# Soft Tissue Enhancement and Implant Placement Following Partial Mandibulectomy Due to Squamous Cell Carcinoma

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Many dental procedures allow for implant placement in partially or totally edentulous patients. Despite the availability of various implant and abutment types on the market, it often becomes quite challenging to achieve the biological and esthetic goals in a patient who has ridge deficiencies. Problems arise from the lack of adequate bone quality and quantity.[1,2] Soft tissue form and maintenance is also a consideration to evaluate.[3] Primary reconstructive techniques following segmental mandibulectomy is evolving and improves quality of life. A seldom encountered complication is the discovery and treatment of a malignant process (for example, squamous cell carcinoma). Oral squamous cell carcinoma (OSCC) is one of the most aggressive malignancies worldwide and accounts for more than 90% of all oral cancers.[4] It is ranked as the sixth leading cause of cancer mortality worldwide. The most common sites of OSCC are the lateral ventral surface of the tongue, the floor of the mouth and buccal mucosa. For most oral cavity cancers, surgery is the initial treatment of choice (often involving the full or partial removal of bony jaw structure).[5] Radiation or chemoradiation is added postoperatively if disease is more advanced or has high-risk features. Successful cancer therapy can affect the quantity and quality of soft tissue in areas where implants are planned, thus affecting the initial placement and the long-term success of the implants. Complications can be numerous; especially difficult is implant treatment in the mandibular anterior area where inadequate alveolar height results in the lingual floor and the vestibule becoming contiguous.[6] Further complicating treatment is the presence of scar tissue (often found following cancer surgery and radiotherapy). The present case is a report of the combination of a soft tissue enhancement and implant placement following partial mandibulectomy resulting from the treatment of oral squamous cell carcinoma.

A video abstract is available for viewing at https://youtu.be/dZ9t3j4ufOc?list=PLvRxNhB9EJqbqjcYMbwKbwi8Xpbb0YuHI.

***Key Words: squamous cell carcinoma, partial mandibulectomy, dermal grafting, allograft, Toronto Bridge***

## CASE DESCRIPTION

### *Oncology*

A 67-year-old female presented to the University of Ferrara clinic with leukoplakia at the retro-incisal area of the floor of the mouth (Figure 1). The patient was a nonsmoker. Existing mandibular dentition was in poor condition with no posterior occlusion to stabilize the arch (Figure 2). Initial workup and coordination of treatment was provided in a team fashion through the University of Ferrara (Ferrara, Italy) Department of Oncology.

A biopsy evidenced squamous cell carcinoma of the floor of the mouth. Additional investigations were performed to determine the extent of cancer involvement to contiguous structures.

After careful planning, the carcinoma was surgically removed with partial floor of mouth dissection. In addition, part of the vestibular portion of the mucosa was removed and a partial resection of the interforaminal portion of the anterior mandible (partial mandibulectomy) was performed (Figure 3).

Healing was painful and complicated. Transient paresthesia of the lower lip (possibly secondary to stretching of the inferior alveolar nerve at the exit from the mental foramina) was noted following surgery. The paresthesia was still present after 2 years but widely regressing in severity.

The surgery removed a wide area of soft tissues of the

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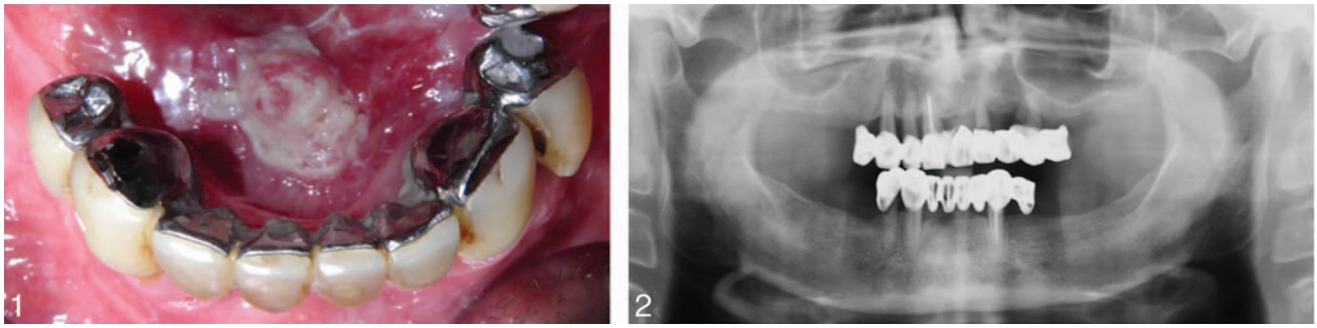


