CASE REPORT

Maxillofacial rehabilitation in a case of osteoradionecrosis refractory to hyperbaric oxygen treatments

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ABSTRACT

This clinical report describes a multidisciplinary approach in maxillofacial rehabilitation of a 61-year-old Caucasian male diagnosed with squamous cell carcinoma of the oral tongue. Following external beam radiation therapy, brachytherapy and a left neck dissection, the patient presented with bilateral osteoradionecrosis of the mandibular rami refractory to hyperbaric oxygen treatment. A subtotal mandibulectomy with a fibula free flap osteocutaneous reconstruction was subsequently performed. Prosthodontic planning and treatment considerations in a case of osteoradionecrosis refractory to hyperbaric oxygen with a reconstructed mandible is presented in this case report. (*Int J Maxillofac Prosthetics* 2019;1:9-13)

INTRODUCTION

Malignancies of the head and neck accounts for 4-5% of all newly diagnosed cancers in the United States.¹ Of these, 85% are squamous cell carcinoma and more than half of patients will receive radiotherapy alone or combined with surgery and/or chemotherapy.² Complications of radiotherapy can include mucositis, degeneration of salivary glands resulting in xerostomia, dekeratinization of mucosa, hypovascularization, atrophy and fibrosis of muscles of mastication leading to trismus, extensive dental caries, and osteoradionecrosis (ORN).³

ORN is a degenerative pathology caused by radiation-induced cell injury resulting in decreased cell repair, hypovascularity, local hypoxia, necrosis and ulcerations.⁴ It can develop from 4 months to several years after radiation treatment with the vast majority of cases developing during the first 3 years.^{5,6} It occurs in approximately 8% of irradiated head and neck patients⁷ and males are more often

affected than females with a ratio of 3:1. The most common causes of ORN are teeth extraction, cancer surgery biopsy, denture irritation, overlying soft tissue necrosis, and periodontal procedures.^{5,7,8}

Clinical symptoms of ORN include pain, swelling, trismus, exposed bone, pathologic fracture, malocclusion and oral cutaneous fistula formation. ORN was first described by Robert Marx and is characterized by exposed bone in the field of radiation that fails to heal after conservative treatments for longer than 3 months and/or by radiographically visible bone necrosis.^{4,5,9}

Treatment of ORN is primarily supportive, involving nutritional support, superficial debridement, oral saline irrigation of local wounds and decontamination therapy (antibiotics) if there is presence of a superinfection.⁵ If a surgery is planned after radiation treatment has been given to the patient, hyperbaric oxygen (HBO) can be administered as a preventive measure at a rate of 20 dives preoperatively and 10 dives post treatment.

HBO and surgical treatment modalities are still controversial for the treatment of ORN. The purpose of this clinical report is to describe the multidisciplinary approach in treatment of a 61-year-old male who was diagnosed with squamous cell carcinoma of the oral tongue and treated with radiotherapy who subsequently developed ORN of the mandible refractory to HBO treatment.

CASE REPORT

A 61-year-old Caucasian male was diagnosed with a T2N1M0 squamous cell carcinoma of the left posterolateral oral tongue in 1977 and treated with external beam radiotherapy and radium brachytherapy following a hemiglossectomy and left neck dissection. He presented 30 years later to his local dentist with an area of bone necrosis around the roots of the left and right mandibular molars (teeth #3.7, 3.6, 4.6) (Fig 1). Following an unsuccessful 29 dives of HBO therapy, the patient presented to the University of Texas M.D. Anderson Cancer Center for further evaluation and treatment recommendations.

A comprehensive diagnostic and clinical evaluation of the patient was performed by a multidisciplinary team including a head and neck (ENT) surgeon, plastic surgeon, radiologist, and a maxillofacial prosthodontist. The patient's medical history revealed hypocalcemia, hypothyroidism and oral pain. He reported social alcohol consumption and cigarette smoking (2 packs per day) from age 12 to 30 and returned to smoking in 1997 to current day. Extra-oral exam showed a thin left neck

with an atrophied left sternocleidomastoid muscle and fibrotic skin. The patient also had postradiation xerostomia, a reduced oral opening, and an area of non-healing ulceration on the lateral sides of his tongue (Fig 2).

A multidisciplinary treatment plan was proposed to the patient which includes biopsy of lesion to rule out cancer recurrence, smoking cessation therapy, antimicrobial therapy with chlorhexidine gluconate and sodium bicarbonate rinsing, brushing with a high fluoride content toothpaste, six preoperative HBO treatments, multidisciplinary surgery involving head and neck surgeon, plastic surgeon and a maxillofacial prosthodontist, and finally prosthetic rehabilitation.

The biopsy was negative for recurrent disease and the patient was diagnosed with ORN at the horizontal ramus of the mandible. The patient underwent six HBO treatments prior to surgery concurrent with smoking cessation therapy. Soon thereafter, the patient underwent his reconstruction surgery. A large recon plate was bent according to the patient's original facial contours by the maxillofacial prosthodontist, and holes were pre-drilled into the ramus of the mandible to serve as positioning guides for the reconstruction. Bony templates were fabricated off the recon plate shape to guide proper fibula osteotomies. A limited neck dissection, tracheotomy and bilateral hemimandibulectomy were then performed by the ENT surgeon, followed by a left free osteocutaneous fibula flap reconstruction (Fig 3), and a full thickness skin graft to the donor site performed by the plastic surgeon (Fig 4).

