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ORIGINAL RESEARCH

Prosthetic Rehabilitation in a Medication Related Osteonecrosis of the Jaw Patient with Vascularized Free Fibula and Osseointegrated Implants –A Clinical Report

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ABSTRACT

Medication-related osteonecrosis of the jaw (MRONJ) is an identifiable disorder that frequently affects cancer patients taking particular medications that promote bone resorption. Other variables that raise the likelihood of developing osteonecrosis include tooth extractions and bone trauma. The paradigm for achieving intricate craniofacial reconstructions has evolved as a result of technological advancement. The advent of 3D planning and stereolithographic printing of patient models helps in pre-planning the entire surgery well in advance of the actual surgery. Use of a vascularized free fibula flap has been a popular method of osseous reconstruction because of its adequate length and acceptance of dental implants. In this case study, a patient with advanced drug-induced osteonecrosis of the maxilla was successfully treated with hemi-maxillectomy, reconstruction with a vascularized free fibula flap, and implant-supported prosthetic rehabilitation. This patient reported with difficulty in mastication and oronasal communication and after examination and correlating history, the diagnosis of medication related osteonecrosis of the jaw was made following which hemimaxillectomy of the maxilla was done with immediate free fibula grafting. After proper healing, prosthetic rehabilitation with osseointegrated implants and hybrid denture was done.

Key words: Medication related Osteonecrosis of the Jaw, Maxillary Reconstruction, Free Fibula Graft, Stereolithography, Prosthetic Rehabilitation, Implant Prosthesis.

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INTRODUCTION

Osteonecrosis is a type of necrosis that affects the jaw bones and can be spurred on by a number of factors, including radiation exposure, drug usage, or idiopathic causes. One such condition is the medication-related osteonecrosis of the jaw, which arises as a result of taking antiresorptive and antiangiogenic medications.[1] Drugs were prescribed to treat cancer and the immunosuppressive illnesses which can induce a drug-induced necrosis of the bones.

These byproducts of the drug build up in the jaw bones and have hazardous side effects like bone resorption and reduced blood flow. This illness typically co-occurs with localized bone trauma and hinders the healing process. A hemimaxillectomy or total maxillectomy causes complex defects in the maxilla, the zygomatic bone, palate, orbital floor, maxillary sinus, alveolar bone and gingiva. These defects can have severe functional and cosmetic consequences.[2] The main aim of reconstructing complex midfacial defects should be: (1) to recreate facial aesthetic appearance and symmetry; (2) to restore and improve mastication; and (3) to obliterate any communication between the orbit, oral cavity and nasopharynx.

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Defects have traditionally been managed using a large dental obturator prosthesis, which can be an excellent and definitive treatment for some patients. A vascularized free fibular graft is the gold standard for replacing necrotized resected bone in such circumstances where healing is compromised. [3] The use of virtual planning and rapid prototyping is increasingly popular in reconstructive surgery, particularly in complex anatomical reconstructions. Rapid prototyping facilitates the manufacture of three-dimensional (3D) models and templates that allow the surgeon to plan the procedure before surgery, thereby closing the gap between preoperative surgical planning and execution. Here is a case report of medication related osteonecrosis of the jaw patient who was prosthodontically rehabilitated.

CASE REPORT

A 23-year-old male patient visited the clinic complaining primarily of oronasal communication and difficulty with chewing for the past three months. When the patient's medical history was gathered, it was revealed that the patient had acute lymphocytic lymphoma 10 years prior. The lymphoma was treated with chemotherapy, primarily with a known immunosuppressant medication methotrexate. The patient made a full recovery and had been symptom-free up until recently. The patient had an untreatable infection and pain in his left upper molar six months prior, leading to the extraction of the tooth. (Figure 1)

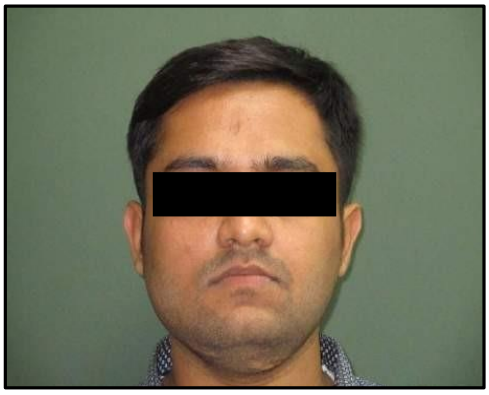

Figure.1: Preoperative Patient Profile

The middle palatal bone was sequestrated, and the area around the extracted tooth had necrotic bone and an oroantral fistula, according to the intraoral examination. The recommended diagnostic evaluation was computed tomography, which revealed uneven borders of necrotized and resorbed bone. It determined that the bone necrosis in question was drug-induced osteonecrosis of the maxillary jaw by correlating the history of malignancy and drug usage.