**Figures 1 and 2. Figure 1.** Patient presents with leukoplakia of the floor of the mouth. A biopsy of the area confirms oral squamous cell carcinoma. **Figure 2.** Panoramic radiograph shows poor dentition with no posterior occlusion to stabilize either arch.

mouth floor and anterior vestibular area (Figure 4), causing the union of the vestibular floor with the lower lip resulting in difficulties with speaking, swallowing, and movement of the lower lip.

### *Implantology*

The patient presented at our practice (FB) asking if was possible to receive implant therapy to stabilize a removable denture. The patient had been edentulous with no denture to prevent soft tissue compression.

Panoramic radiography (Figure 5) and cone beam computerized tomography (OPT and CBCT, respectively) allowed us to plan for 2 implants in the retroforaminal area (spared at the surgery for partial mandibulectomy) and 2 in the intraforaminal area (site of partial mandibulectomy).

The patient was prescribed antibiotics (Augmentin 1 g) twice a day starting 2 hours before surgery and continuing it for 6 days after, along with nonsteroid anti-inflammatory drugs (Oki 80 mg, Dompè, L'Aquila, Italy) that were taken for 4 days starting on the day of surgery. Local anesthetic (Articaine 4% plus epinephrine 1:100 000; Ubistesin, 3M ESPE) was injected lingually and buccally. Implants insertion and soft tissue correction of the anatomy were performed with a full thickness flap. In the anterior portion, it was quite difficult because of the partial mandibular resection. During surgery, careful dissection of the mucosa, muscular fibers and submucosa was undertaken because of extensive scarring due to the previous surgery.

In the area posterior to the foramina, two 6.5 mm in length and 4.1 mm in diameter tapered implants (Shape1 Hybrid, I-RES, Milan, Italy) were positioned; the bone over the mandibular channel was about 8 to 9 mm in height. Anterior to the foramina, two 8 mm implants were positioned (Shape1 Hybrid, I-RES, Milano, Italy; Figure 6). All the implants were

