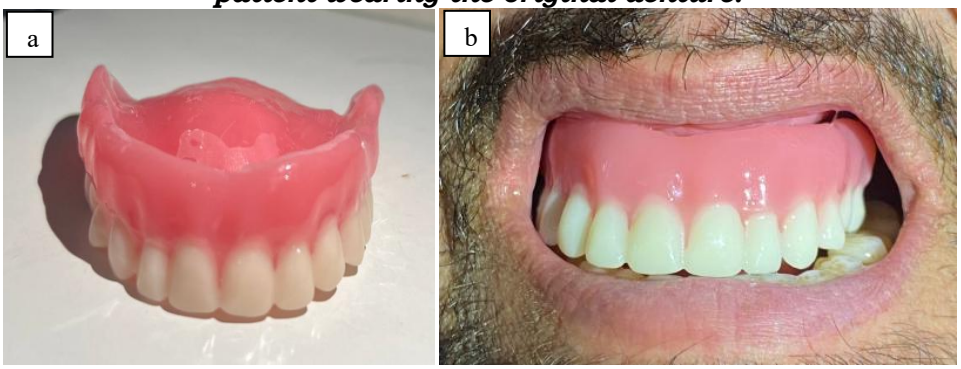

Figure 15 (a). The duplicated maxillary complete denture before clinical relining, (b). Frontal intraoral view of the patient wearing the duplicated denture.

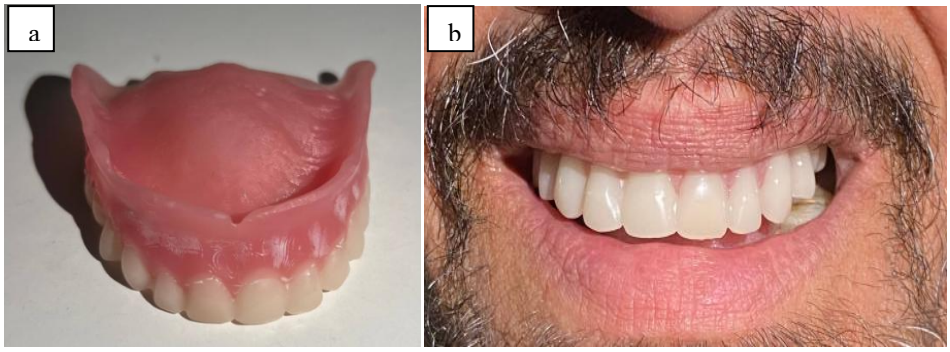

Figure 16 (a). The duplicated maxillary complete denture after clinical relining, (b). Frontal intraoral view of the patient wearing the final duplicated denture.

Discussion

The present case report evaluated the retention of a digitally duplicated maxillary complete denture after clinical relining. Initially, the duplicated denture was fabricated using an intraoral scan of the patient's existing denture and a 3D printing technique. The results demonstrated that the duplicated maxillary denture, directly fabricated from the patient's existing denture, exhibited inadequate retention during clinical evaluation; see (Figure 15-b). This discrepancy may have been influenced by the patient's limited functional use of the original denture, as it was not regularly worn for eating.

To address this, a clinical relining procedure was performed, which significantly improved the adaptation and retention of the denture. Following relining, the denture demonstrated satisfactory retention, and the patient reported comfort and overall satisfaction with the outcome; see (Figure 16-b). The findings of this case report align with those of Fadl SM et al. [10], who demonstrated that the scanning protocol significantly influences the retention of duplicated maxillary dentures. In their study, dentures duplicated using a desktop scanner exhibited the highest retention values, followed by CBCT scanning, while intraoral scanning showed comparatively lower retention. While their study duplicated existing dentures without prior clinical optimization, the present case incorporated clinical relining before digital duplication, aiming to improve the denture-tissue interface before scanning. The clinically acceptable retention observed suggests that pre-duplication relining may help overcome some limitations in intraoral scanning related to soft tissue capture. In addition, CAD-based denture base design modification was applied before fabrication, emphasizing that denture retention is dependent on the entire digital workflow rather than the scanning method alone. Together, these findings support the concept that an optimized intraoral scanner-based workflow, preceded

Received*: 21-02-2026 -* ***Accepted****: 19-04-2026 -* ***Published****: 25-04-2026*

by clinical relining, can produce a functionally retentive duplicated maxillary complete denture in a patient-centered clinical setting.

Although digital techniques for duplicating complete dentures have been described previously [11] limited evidence exists regarding their influence on denture retention. The present study contributes to the literature by evaluating retention of duplicated maxillary dentures fabricated using intraoral scanning and 3D printing, thereby providing clinically relevant data on functional performance rather than technique description alone.