Given the intricate anatomy and the need to gauge the progress of the necrosis, intended to address this case using stereolithographic models and virtual surgical planning. (Figure 2) The patient's stereolithographic model was 3D printed, and a mock hemimaxillectomy procedure was organized and carried out. (Figure 3).

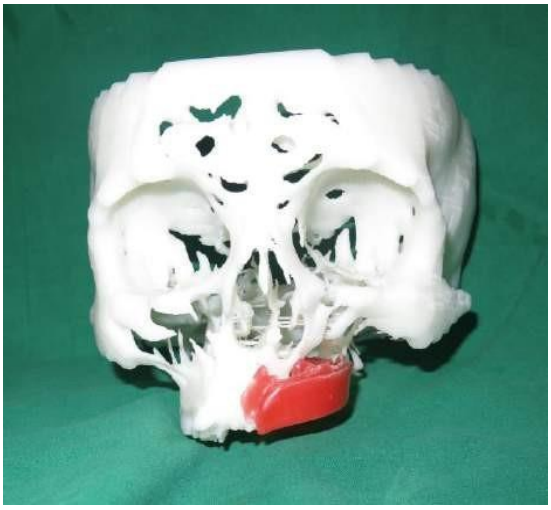

Figure.2: Stereolithographic Model of The Patient Used To Perform Mock Surgery- Profile View

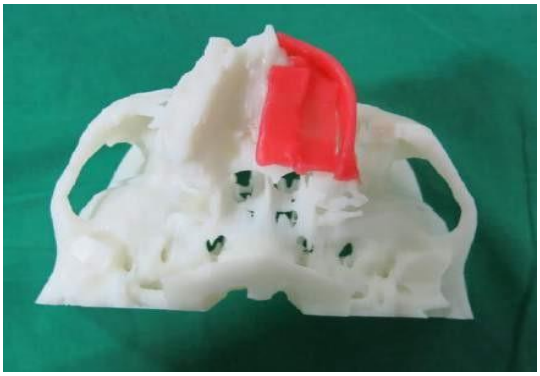

Figure.3: Stereolithographic Model of the Patient used to Perform Mock Surgery- Axial View

This made it easier to envision the osteotomy incisions and prepare for unanticipated difficulties throughout the treatment. The hemimaxillectomy of the left maxilla was done (Figure 4) and autografting of the jaw with a free fibular graft and vascularized soft tissue pedicle were both accomplished by the maxillofacial surgeons. (Figure 5,6) The left maxillary defect included osteomyelitic bone (discoloured and necrotic bone) involving the canine / premolar region with loss of posterior maxilla resulting in a oroantral fistula.

Figure.4: Hemimaxillectomy Intraoperative View

Figure.5: Free Fibula Harvested Site

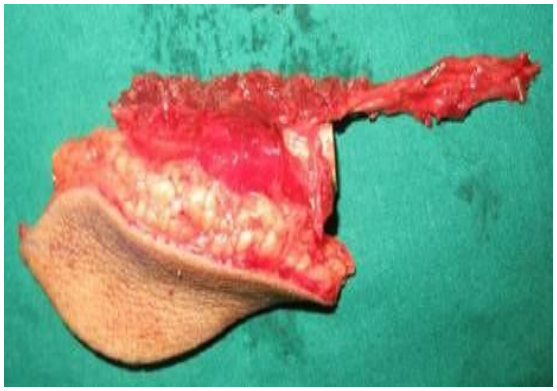

Figure.6: Harvested Fibula With Pedicle Flap

The surgery involved removal of the necrotic bony segment resulting in a wider oroantral communication. The ensuing defect was reconstructed with a fibula osteocutaneous micro vascular flap with bone anchored from the right maxilla onto the left zygomatic complex and the skin paddle providing the oral lining. Throughout the healing process, the patient was closely watched and scheduled for follow-up visits on a regular basis. The fibula was successfully transplanted and had correctly healed after six months. (Figure 7).