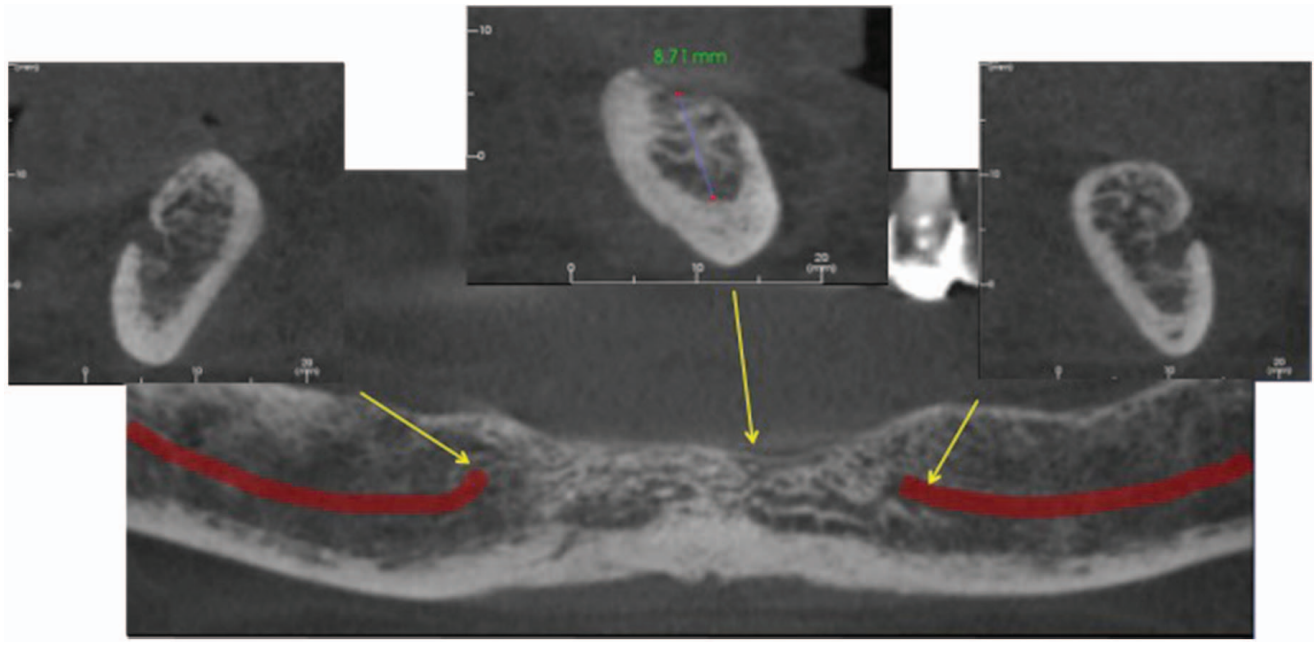
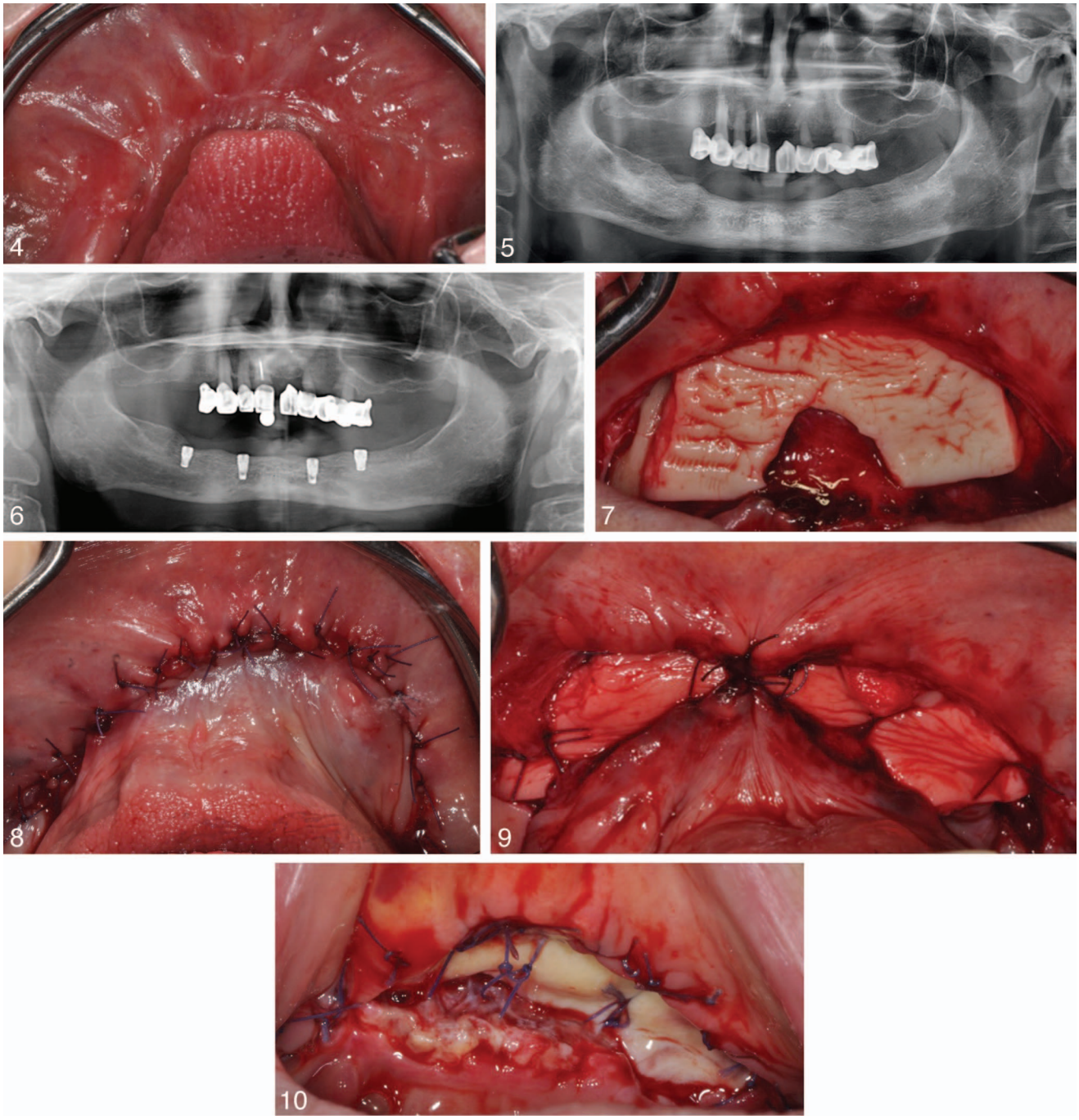



