Case Report

Advancing oral rehabilitation: A case report on CAD/CAM obturator implementation for an oral cancer patient

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Abstract

Oral cancer treatment often leads to the loss of a portion of the maxilla or mandible, resulting in functional and aesthetic challenges for patients. Obturators made by Computer-Aided Design and Computer-Aided Manufacturing (CAD/CAM) have emerged as a revolutionary solution in dentistry. This case report presents the successful application of CAD/CAM obturator in restoring the form and function of the oral cavity for a 54-year-old patient who suffered from adenoid cystic carcinoma with limited mouth opening.

Key words: obturator, oral cancer, CAD/CAM, digital dentistry

Introduction

Oral cancer, a complex and debilitating condition, necessitates innovative approaches to address the functional and esthetic challenges posed by extensive surgical interventions such as maxillectomy. The treatment usually involves the use of a maxillary obturator, which blocks the oral nasal opening to re-establish speech and deglutition. Conventional obturator, while effective to some extent, often fall short in providing an optimal fit, comfort and functionality. The fabrication process encounters several complications; the risk of aspiration of impression material through oral nasal communication, difficulty placing the impression tray in patients with limited mouth opening, and problems when removing the impression from the oral cavity due to tissue scarring and undercuts around the defect.[1-5]

CAD/CAM technology is a revolutionary approach that combines computer-based design and manufacturing processes. It allows the creation of highly precise and customised dental prostheses, such as obturators, which are used to restore the form and function of the oral cavity. CAD/CAM technology utilised three-dimensional imaging, virtual modelling, and computer-controlled milling to fabricate prostheses that perfectly fit the patient's unique anatomy. [3,6]

CAD/CAM obturators offer several advantages over the traditional methods. The use of optical impression provides better patient comfort, reduce errors and risks when compared to conventional impression. Furthermore, CAD/CAM enables fewer hospital visits and faster fabrication times. This not only reduces the waiting time for patients but also allows immediate adjustments of modifications if necessary. CAD/CAM obturator

can be processed using biocompatible materials with better mechanical properties. The use of high-quality materials ensures longevity and minimised the risk of complications or discomfort for the patient.[7-10]

The implementation of CAD/CAM obturators has significantly improved the quality of life for oral cancer patients. By restoring the form and function of the oral cavity, these prostheses enable patients to speak, chew, and swallow more effectively. This restoration of basic oral functions not only inhales the patient's ability to communicate and eat but also improves their overall well-being and self-confidence.[2]

This case report delves into the successful application of a CAD/CAM obturator in the rehabilitation of a oral cancer patient. The rationale behind choosing CAD/CAM technology is explored in the context of its potential to offer personalised and precise solutions tailored to the unique anatomical and functional requirement of the patient.

Case Report

A 54-year-old female patient with previously failed implant assisted overdenture had been diagnosed with adenoid cystic carcinoma. Following tumour resection and total rhinectomy combined with a free flap reconstruction, the patient experienced significant functional and esthetic challenges (Fig. 1 to 3). A CAD/CAM obturator was designed and fabricated using digital imaging and virtual modelling techniques. The obturator restored the patient's ability to eat and drink effectively.

CAD/CAM procedure is as following:

1. Full mouth digital impression and occlusal record were made with an intraoral scanner (PrimeScan; Dentsply Sirona, Bensheim, Germany) (Fig. 4).
2. A standard tessellation language (STL) file of the maxilla was exported to CAD software (Exocad, Exocad GmbH, Darmstadt, Germany) for virtual modelling. Adjustments were made around the boundaries of the oral nasal communication (Fig. 5A to 5C).
3. Modified maxillary STL file was imported to CEREC InLab CAD software (InLAB SW 22.0, Dentsply-SironaTM, Bensheim, Germany). The outline of the obturator was designed on the modified maxillary model with minimal 4mm thickness (Fig. 5D and 5E). After final inspection of the design (Fig. 5F), CAD/CAM obturator with three open windows for implants was printed. (Fig. 5G to 5I).
4. The retention and the fitness of CAD/CAM obturator was checked with Fit Checker Advanced (GC, Japan) (Fig. 6A to 6C). The obturator was then relined with Durabase soft and polished (Fig. 6D to 6I).

Figure 1. Extraoral view. (A) Frontal. (B) Lateral.

