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Diagnostic Features and Management Strategy of a Refractory Case of Osteoradionecrosis of the Mandible - A Case Report

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Abstract

Introduction: Osteoradionecrosis of the jaws produces a considerable amount of esthetic as well as functional deficits, seriously affecting quality of life of the patient. Cases are often notoriously difficult to treat and manage owing to associated comorbidities of the patient, post irradiation fibrosis and decreased vascularity at the site, which complicates free tissue flap and graft transfer, that subsequently succumb to failure. Hyperbaric Oxygen Therapy (HBOT), in which 100% Oxygen is administered by mask under 2.4 Atm pressure, in a Hyperbaric oxygen chamber, helps by increasing local vascularity.

Aim and methods: It was the aim of this study to show that a particularly refractory, compromised and challenging case of osteoradionecrosis can be managed successfully even without HBOT, by mandibular segmental resection followed by reconstruction using a titanium reconstruction plate enveloped within a pedicled Pectoralis Major Myocutaneous flap.

Result: Post-operative recovery of the patient was excellent with good functional and esthetic rehabilitation of the patient with and practically nil donor site morbidity.

Conclusion: It is important to have a thorough knowledge of the clinical, radiographic, histopathologic, CT and MRI features of osteoradionecrosis of the jaws in order to make a quick and accurate confirmatory diagnosis and to overcome possible diagnostic dilemmas.The strategy of reconstruction of a large mandibular defect using a bridging titanium plate sandwiched by a healthy vascularized myocutaneous flap, following ablative surgery for ORN, has proved to be a safe and reliable option for composite mandibular defects, with gratifying long term functional and cosmetic results.

Keywords: Osteoradionecrosis (ORN); Hyperbaric oxygen therapy (HBOT); Mandibular reconstruction; Titanium reconstruction plate/bar; Pectoralis major myocutaneous flap (PMMC).

Introduction

Squamous cell carcinoma of the oral cavity makes up approximately 90% of the malignant tumors for which radiation therapy is used. Unfortunately, this cancer requires a large dose of radiation (greater than 6000 rad (60 Gy) to affect a result, potentially predisposing the patient to future long term side effects including xerostomia and osteoradionecrosis. Among long term survivors of patients treated for head and neck cancer who have received radiotherapy, almost 5% develop complications related to the radiation treatment, usually following a delay or latent period.

Basically, Osteoradionecrosis is devitalization of the bone by cancericidal doses of radiation [1]. Marx has implicated the role of radiation-induced hypocellularity, hypovascularity, and hypoxia as leading factors in the development of ORN [1,2]. Because of the mandible's low vascularity and great density, the incidence of Osteoradionecrosis is highest at this site. The mandible is often involved because head and neck cancers are common, and radiation therapy in these cancers is very effective. The presence of teeth in the jaws, as well as the functional and cosmetic importance of the mandible, means that Osteoradionecrosis of the mandible most dramatically impacts on the patient's quality of life.Bone is 1.8 times as dense as soft tissue and thereby absorbs a proportionately larger dose of incident radiation than does soft tissue. Radiation upsets the normal balance of osteoclastic destruction and osteoblastic reconstruction occurring in bone, hence the turnover rate of any remaining viable bone is slowed to the point of being ineffective in self-repair [2]. The continual process of remodeling normally found in bone does not occur, and sharp areas on the alveolar ridge, like following a dental extraction, will not smoothen themselves over considerable time.

The term osteoradionecrosis (ORN) defines exposed irradiated bone, which fails to heal over a period of 3-6 months without evidence of residual or recurrent tumor [3]. Some of the signs and symptoms include pain, drainage, fistulization to mucosa or skin, trismus, malocclusion, swelling, and food impaction [4]. There is no satisfactory treatment for radiation necrosis using available conventional means. One barrier to healing involves nutrients: providing adequate nutrition and oxygen to radiation devascularised tissue presents a previously insurmountable challenge. Systemic antibiotics are not very effective because ORN is not an infection of the bone, but rather a non-healing hypoxic wound. Because of the decreased vascularity of the tissues, systemic antibiotics do not gain ready access to the area where they are required to function. However, in acute secondary infections, antibiotics may be useful to help prevent spread of infection.

Hyperbaric oxygen therapy (HBOT) has been shown to be beneficial in both prevention of progression to frank necrosis in patients at risk with existing radiation tissue injury, as well as in the treatment of those in whom bone and soft tissue necrosis has already occurred [5]. HBOT has been shown to stimulate angiogenesis within previously irradiated tissue, restoring measured tissue oxygen levels to about 80% of non-radiated tissue values, restoring vascular and cellular density, supporting osteoclastic resorption of necrotic bone. Patients with established Osteoradionecrosis or who have had previous head and neck radiation treatment and who are scheduled for elective dental extraction or oral maxillary surgical procedures should be referred for evaluation for HBOT as a prophylactic measure to prevent ORN [6].