**Figure 3.** The carcinoma was surgically removed with partial floor of mouth dissection. In addition, part of the vestibular portion of the mucosa was removed with a partial resection of the interforaminal portion of the anterior mandible (partial mandibulectomy). A computerized tomography scan shows the extent of removal of the superior cortical section of the mandible.



**Figures 4–10. Figure 4.** Following surgery, there was a union of the vestibular floor with the lower lip, resulting in difficulties with speaking, swallowing, and movement of the lower lip. **Figure 5.** Radiographic studies assisted in the decision for 2 implants in the retroforaminal area (spared at the surgery for partial mandibulectomy) and 2 in the intraforaminal area (site of partial mandibulectomy). **Figure 6.** Posterior to the foramina, two 6.5 mm in length and 4.1 mm in diameter tapered implants were positioned. Anterior to the foramina, two 8-mm implants were positioned. All implants were placed in an adequate 3D position with insertion torque of at least 35–40 N-cm. **Figure 7.** An acellular dermal matrix "horse shoe" was tailored to provide addition soft tissue mass in the affected area. **Figure 8.** Mucosal flaps were sutured with the intention of reducing tension to prevent dehiscence of the wound. **Figure 9.** At postop day 3: a large wound dehiscence appeared where ADM was widely exposed. The wound was disinfected with hydrogen peroxide and resutured using absorbable suture (Vicryl Plus 4-0). **Figure 10.** Appearance after 7 days (day 10 after surgery), revealing a large wound dehiscence.

placed in an adequate 3D position with insertion torque of at least 35 to 40 N-cm.

To overcome the total absence of the fornix because of the fusion on the lower lip with the floor of the mouth, an Acellular Dermal Matrix (ADM; OrACELL, LifeNet Health, Va) "horse shoe" was tailored to provide addition soft tissue mass in the affected area (Figure 7). Absorbable mattress sutures (Vicryl Plus 4-0, Ethicon, Somerville, NJ) were used to fix the ADM to the deeper