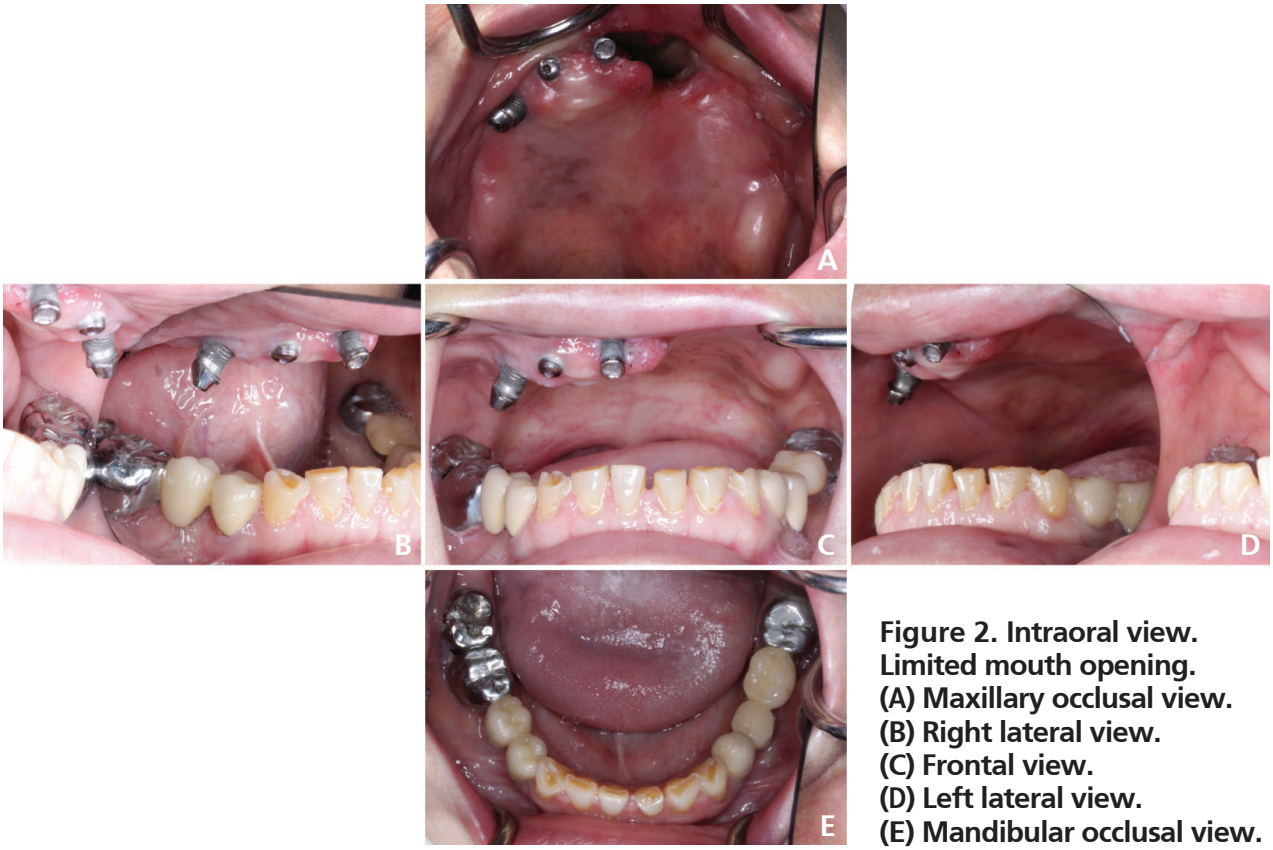

Figure 2. Intraoral view. Limited mouth opening. (A) Maxillary occlusal view. (B) Right lateral view. (C) Frontal view. (D) Left lateral view. (E) Mandibular occlusal view.

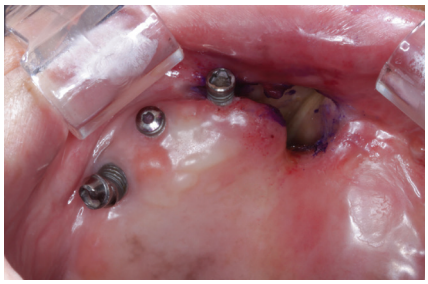

Figure 3. Use of dye to demarcate the boundary.