The HBO protocol involves dives of 100% oxygen breathing by mask for 90 minutes under either 2.4 or 2.0 atmospheres of pressure in a chamber. It includes 30 dives preoperatively and 10 dives postoperatively for diagnosed ORN cases [1,2]. HBO therapy is never used alone as a treatment modality, but as an adjunct to surgical debridement. Marx [1, 2] has reported the best results following an aggressive protocol of preparative hyperbaric oxygen treatment, surgical debridement, and mandibular reconstruction.

Marx's staging system of ORN of the jaws [1,2] is still widely accepted. Stages 1 disease includes exposed alveolar bone without signs of pathologic fracture, which responds to hyperbaric oxygen (HBO) therapy. Stage 2 disease does not respond to HBO, and requires sequestrectomy and saucerization, whereas stage 3, which involves full thickness bone damage or pathologic fracture, usually requires complete resection and reconstruction with free tissue.

The patient described here was an established case of Osteoradionecrosis of the mandible, with a pathological fracture, an oral as well as cutaneous fistula, intraoral bone exposure for a period of 8 months and radiographic evidence of irregular, full thickness bone resorption, necessitating segmental mandibular resection and reconstruction. He hence fell into the Stage 3 of Marx's classification criteria. While HBOT remains a part of the treatment scheme, surgical treatment has come to the forefront of the management of advanced ORN. Aggressive surgical resection of all diseased hard and soft tissue and immediate reconstruction with free tissue transfer has been suggested for stage 3 disease [7].

In the case presented, ablative surgery for osteoradionecrosis of the jaw was carried out, which included excision of a cutaneous sinus leaving a skin defect, and a segmental resection of the mandibular body. Microvascular free tissue transfer for reconstruction following the mandibular resection was ruled out as the deranged and severely compromised pulmonary function tests, bronchiectasis and poor general condition of the patient was not conducive to a long surgery involving blood transfusions, fluid overload and the hyperdynamic circulation required for microvascular patency. Also the patient's past history of smoking had resulted in microvascular thrombosis. There was also a lack of local flap options-platysma, submental flap, trapezius flap, sternocleidomastoid flap due to previous irradiation and severe fibrosis in the neck region.

It is the aim of this case report to describe and evaluate the outcome of mandibular reconstruction using the AO titanium reconstruction plate/bar enveloped with a pedicled Pectoralis major myocutaneous flap, in this late stage and refractory case of ORN of the mandible.

Case Report

A 60 year old totally edentulous male patient reported with the complaints of inability to open his mouth, difficulty in consuming even semisolid food and a persistent dull aching pain in the left side of his lower jaw for the past year. He also complained of the discharge of pus and some gritty whitish material through an opening in the skin in that region for the past year.

History revealed that 6 years ago, the patient who was a chronic smoker, had been diagnosed with Carcinoma of the left tonsil and faucial pillar and the left lateral and posterior pharyngeal wall. He underwent a full course of curative tumoricidal Radiotherapy and received 1.20 Gy per fraction twice daily with a 6-hour inter-fraction interval to a total dose of 76.80 Gy.

At around 9 months post-radiotherapy, the patient had developed pain in his lower molar teeth on the left side, which were then extracted by a local dentist who neglected to go into the patient's recent history of irradiation to the maxillofacial region. One month thereafter, the patient developed a bone exposure at the extraction site, accompanied by a persistent dull pain in that region of the mandible which failed to resolve even with a prolonged course of antibiotics and painkillers.

A year ago, the pain increased in intensity and the patient also developed a localized dehiscence of the facial soft tissues and a draining sinus extraorally through the adjacent skin in the region of the left body of the mandible. The patient also developed a complete inability to open or close his mouth with and to even move his lower jaw.

On examination (Figure 1), there was practically nil mouth opening and the mandible appeared to be "frozen" in the closed position, with a complete absence of palpable condylar movements bilaterally. The patient's edentulous condition as well as the mandibular immobility severely compromised his masticatory efficiency, making it impossible for him to consume anything but oral fluids.

There was observed a draining sinus (Figure 1) on the skin overlying the lower border of the mandible on the left side corresponding to the first molar position, from which there was an active discharge of pus and a whitish gritty material. The region around the sinus was indurated and tender on palpation. On probing the sinus extraorally, the underlying necrosed bone could be felt and visualized through the sinus opening. On intraoral examination, the patient was totally edentulous and there was seen a 1cm X 2cm ulcer on the alveolar ridge (Figure 1) in the left lower molar region, within which irregular yellowish-white, necrosed bone was visible. The surrounding region appeared inflamed.

