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# Rehabilitation of a maxillectomy patient using digital workflow



## Solutions featured:

3Shape TRIOS intraoral scanner



Fig. 1. Initial situation

### Case information

Patient with Squamous Cell Carcinoma (SCC) of his right premaxilla and nasal cavity in need of a removable partial denture obturator.

A 39-year old male patient was referred to our practice for evaluation and prosthodontic treatment planning. The patient was diagnosed with Squamous Cell Carcinoma (SCC) of his right premaxilla and nasal cavity following a biopsy a few days prior to his referral (Fig. 1).

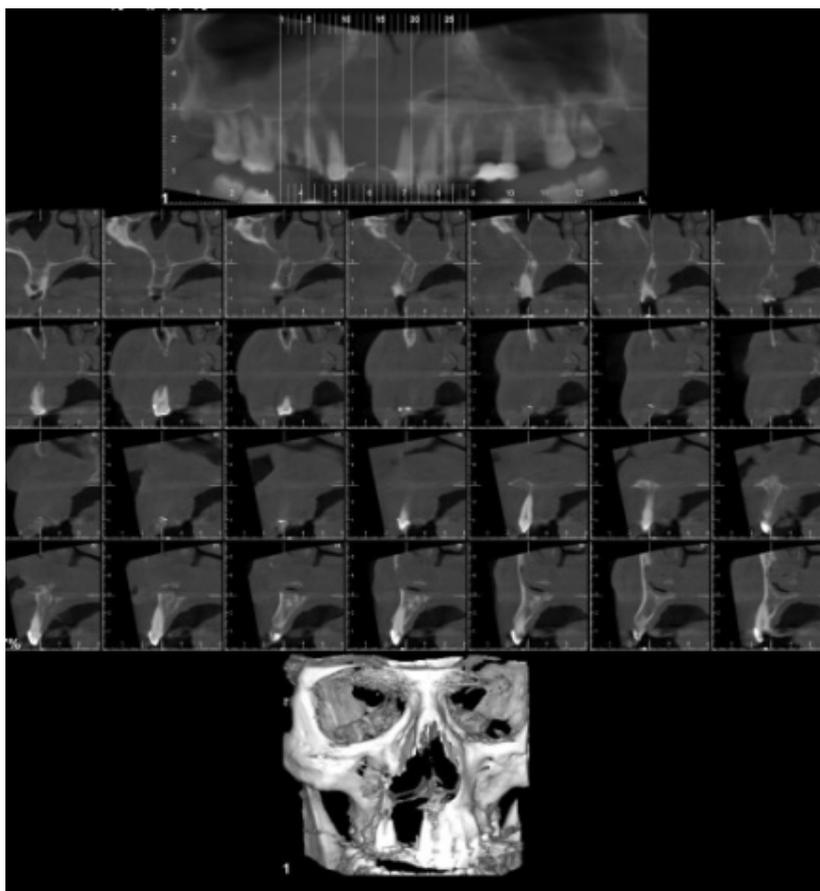


Fig. 2. CT scan of the maxilla and sinuses

A CT scan of the region revealed that the tumor extended towards the nasal septum and the floor of the right sinus cavity (Fig 2.).

### Treatment planning

Initial treatment planning included resection of the lesion, fitting of an immediate obturator prosthesis and placement of 2 dental implants in the position of the upper left first premolar and upper left first molar to assist in the retention of the final obturator prosthesis.



Fig. 3. Immediate obturator relined with Viscogel

### Treatment description

Surgery to remove the carcinoma was carried out two weeks later and the patient exited the hospital wearing the immediate obturator prosthesis relined with a soft denture temporary reline material (Viscogel, Dentsply USA) (Fig. 3). Two Straumann tissue level implants (Straumann, Switzerland) were placed as scheduled and 6 weeks later the patient proceeded to receive adjuvant radiotherapy (54 Gy in 30 sessions, 1,8Gy per session) and chemotherapy (Cisplatin 20mg). Mild xerostomia and trismus developed as side-effects of radiation and chemotherapy. Saliva substitute and physiotherapy were, thus, prescribed to the patient.