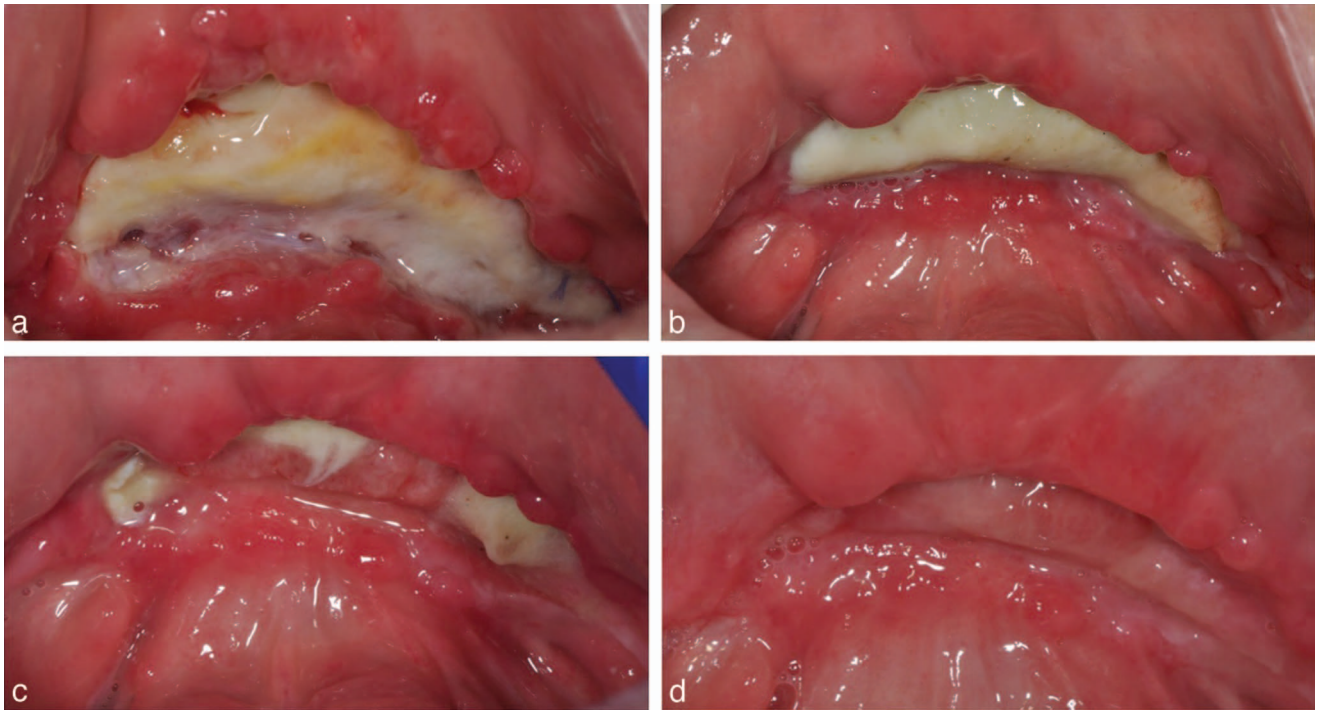



**Figure 11.** (a) At day 16 postoperative, the dehiscence was visibly reduced. (b) At day 25, postop healing continued, and (c) at day 33 postop, "mucosa bridges" were noted between vestibular and lingual area, with (d) complete re-epithelialization of dehiscence with new tissue formation visible at 39 days postop.

layers. Then, mucosal flaps were sutured (Vicryl Plus 4-0) with the intention of reducing tension to prevent dehiscence of the wound (Figure 8). Even with careful planning and surgical technique, it was difficult to provide perfect tension-free flaps and good closure due to the excessive scarring of the cancer surgery; therefore, some areas were closed with high tension.

Postoperative instructions were provided. No major problems were noted postoperatively. Soft tissue edema was seen, as expected.

Postsurgical instructions were a soft-food diet for 3 weeks and adequate oral hygiene with chlorhexidine digluconate 0.2% (Corsodyl 0.2%, GlaxoSmithKline, Brentford, UK) rinses (3 times daily) along with chlorexidine digluconate gel 0.5% (Corsodyl Gel 0.5%, GlaxoSmithKline) application.

At postop day 3, a large wound dehiscence appeared. The incision borders appeared jagged and irregular, and a space between them, ranging from 10 to 20 mm, was appreciable; in the dehiscence area, the ADM was widely exposed (Figure 9). The wound was disinfected with hydrogen peroxide and resutured using absorbable suture (Vicryl Plus 4-0).

After 7 days (day 10 after surgery), a large wound dehiscence appeared (Figure 10). The patient was encouraged to rinse with chlorhexidine rinse, chlorhexidine gel, and a combination amino acid/hyaluronic acid gel (Aminogam, GDP, Genova, Italy) to stimulate the mucosa healing. At day 16 postop, the dehiscence was visibly reduced (Figure 11a). At day 25 postop, healing continued (Figure 11b) and at day 33 postop, "mucosa bridges" were noted between vestibular and lingual area (Figure 11c)—complete re-epithelialization of dehiscence with new tissue formation was visible at 39 days postop (Figure 11d). A stable wound bed was noted at postop day 60 (Figure 12).

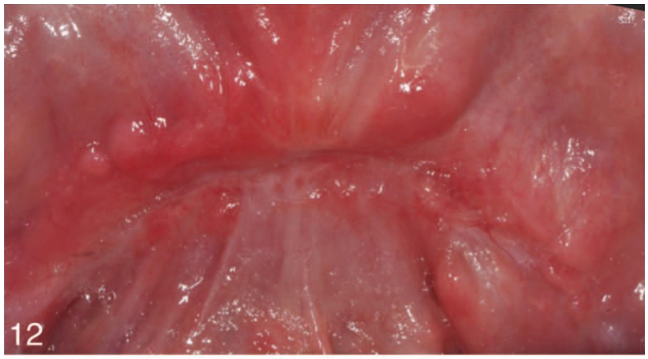
Implants were exposed at 4 months postoperatively, and full thickness biopsies were taken in the grafted area for histologic examination (Figure 13). The patient was eventually rehabilitated with a screw-retained Toronto Bridge (Figure 14).