There was post-irradiation fibrosis and rigidity noted in the neck region, as well as the left buccinator and masseter regions.

Radiographs (orthopantomogram, postero-anterior and lateral oblique views of the mandible) (Figure 1) revealed an irregularly radiolucent, moth-eaten appearance in the left body region of the mandible with evidence of discontinuity and a step at the inferior border of the mandible, suggestive of a pathological fracture. Previous

CT scans available with the patient and taken 6years ago revealed mass lesions (diagnosed as carcinoma) of the left tonsil and faucial pillar and the left lateral and posterior pharyngeal wall.

A CECT (contrast enhanced computed tomographic scan) of the maxillofacial skeleton was carried out and serial 3mm axial sections with 0.75 mm collimation were obtained following administration of Intravenous Iodinated contrast.

Figure 1: (A) A 60 year old edentulous male patient, with restricted mouth opening and a draining sinus on the skin overlying the lower border of the mandible on the left side corresponding to the first molar position, with an active discharge of pus and a whitish gritty material; (B) Cessation of pus discharge from the extraoral sinus after a course of oral antibiotics; (C) A 1 cm × 2 cm ulcer on the alveolar ridge in the left lower molar region, within which irregular yellowish-white, necrosed bone was visible. The surrounding region appeared inflamed; (D) Lateral oblique view (Left) of the mandible clearly demonstrating the displaced fracture of the left body of the mandible.

Ill-defined lytic areas were seen involving both the inner and outer cortices of the mandible (Figure 2). Irregular destruction of the trabecular pattern of the medullary cavity with multiple cortical breaks was noted in the posterior two-third of the body of the mandible, strongly suggestive of osteoradionecrosis in view of history of irradiation to the region followed by dental extractions. Asymmetric soft tissue thickening was noted in the left Retromolar trigone region with loss of fat plane around the buccinator and medial pterygoid muscles. 3D Reformatting of the CT scans provided clear visualization of the displaced pathological fracture of the left body of mandible (Figure 2).

An MRI of the temporomandibular joints and muscles of mastication was also carried out to determine the cause of severely restricted Joint movement and the immobility of the mandible. The TMJs showed normal alignment and configuration bilaterally. There was T2 and STIR hyperintensity noted in the left Temporalis, Masseter and Medial Pterygoid muscles, without any significant loss of muscle bulk suggestive of fibrosis of these muscles. There was also cortical thinning and hyperintensity in the angle and posterior part of body of mandible suggestive of marrow edema. There was also seen edema in the skin and subcutaneous tissue in the left submandibular region.

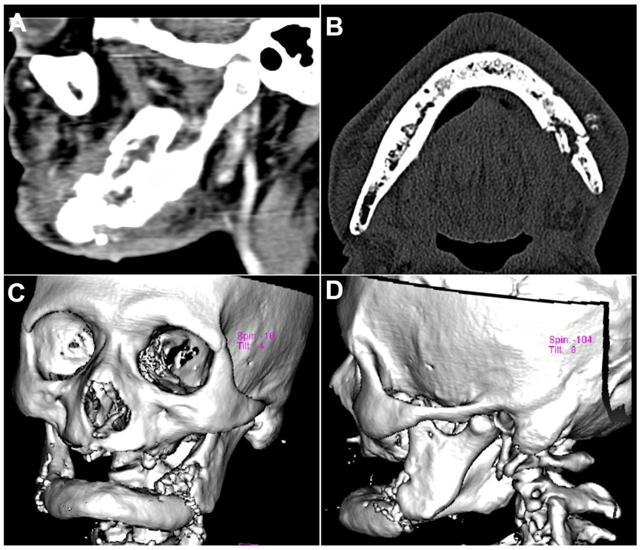

Figure 2: (A,B) Ill-defined lytic areas seen involving both the inner and outer cortices of the mandible. Irregular destruction of the trabecular pattern of the medullary cavity with multiple cortical breaks was noted in the posterior two-third of the left body of the mandible; (C,D) 3D Reformatting of the CT scans with clear visualization of the displaced pathological fracture of the left body of mandible.