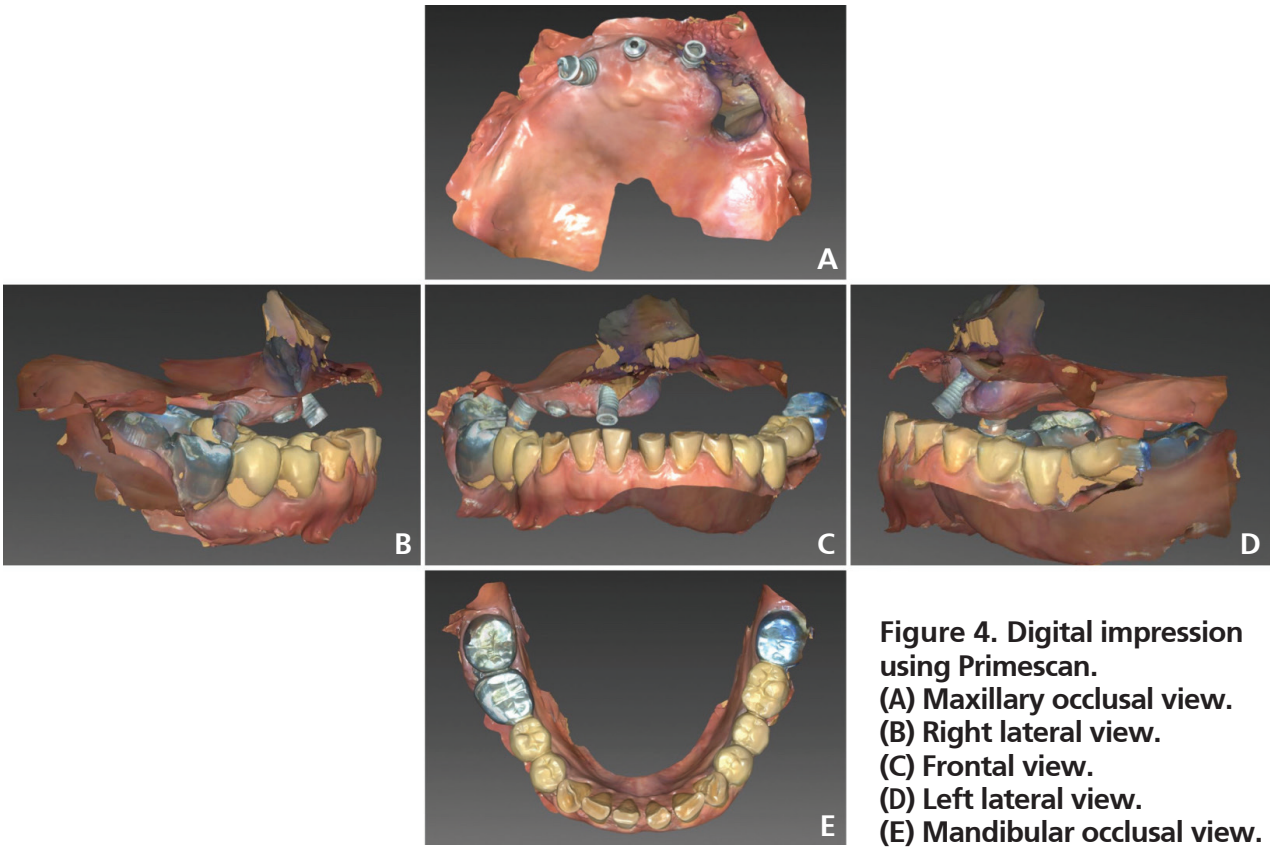

Figure 4. Digital impression using Primescan. (A) Maxillary occlusal view. (B) Right lateral view. (C) Frontal view. (D) Left lateral view. (E) Mandibular occlusal view.