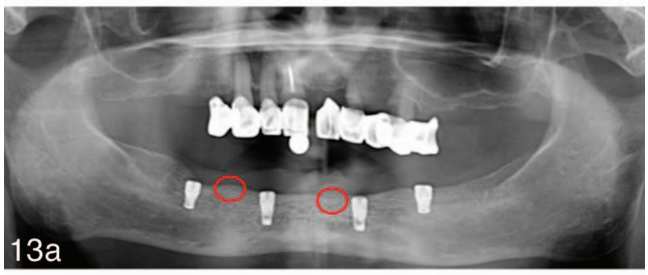
### *Histology*

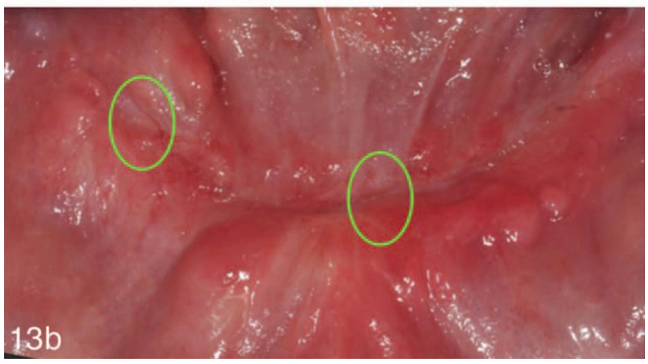
The histologic examination evidenced a healthy incorporation of graft tissue with host tissue, and the surface was partially covered by viable nonkeratinizing squamous epithelium; the submucosal layer was completely normal. The grafted tissue appeared composed of highly vascularized, very cellular dense connective tissue, infiltrating and merging with overlying submucosa (Figure 15). At the junction, scattered small structures, possible representing nerves, were noted.

## Discussion

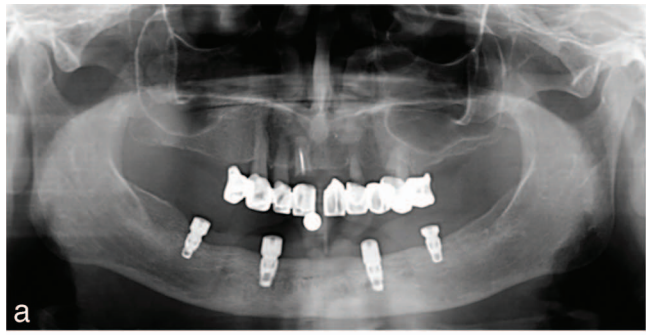
Despite advances in surgery and radiotherapy, which remain standard treatment options, the mortality rates for OSCC have remained largely unchanged for decades with worldwide incidence of 2 to 4% and 5-year survival rates of 57%. In the primary (1st and 2nd) stages, the treatment of choice is surgery and/or radiotherapy, which will usually result in permanent cure. Combination of surgery, radiotherapy, and chemotherapy are used for the treatment of the 3rd or 4th stage of OSCC, but early detection is still critical. When detected early, eradication and rehabilitative surgeries are much less extensive. However, most OSCC cases are diagnosed at the late stage of the disease. The




**Figures 12 and 13. Figure 12.** Postoperative day 60 shows a stable wound bed. **Figure 13.** Biopsies obtained from areas indicated with circles.



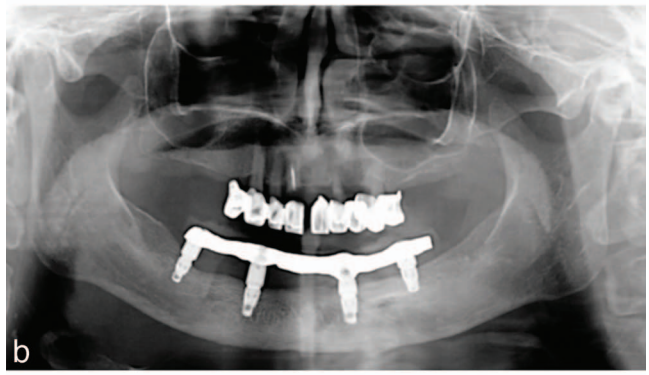





**Figure 14.** Final treatment with a Toronto Bridge was chosen to match the patient's needs. It consisted of a screw-retained mesostructured (a) and a cemented suprastructure (b). The lower image (c) shows the final clinical presentation.