Many researchers studied the retention of maxillary dentures using a conventional method. For example, Shawi et al., [12] reported that targeted modifications in denture base design can significantly enhance the retention of maxillary complete dentures, a finding that supports the results of the present study. In their clinical case report, improved retention was achieved through the incorporation of selective relief using the spacer technique, optimization of the posterior palatal seal, and engagement of anatomical undercuts. Among these approaches, dentures with an enhanced posterior palatal seal and spacer design demonstrated superior retention and higher patient satisfaction compared with those relying on undercut engagement. These findings emphasize the importance of accurate tissue adaptation and effective peripheral sealing in achieving optimal maxillary retention. Similarly, the improved retention observed in the current study may be attributed to the precise reproduction of the denture bearing area achieved through digital duplication using intraoral scanner and 3D printing, which facilitates improved surface adaptation and posterior palatal seal accuracy. Collectively, these results highlight that whether achieved through conventional design modification or digital fabrication techniques, optimizing denture base adaptation remains a key determinant of maxillary complete denture retention. The retention outcomes observed in this study can be explained by the enhanced adaptation of the denture base to the underlying tissues achieved through digital duplication. Intraoral scanner provides highly detailed surface data, allowing accurate reproduction of the existing dentures' intaglio surface or the denture-bearing mucosa [13]. Moreover, the combination of digital duplication with clinical relining represents a methodological refinement over conventional duplication, as it leverages the precision of digital technology while addressing the individual variability of the patient's oral tissues.

From a technical perspective, specific design parameters of the denture base, including minimum thickness under the teeth (0.5 mm), tooth pocket gap (0.15–0.2 mm), blockout angle, and depth limit facilitated an accurate fit of the 3D-printed teeth within the denture base. These design considerations may reduce the need for extensive post-fabrication adjustments, but as observed, they do not fully replace the need for intraoral verification and relining. A limitation of the present report is the lack of quantitative measurement of retention forces therefore; further study is required to consider using objective retention testing to compare digitally duplicated dentures with and without relining.

Conclusion

This case report demonstrated that digitally duplicating a maxillary complete denture after clinical relining can produce a denture with clinically acceptable retention. The incorporation of CAD-based denture base design modification further enhances the adaptation and functional performance of the duplicated denture. This approach highlights the importance of workflow optimization, showing that intraoral scanner based duplication can be successfully applied in a patient-centered clinical setting when preceded by relining. These findings suggest that pre-duplication clinical optimization combined with digital design refinement is a strategy for improving the functional outcomes of duplicated complete dentures.

Recommendations

For future studies, it is recommended to evaluate the retention and clinical performance of digitally duplicated maxillary complete dentures following clinical relining in a large cohort of patients to validate the findings of this case report. In addition, comparative studies could investigate the effect of different intraoral scanning systems, scanning strategies, or 3D-printing materials on retention and fit of the digitally duplicated maxillary denture.

Conflict of interest. Nil

References

1. Kaur S, Datta K, Gupta SK, Suman N. Comparative analysis of the retention of maxillary denture base with and without border molding using zinc oxide eugenol impression paste. Indian J Dent. 2016;7(1):1-6.
2. Ibraheem EMA, El-Sisy AME. Comparing the effect of three denture adhesives on the retention of mandibular complete dentures for diabetic patients: a randomized clinical trial. Bull Natl Res Cent. 2019;43:1-6.
3. Adali U, Peroz S, Schweyen R, Hey J. Replica denture technique: improvements through the use of CAD/CAM technology. Int J Comput Dent. 2021;24(4):439-448.
4. Oyamada Y, Yonezawa Y, Kondo H. Simple duplication technique of complete denture using an intraoral scanner. J Prosthodont Res. 2021;65(3):458-461.

Received: *21-02-2026* - ***Accepted***: *19-04-2026* - ***Published***: *25-04-2026*

5. Soo S, Cheng AC. Complete denture copy technique: a practical application. Singapore Dent J. 2014;35:65-70.
6. Ozkomur A, Manfroi F. Multifunctional guide for implant placement, impressions, and an occlusal index for fixed complete dentures. J Prosthodont. 2018;27(2):197-200.
7. Shor A, Shor K, Goto Y. An alternative technique for the fabrication of removable complete dentures. Pract Proced Aesthet Dent. 2007;19(6):337-344.
8. Lindquist TJ, Narhi TO, Ettinger RL. Denture duplication technique with alternative materials. J Prosthet Dent. 1997;77(1):97-98.
9. McCord JF, Hannah VE, Cameron D, Watson D, Donaldson AC. An update on the replica denture technique. Dent Update. 2010;37(4):230-235.
10. Fadl SM, El Sharabasy RA. Effect of different scanning protocols on the retention of duplicated maxillary complete denture: a cross-sectional study. Egypt Dent J. 2023;69(4):3023-3034. doi: 10.21608/EDJ.2023.229609.2682.
11. Figueras-Alvarez O, Brufau-de-Barberà M, Brufau-Cochs A, Cabratosa-Termes J, Real-Voltas F. A digital technique for fabricating removable complete dentures with a printed denture duplicate from a digital scan of a patient's old complete denture. Open Access J Dent Oral Surg. 2020;1(2):1006.
12. Shawi H, Dirbal M, Altireeki S, Alriyani A, Arifin Z. Improving the retention of maxillary complete denture: a case report. AlQalam J Med Appl Sci. 2024;7(1):113-120.
13. Srivastava G, Padhiary SK, Mohanty N, Molinero-Mourelle P, Chebib N. Accuracy of intraoral scanners for recording completely edentulous arches: a systematic review. Dent J (Basel). 2023;11(10):241. doi: 10.3390/dj11100241.

Received*: 21-02-2026 -* ***Accepted****: 19-04-2026 -* ***Published****: 25-04-2026*