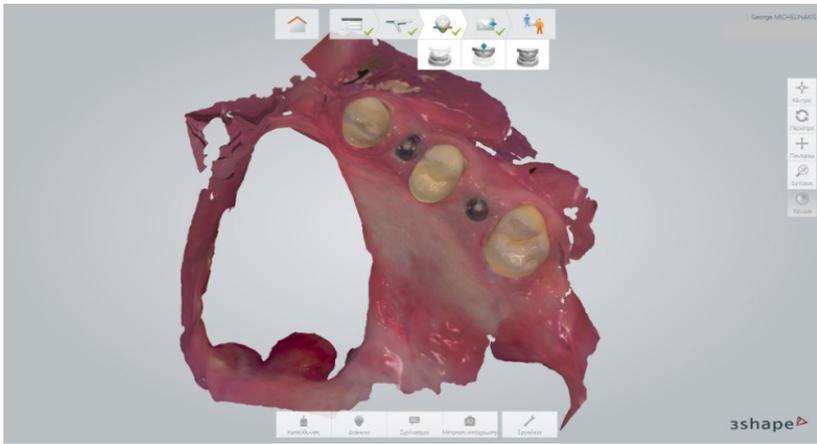


Fig. 4a. Intraoral scan of the maxilla and defect

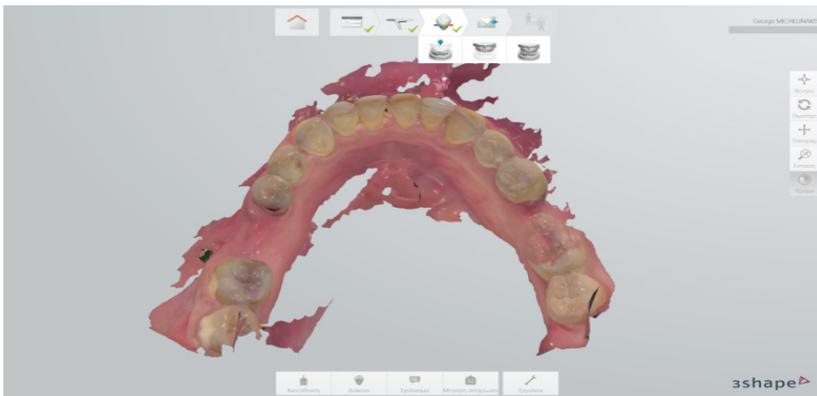


Fig. 4b. Intraoral scan of the mandible

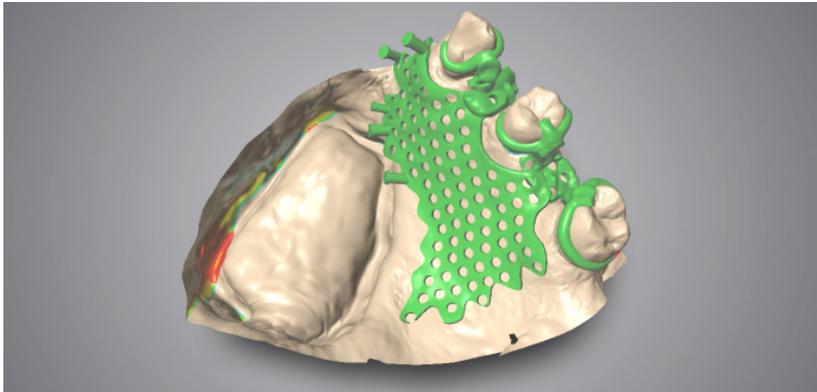


Fig. 5a. CAD of the RPD framework

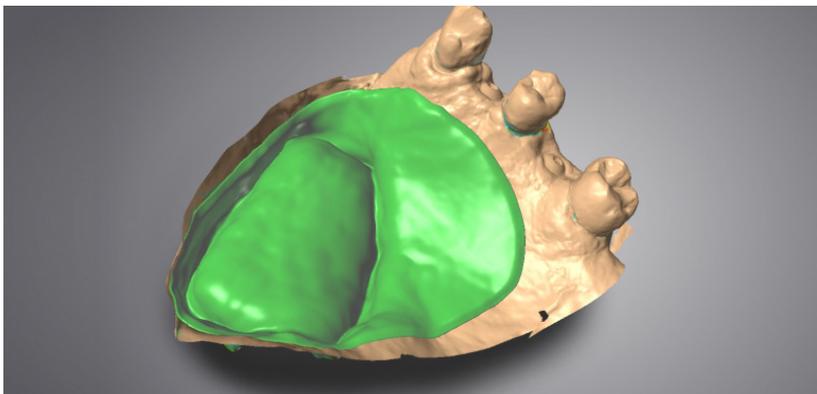


Fig. 5b. CAD of the obturator and denture base

6 months after the ablative surgery, the patient's maxilla, mandible and bite were scanned using an intraoral scanner (3Shape TRIOS, Copenhagen) following the official scan strategy suggested by the manufacturer (Fig. 4a and 4b). The total number of 3d images was kept below the critical number of 1500 for each jaw, a threshold set by the software.

STL data was imported into CAD software (Dental Wings Productivity Package, Dental Wings) and the obturator and RPD framework were designed (Fig. 5a and 5b).



Fig. 6a. 3d printed maxillary cast



Fig. 6b. 3d printed mandibular cast



Fig. 7a. CAD-RP RPD framework and trial obturator assembled on master cast.