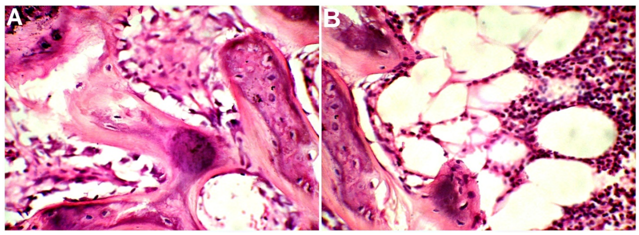

Figure 3: (A,B) Photomicrograph of the biopsy specimen showing viable, dead and partially necrotic bony trabeculae, with some lacunae containing viable osteocytes and other empty lacunae. There is interspersed fibrocollagenous tissue. (H and E staining, original magnification 200X). (D) Evidence of dense inflammatory infiltrate in the inter-trabecular spaces and marrow areas of the cancellous bone. There is also seen diffuse coagulative necrosis of the marrow cells (Haematoxylin and Eosin staining, original magnification 200X).

Correlation of the history, clinical features, and radiographic, CT and MRI findings led to the diagnosis of a Pathological fracture of the left body of mandible and a draining extraoral sinus resulting from osteoradionecrosis of the jaw, with secondary infection.

A biopsy was carried out and pieces of the intraorally exposed, necrotic bone were sent for histopathological examination (Figure 3). Photomicrograph of the biopsy specimen showed viable, dead and partially necrotic bony trabeculae, with some lacunae containing viable osteocytes and other empty lacunae (Figure 3). There was seen interspersed fibrocollagenous tissue. There was also evidence of dense inflammatory infiltrate in the inter-trabecular spaces and marrow areas of the cancellous bone. There is also seen diffuse coagulative necrosis of the marrow cells (Figure 3). Fibrosis was noted in the marrow areas of the haversian systems. There were no atypical or malignant cells seen, ruling out possibility of secondary carcinoma of the mandible.

The patient was put on Oral antibiotics which helped in resolution of the secondary infection, pain and tenderness. The active pus discharge from the extraoral sinus stopped.

The treatment plan initially chalked out for the patient was hyperbaric oxygen therapy followed by segmental resection of the mandible followed by reconstruction using a free vascularized, preferably free fibular osteomyocutaneous flap. The Marx protocol of HBOT was planned for the patient, consisting of 30 pre-operative dives of HBOT (100% oxygen administered by mask under 2.4 Atm pressure, in a hyperbaric oxygen chamber) five days in a week for 6 cycles, and 10 such dives post-operatively.

The patient was referred to the Institute of Marine Sciences at Mumbai for initiation of the HBOT. However, he was diagnosed to have a calcified granuloma, fibrosis and traction bronchiectasis of the anterior segment of the right upper lobe of the lung, which contraindicated HBOT for the patient.

The treatment plan for the patient was revised. The severely compromised pulmonary function tests would definitely not be conducive to long surgery involving blood transfusions, fluid overload, hyperdynamic circulation required for microvascular patency. Hence microvascular options were ruled out. Past history of smoking would have resulted in microvascular thrombosis, and history of irradiation to the head and neck region had compromised the vascularity of the region, as evidenced by the Doppler's test. Hence, success of microvascular surgical options as well as a non-vascularized free bone graft seemed extremely doubtful. The edentulous condition of the patient would not allow load sharing implants; hence the decision to use a Titanium reconstruction plate which would have to be covered with muscle was made. Further, there was a lack of local flap options - platysma, submental flap, trapezius flap, sternocleidomastoid flap due to post irradiation fibrosis of the neck. Hence the PMMC flap was chosen to wrap around the reconstruction plate. A skin paddle would also be required to reconstruct the deficiency remaining after excision of the extraoral sinus in the submandibular region.

There was also the need for massive release of the pterygomasseteric sling, and all the fibrosed muscles of mastication to permit mandibular movements and establish a normal interincisal mouth opening.

So, after the routine workup, the patient was taken up for Segmental mandibular resection followed by reconstruction under General anesthesia, without HBOT. Owing to severely restricted mouth opening, post-irradiation fibrosis and rigidity of neck region, lung bronchiectasis and the emaciated condition of the patient, he was placed in ASA Grade II. GA was administered via Fibreoptic assisted nasoendotracheal intubation and considerable difficulty was encountered during the Fibreoptic bronchoscopy and intubation.

Mandibular segmental resection and reconstruction plate fixation

A submandibular incision was employed after excising the cutaneous sinus and its tract (Figure 4). Dissection was carried out through the superficial fascia including the platysma, investing layer of deep cervical fascia, the facial vessels were identified and ligated. The Pterygomandibular sling was incised and the masseter stripped off the angle and body regions of the mandible exposing the necrosed segment of bone and the site of pathological fracture (Figure 4). The Medial pterygoid muscle was stripped from the medial surface of the body and angle region. Segment of bone to be resected was marked which included a margin of 1cm of apparently healthy bone on either side of the necrosed portion. A subperiosteal dissection and stripping of the body region was carried out to accommodate for an at least three-hole fixation on both sides.