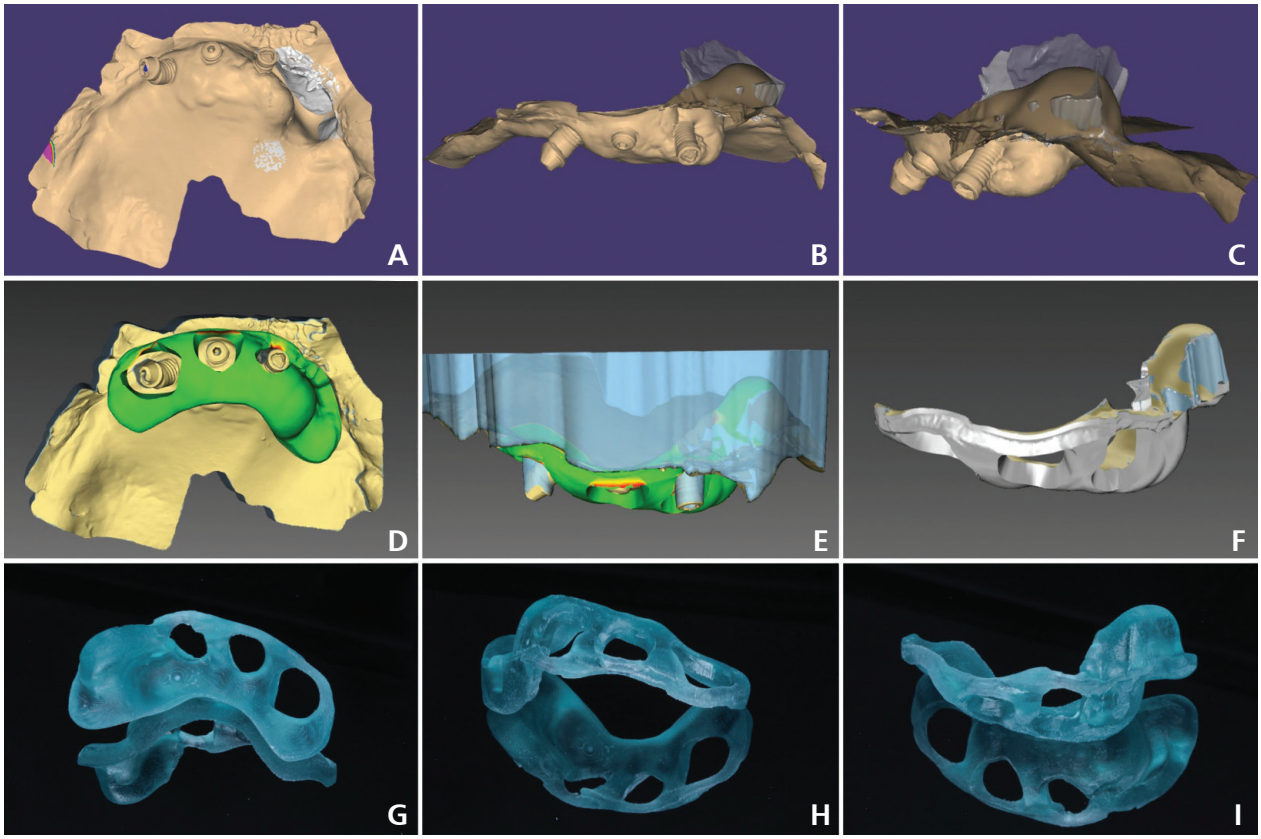

Figure 5. CAD/CAM process.
(A-C) Use of Exocad to adjust and smooth the defect. Yellow: original. Grey: adjusted.
(D-E) Design of obturator with minimal 4mm thickness.
(F) Final design before printing.
(G-I) Different views of printed obturator.