Fig. 7b. Assembly tested intraorally for fit

The STL data of the upper and lower jaw were also sent to an SLA printer (Projet 6000, 3D Systems) and a resin model of the resected maxilla and intact mandible were 3d printed with a dedicated resin (Visijet SL e-Stone, 3D Systems) (Fig. 6a and 6b).

The metal framework for the RPD was constructed with Selective Laser Melting technique using a SLM machine (PRO100 DMP, 3D System) and a Co-Cr alloy (BioSint 16, Stroumpos H e-Dental) and the trial obturator portion of the RPD was milled using a resin blank (Copro wax PMMA Disc, Whitepeaks). The two were assembled on the maxillary resin master cast and tested for accuracy of fit intraorally (Fig. 7a and 7b).

The metal framework exhibited excellent fit, retention and stability to finger pressure and the closure of the oronasal communication by the obturator was verified with water intake by the patient.



Fig. 8a. Obturator and denture base milled from Ivoclar CAD pink resin blank



Fig. 8b. Teeth trial set-up



Fig. 9. Evaluation of aesthetics and soft tissue support

Once clinical fit was verified, the permanent obturator part was milled from a pink resin blank (CAD, Ivoclar Vivadent) using a milling machine (Coritec 250i imes, Icore) and incorporated into the denture base (Fig. 8a and 8b).

Denture teeth (SPE, Ivoclar Vivadent) were set on the wax base plate and assessed clinically for aesthetics and phonetics (Fig. 9).



Fig. 10. Intraoral pick-up of the locator matrix attachment to establish accurate implant position



Fig. 11a. Intaglio surface of obturator RPD prosthesis



Fig. 11b. Final view of the obturator in situ

Locator attachments (Zest Anchors, Carlsbad USA) were torqued onto the implants and their respective female caps were picked-up in the framework using an appropriate resin (Kallocryl, Speiko Germany) to accurately establish the implants' position (Fig. 10) before final denture processing.

For the denture base, a heat-polymerized resin was used (Weropress, Merz Dental). The obturator prosthesis was delivered to the patient 8 months following the tumor resection surgery (Fig. 11a and 11b).

### Summary

A 39-year old partially dentate male patient was referred to our practice by the Oral and Maxillofacial Surgery Department of the local General Hospital for evaluation and prosthetic treatment planning. The patient had undergone biopsy for a lesion located in the right quadrant of his maxilla and was scheduled for a hemimaxillectomy for removal of a Squamous Cell Carcinoma. A surgical obturator was prepared for placement at the time of ablative surgery. Following completion of adjuvant radiotherapy and chemotherapy, a digital intraoral impression of the remaining maxilla and mandible was obtained and a CAD/CAM obturator removable partial denture utilizing a SLM-produced metal framework was fabricated and delivered to the patient to restore function and aesthetics. This protocol eliminated the need for physical impression taking thus reducing the number of necessary appointments, leading to less irritation to the irradiated mucosa and more comfort to the patient. This case exhibits the merits of intraoral scanning in the hemimaxillectomy patient group.

# Clinical benefits

The major benefit of using the 3Shape TRIOS® intraoral scanner in this case was that the patient who had undergone radiotherapy and chemotherapy did not experience any discomfort or pain associated with the conventional impression technique. Patient acceptance of the digital impression procedure was very high.

The TRIOS scanner was capable of scanning both teeth and soft tissue (let alone a resected maxilla) with high accuracy and precision. This is the very first case described in the literature that any intraoral scanner is used for rehabilitation of oral cancer patients.

In addition, despite the patient's limited mouth opening because of trismus and radiotherapy, the TRIOS scanning tip was, nevertheless, versatile and capable of obtaining a perfect digital impression of the resected maxilla.

Clinical benefits from the use of the TRIOS scanner also included the need for fewer impression appointments (one appointment) in contrast to the 2 or 3 appointments needed for conventional impressions for maxillectomy patients. This is a clear benefit as the treatment is completed sooner than usual.

Also, communication and treatment planning and execution of the plan with the lab technician was favored tremendously by the digital impression procedure. Digital designing was implemented and new CAD/CAM materials (CAD, Ivoclar) and established techniques (SLM, Milling) were utilized.

Overall, the use of the TRIOS scanner in this extremely challenging case was proven successful and served as a base for formulating a new digital impression protocol for our referral patients.

## About 3Shape

3Shape is changing dentistry together with dental professionals across the world by developing innovations that provide superior dental care for patients. Our portfolio of 3D scanners and CAD/CAM software solutions for the dental industry includes the multiple award-winning 3Shape TRIOS intraoral scanner, the 3Shape X1® CBCT scanner, as well as market-leading scanning and design software solutions for both dental practices and labs.

Two graduate students founded 3Shape in Denmark's capital in the year 2000. Today, 3Shape employees serve customers in over 100 countries from 3Shape offices around the world. 3Shape's products and innovations continue to challenge traditional methods, enabling dental professionals to treat more patients more effectively.

Let's change dentistry together

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