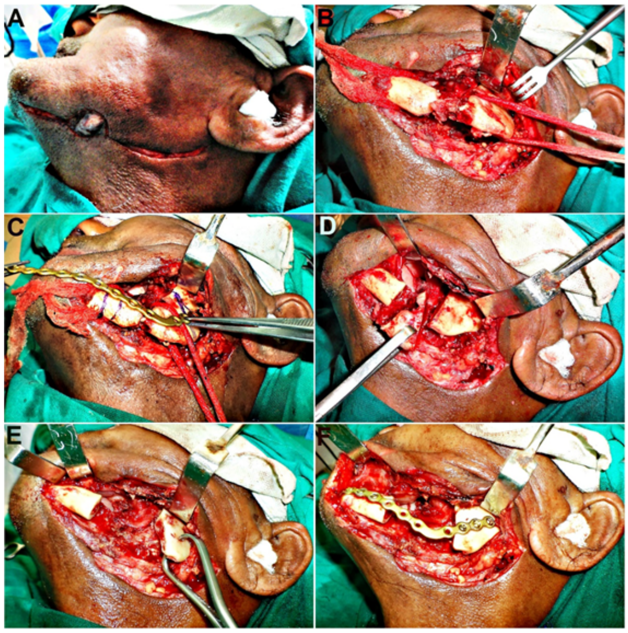

Figure 4: (A) Submandibular incision and excision of the cutaneous sinus and its tract; (B) Exposure of the necrosed segment of body of mandible after transsection of the pterygomasseteric sling and periosteal stripping; (C) Titanium reconstruction plate was adapted catering for adequate length on either side of the planned segmental resection of the mandible; (D,E) Removal of the involved segment of the body of the mandible; (F) Reconstruction plate replaced into its predetermined position and fixed using bicortical screws.

A 2.7 mm AO titanium reconstruction plate was bent to match the curvature of the lower margin of the mandible (Figure 4). After adaptation of the plate catering for adequate length on either side of the planned resection, preliminary pilot holes were drilled through apparently sound bone. The plate was removed, kept aside and the mandibular resection of the necrosed segment of bone was completed (Figure 4). Bleeding was ensured from the inferior alveolar canal at the distal segment and from the cancellous bone of the proximal segment of the mandible following resection, confirming the presence of healthy bone (Figure 4). The reconstruction plate was now replaced into its predetermined position and fixed using 10 mm bicortical screws (Figure 4). Exclusion of saliva from plate and bone was accomplished by using mobilized mucosa internally. Intraoperatively, the skin deficiency was found to be greater than expected after sinus excision due to external irradiation scarred skin.

Design and harvesting of the pectoralis major flap

The skin island of the pectoralis major myocutaneous flap was designed medial to the nipple-areola complex (Figure 5), to match the shape of the skin defect following excision of the cutaneous sinus. The pectoralis major musculocutaneous flap is based on the pectoral branch of the thoracoacromial vessels.

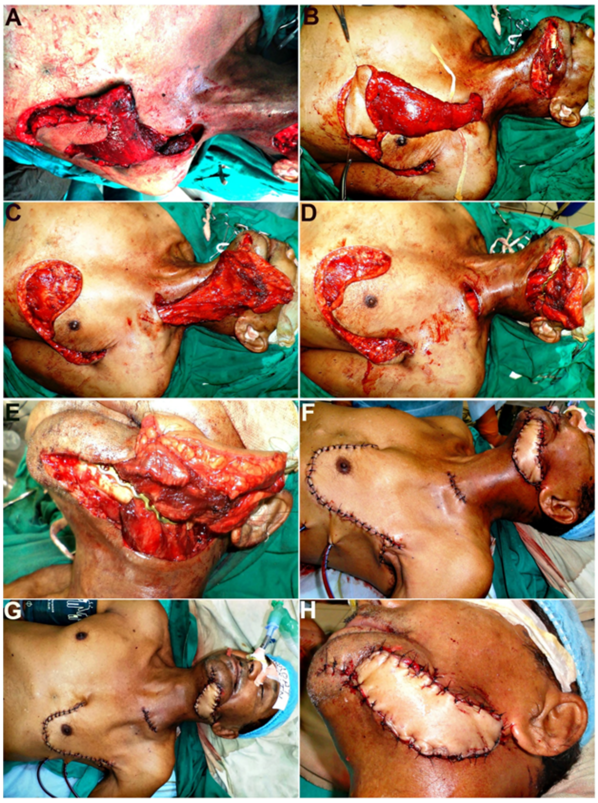

Figure 5: (A) Designing the pectoralis major myocutaneous flap medial to the nipple-areola complex, with the skin island matching the shape of the skin defect following the sinus excision; (B,C,D) Skin paddle was designed on the lower chest so that the pedicle length was long enough when turned over the clavicle, placed through the neck, and into the cheek; (E) The pectoralis major myocutaneous flap was wrapped around the metal plate covering the plate completely with particular care taken to cover the surfaces most subject to frictional forces, the body intraorally and the angle region extraorally; (F) Skin paddle used to reconstruct the skin defect at the region of the excised sinus.