prognosis of OSCC varies on a number of factors that are related to the tumor, to the treatment, and to the patient. While generally 5-year survival rates are good, rates for the late stage of the disease typically do not exceed 12%. Most patients with advanced OSCC usually die within the first 30 months of their disease.[4]

Clinicians must perform a careful visual and physical examination of the oral structures. All patients should be encouraged to perform self-exams and make regular visits to their dental care provider. The case described here illustrates that a structurally and physiologically challenged patient's treatment may not always go to plan. It also illustrates that recent advances in biomaterials for augmentation and therapeutics can aid the clinician in difficult soft tissue cases. Improvements in implant design and technology as well as advanced prosthetic materials and design can provide solutions that may go far when treating any severely compromised patient. Surgeon knowledge and skill is key in handling unanticipated sequela.

The focus of this case letter is the enhancement and management of subsequent challenges necessary to improve the soft tissue surrounding the 4 mandibular implants. Few studies have addressed the method of grafting in cases where there is a total absence of mandibular ridge and fornix when significant scarring is present. Regardless, the reduction of tension at wound closure is logical and would be difficult with the addition of any grafting material.[7,8]

In recent years, there has been an increase in the number of grafting options, but in all cases, primary closure over the grafting material is recommended.[9,10] Autograft was not an option in this case, with allograft chosen due to its history of successful use and availability. The histology showed a favorable outcome with healthy incorporation of graft tissue and absence of scarring. Although the resulting tissue seen in this case was nonkeratinized, there remains controversy

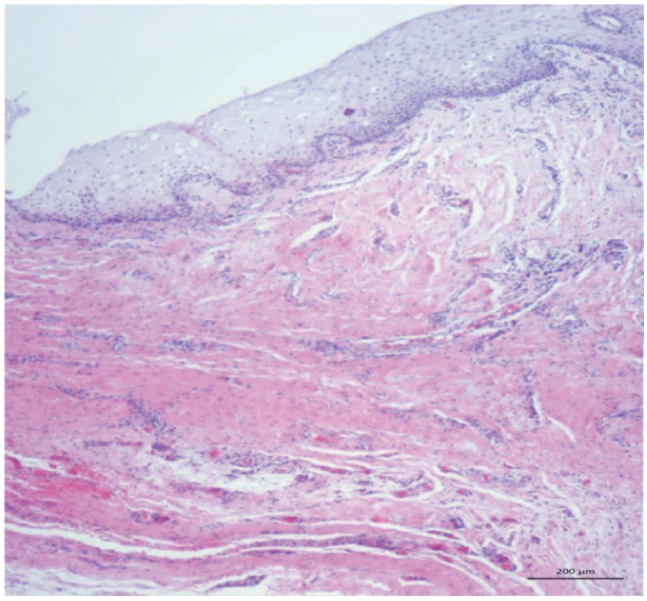



**Figure 15.** Magnification (×10 original) revealed a healthy incorporation of graft tissue with host tissue and a surface partially covered by viable nonkeratinizing squamous epithelium. The submucosal layer was completely normal.

regarding the necessity of keratinized mucosa surrounding dental implants. Studies suggest that nonkeratinized peri-implant mucosa does not seem to predispose peri-implant disease, while keratinized tissue seems to be desirable for hygiene procedures and esthetics but is not necessary for implant success.[11,12] It is important to note that there was marked improvement in the ability of the patient to move their lower lip, speak, and eat.

Lastly, the current case illustrates the successful management of a large graft exposure with conservative measures and reinforces the concept that complications can occur and must be dealt with in a reasonable way. In addition, while many implant options are available, final treatment with a Toronto Bridge was chosen to match the patient's needs. It consisted of a screw-retained mesostructure and a cemented suprastructure.[13] Hybrid prosthetics of this type are gaining in popularity.

It is hoped that more cases like this will be chronicled and presented to train others in the area of soft tissue and implant management following cancer therapy.

## Abbreviations

ADM: acellular dermal matrix
OSCC: oral squamous cell carcinoma

## Note

Dr Bertasi, Dr Powers, and Mr Bullock consult for LifeNet Health, Virginia Beach, Va. There are no other conflicts of interest to report.

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