Figure.7: Postoperative Occlusal View of Hemimaxillectomy Site After Healing

The implant-supported prosthesis planned prior to the hemimaxillectomy using the free fibula graft and osseointegrated dental implants. After the proper healing of the bone graft, the position and remaining structures were taken into consideration to alter the site of implant placement. Once the flap healed completely and the patient had no residual fistula at the end of 6 months and was scheduled for placement of osseointegrated implants. Four implants of the MIS System of sizes 3.75*8mm one implant and 3.75*13mm three implants were placed from left maxillary incisor to the molar region. (Figure 8,9)

Figure.8: Intraoral View After Implant Placement

The patient was periodically checked up on to ensure proper osseointegration. After achieving full osseointegration of the implants by six months, a screw retained hybrid prosthesis was inserted. (Figure 10,11) The patient was delighted with the prosthesis outcome and was able to attain back his quality of life. Yearly follow up has shown wonderful results and the patient is highly satisfied with the prosthetic outcome.

Figure.9: Radiographic View of the Hemimaxillectomy Site with Osseointegrated Implants

Figure.10: Intraoral View of the Implant Retained Prosthesis

Figure.11: Occlusion and Lateral View of the Implant Retained Prosthesis

DISCUSSION

The use of the free fibula graft is a well-established technique which has clinical and anatomical advantages, such as adequate bone length and volume in combination with low donor site morbidity and a well-perfused myocutaneous flap. Olszewski et al stated that one would expect to pay a low price for free fibula flap surgery with adequate surgical experience, refinements in surgical technique, and comprehensive postoperative care. [5] The 3D reconstruction of the maxilla is a complex procedure to restore aesthetic appearance and function such as respiration, digestion and speech. These complex reconstructions require a high degree of surgical experience. [8] Virtual planning and rapid prototyping are a valuable and precise technique for large reconstructions of complicated anatomical sites. Hirsch et al and Juergens et al both recently presented good results concerning precision and outcome using virtual planning and rapid prototyping in reconstruction of the mandible using the gold standard fibula graft. [9,10] Virtual planning and rapid prototyping provide: (1) a method to accurately evaluate the anatomy of a defect; (2) optimized presurgical planning; (3) accurate preplanning of osteotomies; (4) optimized fit of the graft without further need for osseous adaption; (5) shortened surgical time; (6) a highly predictable outcome of surgery, as Antony et al have reported; and (7) improved communication between surgeons and between the surgeon and the patient. [7] Virtual planning and rapid prototyping have few disadvantages, although software is expensive and presurgical planning is time-consuming.In comparison to traditional dental implant dentures, free fibula grafting and rehabilitation with osseointegrated implants are exceedingly difficult for the prosthodontist but this procedure ensured the long term success given the younger age of the patient.[23] Even with precise 3D planning and placement of the free fibula, it can be challenging to shape the free fibula, and the final graft occasionally cannot fit into the remaining dental arch because it is too buccal, lingual, or palatal, which can compromise the function and appearance of the final prosthesis. Osseointegrated implants have shown the highest results in terms of long-term effectiveness in clinical circumstances with limited bone support (carcinoma repair). [15] Lee ZH et al have used customized guides for fibula reconstruction and implant placement and this has shown very good outcome along with reduced intraoperative time. [22] Postoperative complications such as donor site wound dehiscence and recipient site wound infection are a common occurrence which was prevented by sterile and careful surgical procedure. A multidisciplinary team-based

approach to patient care following cancer promotes effective rehabilitation. Comprehensive prosthetic rehabilitation is crucial after head and neck reconstruction to improve the patient's quality of life.

CONCLUSION

This clinical case report serves as a testament to the success of immediate surgical reconstruction of the complex bone defect caused by tumor surgery using free fibula flap which has in turn revolutionized the post-surgical prosthetic rehabilitation. The success rates of free fibula grafts with osseointegrated implants have been documented extensively in various reports and their long term follow up has shown exemplary results. This report emphasis on a holistic approach of the Oral Surgeons and the Prosthodontists to aid in fulfilling the patient's need and restoring their quality of life.

CONFLICTS OF INTEREST

No conflicts of interest

CLINICAL TRIAL REGISTRATION

This case is not registered under the clinical trial because have not modified or added any new procedures rather have proceeded the case with a digital work-flow instead of the conventional freehand free fibula grafting and implant placement.

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