The surface marking of the vessels is along the line joining the acromion to the xiphoid. In the upper part of the chest, the vascular pedicle swings medially, perpendicular to this line, toward the midpoint of the clavicle. The skin paddle was designed on the lower chest (Figure 5) so that the pedicle length was long enough when turned over the clavicle, placed through the neck, and into the cheek (Figure 5). While raising the flap, we kept a muscle cuff of approximately 3 to 4 cm in width right up to the level of the clavicle. This prevents any inadvertent trauma to the vascular bundle either during dissection or during the early postoperative period. After dissection of the flap, a tunnel is made under the skin of the neck so that the flap can be passed through it into the cheek and oral cavity (Figure 5). To reduce the morbidity at the donor site only the sternocostal part was used as a pedicled segmental pectoralis major muscle- or musculocutaneous island flap and transposed upwards. Dissection was performed flush on the thoracoacromial vascular pedicle to preserve the nerve branches to the clavicular part of the muscle. The Pectoralis major muscle was split between the sternocostal and clavicular fibers lateral to the thoracoacromial pedicle. Next, the investing cervical fascia overlying the clavicle was divided gaining access to the subplatysmal plane. The flap was passed above the clavicle and below the platysma and subsequently tunneled through to the submandibular incision (Figure 5).

The flap was rotated upwards above the undivided Sternocleidomastoid and beneath the platysma muscles, and brought out from the Submandibular incision. The pectoralis major myocutaneous flap was wrapped around the metal plate covering the plate completely with particular care taken to cover the surfaces most subject to frictional forces, the body intraorally and the angle region extraorally (Figure 5). The skin paddle was used to reconstruct the skin defect at the region of the excised sinus (Figure 5).

Histopathological examination of the resected specimen of bone (Figure 6) demonstrated viable as well as dead bony trabeculae with fibrocollagenous tissue interspersed (Figure 6), which was consistent with the clinical diagnosis of osteoradionecrosis. In some areas, there were observed completely necrotic bone trabeculae. Almost all osteocytic lacunae in the bone trabeculae were empty (Figure 6). A few bone resorption lacunae were seen and an occasional multinucleated osteoclast. Photomicrographs (Figure 6) also showed clinging muscle fibers of the adjacent pterygomasseteric sling. An intense inflammatory infiltration was seen in the adjacent overlying mucosa (Figure 6).

Skin paddle imported into tight deficient scarred facial skin allowed primary healing with no wound dehiscence. Postoperative congestion of flap edges (Figure 7) remained for 5 days after which 3 mm epidermal loss persisted with good dermal take (Figure 7). This allowed primary healing with no need for any further procedures (Figure 7). Use of postoperative sequential static splints allowed the patient to improve and maintain a satisfactory mouth opening (Figure 7). The patient could maintain a very good oral hygiene, chewing on blenderized soft diet on right side with no pooling of food on left, due to maintenance of a satisfactory gingivobuccal bulk. There was also maintenance of salivary drainage with no slurring of speech, good deglutition due to adequate support to floor of mouth from reconstructed mandible and finally acceptable cosmesis of the lower face. There was, however, an appreciable weakness of the marginal mandibular branch of the facial nerve (Figure 7).

There was a good preservation of clavicular and sternocostal fibers of the pectoralis muscle, which produced an anterior axillary fold with no contour loss in the chest. Post op physiotherapy started after drain removal on 5^{th} day allowing full arm abduction by the fifth postoperative week, thus achieving practically nil donor site morbidity (Figure 7).

Nutritional support in the form of a high protein diet ensured a smooth postoperative recovery and nourishment for the patient as well as a quick healing of all operated sites.

Postoperative orthopantomogram taken immediately following surgery showed a good restoration of mandibular contour and continuity achieved with the help of the reconstruction plate (Figure 8).