Fig 1. Initial panoramic radiograph revealing mandibular infection and osteoradionecrosis.

Fig 2. Post surgery prosthodontic reevaluation.

At the three months follow-up, the flap was viable, healthy and well healed with moderate edema. The patient reported sufficient nutrition through a soft and liquid diet. The patient's mouth opening was within normal limits, and the remaining tongue showed sufficient freedom of movement to control food bolus and produce intelligible speech. Unfortunately, the patient developed smoker's halitosis and admitted he stopped his smoking cessation therapy. A prosthodontic treatment plan was composed. Implants were contraindicated for this patient due to his smoking habits and history of ORN. Dental cleaning, oral care guidelines, and conventional prosthetic rehabilitation with a mandibular resection removable prosthesis were recommended. The patient's expectations and clinical outcomes with limitations of treatments were thoroughly discussed.

Fig 4. Intraoral view of the intraoral flap reconstruction.

Fig 3. Panoramic radiograph following the hemimandibulectomy and microvascular reconstruction.

Preliminary impressions were made using irreversible hydrocolloid in stock metal trays for both the maxilla and mandible and poured in type III dental stone. A mandibular custom tray was fabricated using Triad light cured acrylic resin material (Dentsply Trubyte).

The custom tray was border molded using green modeling plastic impression compound and lightly coated with tray adhesive. A selective pressure intraoral impression was made using light polyvinylsiloxane impression material. The impression was then poured in type III dental stone.

A processed base was fabricated using heat cured polymethylmethacrylate resin and tried-in the patient's mouth using indicating paste to adjust pressure spots. An occlusal wax rim was fabricated over the mandibular processed base and the vertical dimension was established using resting vertical dimension and phonetics as guides. Centric jaw relation records were made using aluwax, and a facebow transfer was completed using a Hanau facebow (Whip Mix Corporation). The case was mounted on an Hanau H2 articulator (Whip Mix Corporation) using type III mounting stone.

Tooth shade was chosen for the patient: maxillary teeth were Vita A4 but the patient was adamant on pursuing whiter teeth and decided to have his mandibular teeth in shade A3. Anterior teeth Vivodent DCL (Ivoclar Vivadent Inc, Amherst, NY) mould A8 in shade A3 with 0-degree posterior teeth mould ML5 were used in the prosthetic setup for this patient to allow for freedom of movement and bilaterally balanced occlusion. Due to the position of the mandibular reconstruction, horizontal overlap was minimized on the right side and teeth were set in crossbite. The trial wax denture was evaluated in the mouth and the teeth setup was evaluated for esthetics, phonetics, occlusal relationship and vertical dimension. The patient and his wife approved the prosthetic arrangement. The prosthesis was flaked and processed using heat-cured polymethylmethacrylate resin using a conventional laboratory technique.

Following the deflasking, trimming and polishing of the prosthesis, the prosthesis was verified intraorally for pressure and overextended borders. The occlusion was refined chairside (Fig 5). The patient was then educated on how to place the prosthesis in and out of his mouth using a mild denture adhesive, and on how to maintain proper hygiene of his remaining natural teeth and of his prosthesis, including teeth flossing and brushing, and prosthesis cleaning instructions, as well as removing his prosthesis at least 8hours per 24 hours period. Figure 6 shows the complete prosthetic rehabilitation.

The patient was seen at a 24-hour follow-up visit at which time he was asymptomatic and also reported notably less tension in his jaw muscles. The patient was still very pleased with the esthetics, function and comfort of the prosthesis at the 3-month follow-up visit and reported that he was able to eat and swallow with proper prosthesis retention. Further follow-ups in prosthodontics will be scheduled simultaneously with his cancer follow-up appointments.

Fig 5. Mandibular resection prosthesis in place. Note the enhanced stability with the established crossbite.

Fig 6. Complete prosthetic rehabilitation.

DISCUSSION

HBO and surgical reconstruction are both very controversial treatment modalities for ORN patients. HBO claims to reduce hypoxia, hypovascularity and hypocellularity and thus improves wound healing, yet has the disadvantage of being expensive, time consuming and does not prevent the development of ORN or reverse an established case of ORN.^{5, 6, 10} Some studies have shown the benefit of HBO therapy in the management of stage I and II ORN;^{11, 12} however most reconstructive surgeons would rather use vascularized free tissue transfer reconstructions to manage stage III cases.

Microvascular reconstruction is becoming the standard of care for stage III ORN and involves resecting the nonviable bone and using a myosteocutaneous flap, most commonly from the fibula or the iliac crest, using recipient vessels from the neck for microvascular anastomosis. The advantages of this approach are an immediate reconstruction and restoration of mandibular continuity in a shortened treatment course. Disadvantages, although minimal for most patients, could include inadequate bone for the prosthetic rehabilitation, prolonged intensive care unit stay and hospitalization, and increased donor site morbidity.^{5, 13, 14}

Only 2% of all mandibular reconstruction patients present with prosthetic rehabilitation.¹⁵ Facial appearance, speech and masticatory function are primordial for a patient's self-esteem after cancer treatment, yet lack of adequate tissue support after reconstruction often complicates dental rehabilitation.¹⁶

CONCLUSION

The management of patients with extensive osteoradionecrosis can be challenging. This case report demonstrates how one can provide a conventional removable maxillofacial prosthesis to restore chewing ability, facial contour, lip competency, vertical dimension and vertical stop, and enhance quality of life.

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