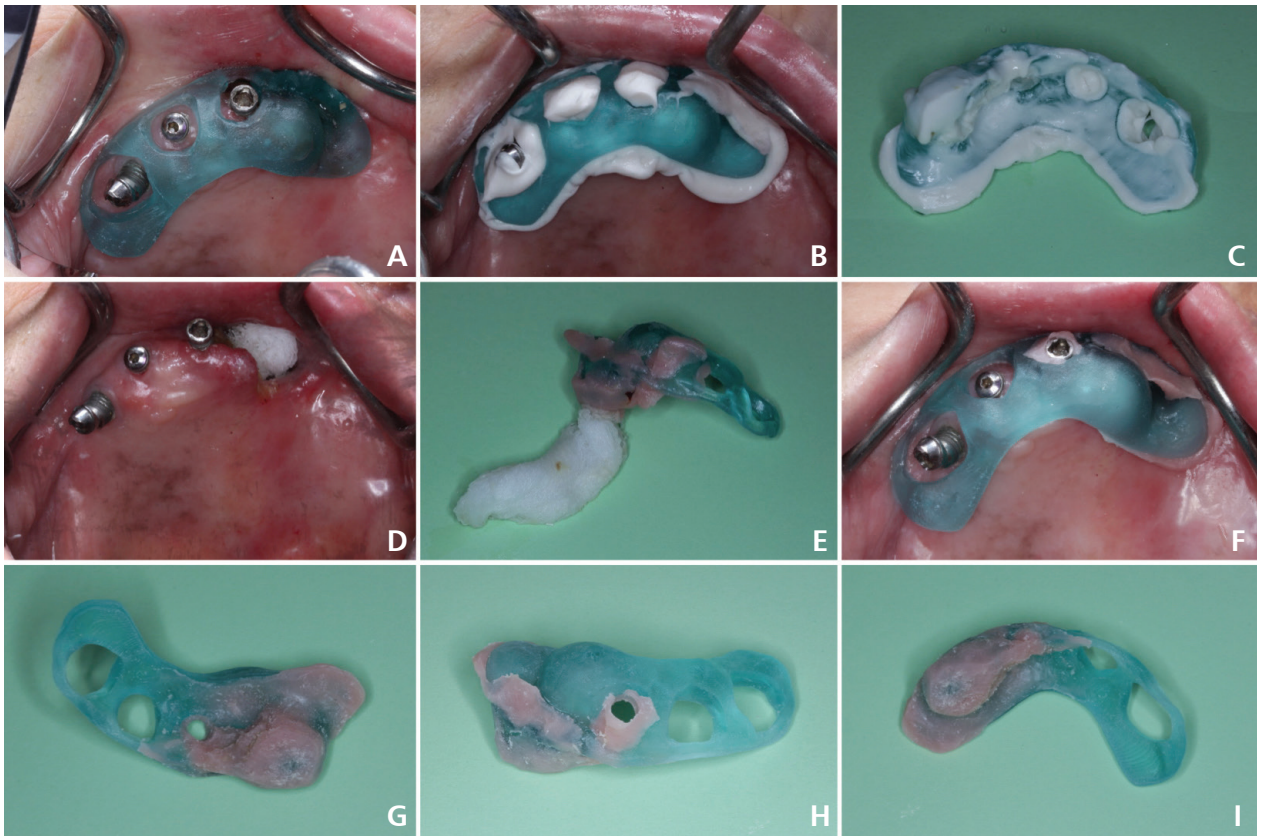

Figure 6. Intraoral adaptation.
(A) Clinical try in of obturator.
(B-C) Fitness checked using pressure indicating paste.
(D) Gauze placement inside the defect prior to relining.
(E) Relined obturator before polishing.
(F-I) Different views of relined obturator.

Discussion

The successful implementation of the CAD/CAM obturator in this case underscores its potential as a transformative tool in oral rehabilitation. The precision afforded by CAD/CAM technology in designing and fabricating patient-specific prosthetics represents a substantial leap forward from conventional methods.

Precision and personalization:

CAD/CAM technology allows for a meticulous and patient-specific design of obturators, addressing the unique anatomical intricacies of each individual. The use of advancing technology helps to overcome the limitations of soft tissue stitching while taking a digital impression; the implants presented in this case were used as references and helped to determine the ideal path of insertion. This offers high level of precision which is critical in optimising fit, comfort, and functionality.

Clinical efficacy:

The clinical outcomes observed in this case report demonstrate the superior efficacy of the CAD/CAM obturator in comparison to traditional methods. The improvements in speech, oral competence, and masticatory function contribute to a more comprehensive rehabilitation, positively impacting the patient's overall well-being.

Technological advancements and workflow efficiency:

The streamlined workflow of CAD/CAM technology, from digital imaging to virtual modelling and manufacturing, represents a notable advancement. This efficiency not only reduces fabrication time but also enhances the overall predictability and reproducibility of the prosthetic outcomes. Ogami et al. demonstrated the use of thermoplastic resin (PEKK) in denture production; the lightweight material offers patient an alternative as it reduces stress soft tissue [2]. This could be one of the material used for definitive prosthesis.

Patient satisfaction:

The subjective experience of the patient is paramount in evaluating the success of any prosthetic intervention. The increased comfort reported by the patient, coupled with improved functional outcomes, underscores the potential of CAD/CAM obturators to enhance patient satisfaction and quality of life.

Challenges and considerations:

While the success of this case is promising, it is essential to acknowledge potential challenges, including the cost of CAD/CAM technology implementation, the learning curve for clinicians, and the need for specialized equipment. Further research and long-term follow-up studies are warranted to validate these findings across diverse patient populations.

Conclusion

This case report provides compelling evidence for the transformative impact of CAD/CAM obturators in oral cancer rehabilitation post-maxillectomy. As the field of dental technology continues to evolve, the integration of precision-driven solutions such as CAD/CAM technology represents a paradigm shift in the approach to oral prosthetics. The implications of this case extend beyond the individual patient, offering valuable insights for clinicians, researchers, and the broader dental community as we collectively strive to enhance the quality of life for those affected by oral cancer.

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