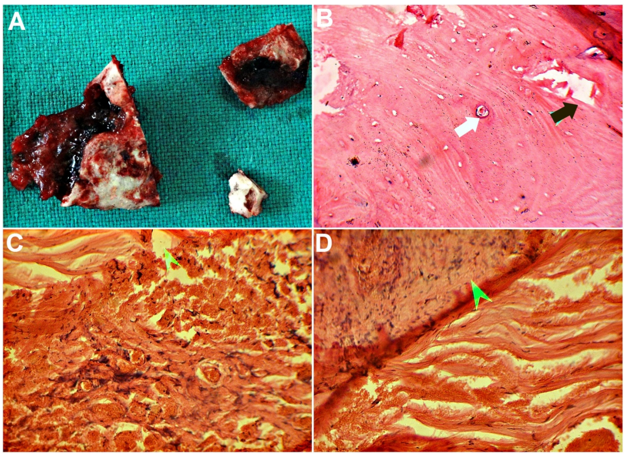

Figure 6: (A) Segments of excised Bony sequestrae from the mandible which were sent for Histopathological examination; (B) (H and E staining, original magnification 200 X). Photomicrograph of the resected specimen of mandible showing completely necrotic bone trabeculae. Almost all osteocytic lacunae in the bone trabeculae are empty A few bone resorption lacunae may be seen (black arrow) and an occasional multinucleated osteoclast (white arrow); (C) (H and E staining, original magnification 300 X) Photomicrograph showing muscle fibers of the adjacent Pterygomasseteric sling (D) (H and E staining, original magnification 400 X) An intense inflammatory infiltration is seen in the adjacent overlying mucosa.

Figure 7: (A) Postoperative congestion of flap edges which remained for 5 days after which 3 mm epidermal loss persisted with good dermal take; (B,C) An excellent primary healing at the graft site with no need for any further procedures; (D) Use of postoperative sequential static splints allowed the patient to improve and maintain a satisfactory mouth opening; (E,F) Full neck mobility and arm abduction by the fifth postoperative week, thus achieving practically nil donor site morbidity.

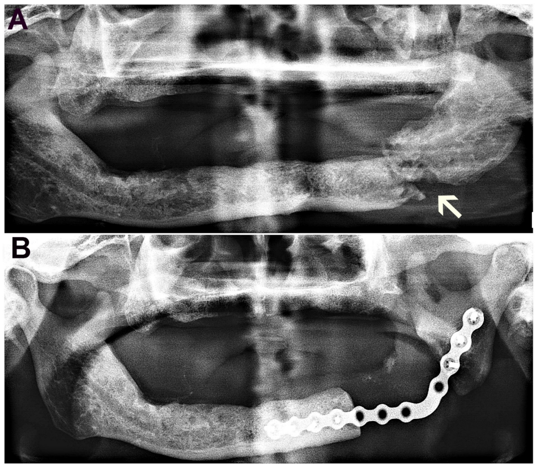

Figure 8: A comparison of pre- and post- operative orthopantomograms (OPGs). (A) Preoperative OPG demonstrating an ill-defined moth eaten radiolucent area located in the left body region of the mandible, with evidence of a pathological fracture as indicated by a step along the inferior border and an upward displacement of the proximal ramal fragment; (B) Postoperative OPG showing a good restoration of mandibular contour and continuity achieved with the help of the Reconstruction plate.

Radiographs and CT scans taken 8 months after the surgery showed remodeling of the bony margins and the reconstruction bar maintaining good continuity of the mandible (Figure 9). Clinically, there was no evidence of any tissue dehiscence or exposure of the implant either intra-or extraorally.

Discussion

Treatment of ORN is a challenging problem. There are a variety of treatment options, and no universal approach to management. Patients with stage 3 disease are treated aggressively by surgical resection of all diseased hard and soft tissue and immediate reconstruction with free tissue transfer [1,2]. HBOT does not seem to have much of a role or beneficial effects in this stage. Reconstruction of the osseous continuity of the mandible alone is not sufficient to restore its function, it is also necessary to repair and restore associated soft tissue defects, including skin and mucosal defects.

The use of vascularized bone grafts has become “state of the art” for mandibular reconstruction, the most common donor sites for osseous free tissue transfer being the fibula, scapula, iliac crest and radius [8]. However it has a number of disadvantages such as donor site morbidity [9,10], a mandatory two-tem approach, need for microvascular surgical expertise, a longer operative period with greater blood loss and high cost of surgery. These may not be justified in patients with advanced disease and poor prognosis, or poor performance status. Moreover, presence of comorbidities often contraindicates long surgeries involving blood transfusions, fluid overload and hyperdynamic circulation, which are necessary for microvascular patency. In addition, post-irradiation fibrosis and microvascular thrombosis in the head and neck region in such patients may be non-conducive for microvascular free tissue transfer. In such cases, simpler mandibular reconstruction using pectoralis major myocutaneous flap and a bridging titanium reconstruction plate may be employed, providing a reliable restoration of function including speech, masticatory efficiency, and improving appearance, thereby improving quality of life [11].

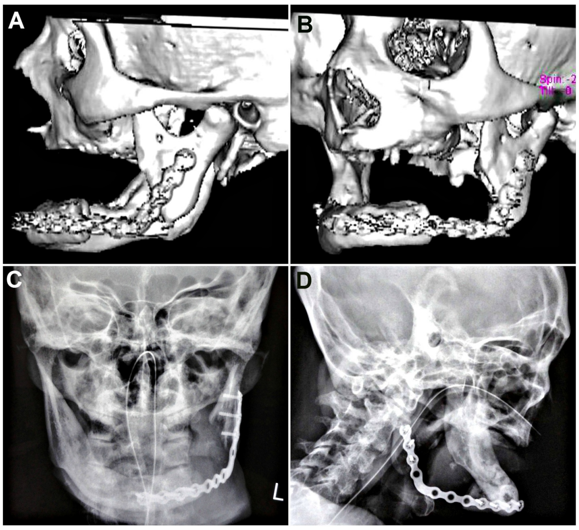

Figure 9: (A,B,C,D) Postoperative radiographs and CT Scans showing bony remodeling of the resected bony margins and a good restitution of the continuity of the mandible achieved with the help of the reconstruction plate following segmental resection of the mandible.

Since their application clinically in 1976, the 3-dimensional bendable mandibular reconstruction plates (3D MRPs) have afforded a means of rapid rehabilitation of the patient with mandibular defects by providing immediate restoration of mandibular continuity and stabilization without imparting any additional donor site morbidity [12]. Additional advantages include generalized availability, ease of application and biocompatibility. Plates permit restoration of speech, mastication, swallowing and facial contour. They prevent mandibular deviation and a residual facial asymmetry and mandibular deformity.

However, a bridging plate alone is plagued by complications such as plate fracture and loosening of fixation, and most importantly, plate exposure or extrusion. Early plate exposure has been related to wound breakdown following infection or soft tissue necrosis. Late exposure is considered a consequence of long-term friction between the plate and soft tissues [13]. Recent studies have suggested that plate exposure rates can be markedly reduced by covering the plate with a myocutaneous flap [14]. It has been proposed that the key to metal retention and absence of exposure is the presence of a substantial, well vascularized soft issue covering to the plate. In particular, plate exposure rates can be markedly reduced by covering the plate with a myocutaneous flap [15]. Yokoo et al. have described a technique of wrapping the plate with muscle and anterior rectus sheath from a free vascularized rectus abdominis myocutaneous flap. They feel also that the anterior rectus sheath reinforces the muscle and may help prevent plate exposure [16].

The pectoralis major myocutaneous flap is considered the workhorse of head and neck reconstruction in view of its versatility, reliability and ease of use. Its muscle tissue is considered particularly resistant to infection and plate exerted pressure [17]. When a free tissue transfer is not feasible, a viable treatment option supported by many authors is the use of the AO Reconstruction plate for mandibular reconstruction to precisely bridge the mandibular defects [18-22]. Ease of its application allows a relatively rapid and simple reconstructive option, especially in advanced or palliative cases or where the general condition of the patient does not allow for an extensive microvascular free flap transfer procedure [23].

According to Kiyokawa and associates [24], the use of Pectoralis major myocutaneous pedicled flap has solved two important problems, the first problem is postoperative infection caused by foreign body reactions or movement between the plate and the surrounding tissue and the second problem is metal plate exposure caused by pressure applied to the skin overlying the mandible, gingiva, or grafted skin flap which can be best addressed by completely rolling the muscular tissue of the Pectoralis major myocutaneous flap around the metal plate. As when compared with skin or subcutaneous tissue, muscular tissue facilitates wound healing to a greater degree [25-30].

In the Stage 3 and refractory case of ORN of the mandible described in this report, gratifying esthetic as well as functional results were obtained using this technique of a Titanium bar/Reconstruction plate wrapped in a PMMC flap following ablative resection of the mandible.

Conclusion

It is important to have a thorough knowledge of the clinical, radiographic, histopathologic, CT and MRI features, together with the treatment protocol choices of Osteoradionecrosis. A bridging titanium plate covered by a healthy myocutaneous flap is an effective and reliable method for primary reconstruction of lateral mandibular defect. It improves quality of life by allowing restoration of mandibular movement, speech, mastication, swallowing and facial contour and esthetics. By sandwiching it within the soft tissue flap, complications such as plate extrusion and exposure can be averted.

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