

## Case Report

# Mandibulectomy Reconstruction with Pectoralis Major Island Flap Associated with Primary Reconstruction Plate for Mandibular Medication-Related Osteonecrosis

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**ABSTRACT:** A bimaxillary edentulous male patient, aged 67 years, diagnosed with prostate cancer who underwent intravenous bisphosphonates treatment (zoledronic acid) for about one year presented with pain in the anterior mandibular arch, with exposed necrotic bone, and was diagnosed with stage 2 medication-related osteonecrosis of the jaw (MRONJ). MRONJ is the development of bone necrosis in the oral cavity as an adverse reaction in patients treated with antiresorptive and antiangiogenic medication, without radiation therapy to the head and neck. This persistent bone necrosis does not always respond to standard treatments. The reconstruction technique with pectoralis major flap, at a distance, associated with the primary reconstruction plate, was an effective treatment modality for the treatment of large osteonecrosis noncompliant with conservatory treatments. Through this technique, the morpho-functionality of the jaw can be restored almost completely.

**KEYWORDS:** Medication-related osteonecrosis of the jaw (MRONJ), zoledronic acid, mandibulectomy reconstruction, remote pectoralis major flap.

## Introduction

Medication-related osteonecrosis of the jaw (MRONJ) is a common complication of oral and intravenous antiresorptive and antiangiogenic therapy that can sometimes progress to full-thickness destruction of the mandibular bone.

It can cause pathologic fractures and fistulations, as well as chronic pain associated with infection.

In Romania, MRONJ prevalence is higher for the treatment with Zoledronic acid compared with other antiresorptive or antiangiogenic medication [1].

Known as bisphosphonates-related osteonecrosis of the jaw (BRONJ), this condition was renamed in 2014 by the American Association of Oral and Maxillofacial Surgeons as medication-related osteonecrosis of the jaw (MRONJ) due to the growing number of osteonecrosis associated with other antiresorptive and antiangiogenic drugs [2,3,4,5].

For a diagnostic of MRONJ in a patient [2,6], there should be met three characteristics:

- antiresorptive or antiangiogenic agents as current or previous treatment;
- exposed bone or intraoral or extraoral fistula in the maxillofacial area that has lasted for more than 8 weeks;
- no history of jaw radiation therapy or apparent metastatic jaw disease.

From a clinical and radiological point of view, MRONJ has 4 stages [2]:

- stage 0: nonspecific clinical signs, radiographic changes and symptoms, without necrotic bone exposure;
- stage 1: exposed necrotic bone or fistula, without signs of infection;
- stage 2: exposed necrotic bone or fistula, with signs of infection, with/without purulent drainage;
- stage 3: exposed necrotic bone or fistula, with signs of infection, associated with at least one of the following: osteolysis extended to the floor of the sinus or lower border of the jaw, oral antral or oral nasal communication, extraoral

fistula, exposed necrotic bone extending beyond alveolar bone, resulting to pathological fracture of the jaw.

Surgical treatment was initially used as a last resort due to fears of relapse of MRONJ [2,7].

As a first intention, for stages 1 and 2 of BRONJ it was attempted a conservative treatment that included the removal of necrotic bone associated with antibiotic treatment and oral lavage with antiseptic solutions [8].

Hyperbaric oxygen therapy was also attempted but the results were not relevant [9,10].

Clinical studies [11,12] and other articles [13,14] have indicated that surgical treatment by radical removal of necrotic bone tissue with a remote flap covering of the wound was a method with excellent healing potential. In many cases, free flap vascularized with fibula or iliac crest was used [13,14].

Mandibulectomy reconstruction with remote pectoralis major flap associated with primary reconstruction plate is an effective surgical treatment method for this condition.

The pectoralis major flap is often used in maxillofacial surgery.

However, as resulted from the review of the literature, its use in MRONJ treatment has not been analyzed yet.

This study aims to highlight the main advantages of this flap.

## Case Report

A totally bimaxillary edentulous male patient, aged 67 years, diagnosed with prostate cancer who underwent intravenous bisphosphonates treatment (zoledronic acid) for about one year presented himself in March 2018 to Maxillofacial Surgery Department of County Clinical Hospital of Craiova.

The patient had pain in the anterior mandibular arch, with exposed necrotic bone. Diagnostic was stage 2 MRONJ.

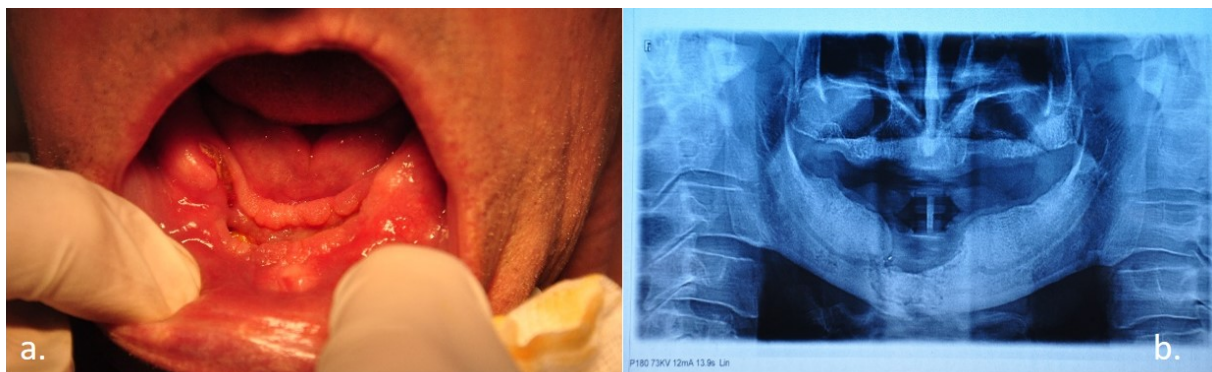
Bisphosphonate treatment was discontinued about 6 months in advance.

Following clinical examination corroborated with the imaging investigations, it was decided to adopt a conservative treatment which consisted in removing the necrotic bone tissue by marginal resection of the mandible down to the clinically healthy bone, associated with lavages with antiseptic solutions and antibiotic therapy.

Patient gave the written informed consent for the treatment, and also for publication of his case.

Although initially the evolution was favorable, after about 2 weeks there were numerous infectious episodes that required repeated antibiotic treatment.

The patient developed a dehiscence in the operated area (Figures 1a, b).



**Figure 1. Stage 2 MRONJ. Clinical aspect of dehiscence in the operated area, 2 weeks after surgical intervention of removing the necrotic bone tissue by marginal resection of the mandible down to the clinically healthy bone (a). Radiological aspect of MRONJ (b).**

Due to the progressive nature of MRONJ, it was decided to perform a radical surgery, with the written informed consent of the patient.

Under general anesthesia, a submandibular incision was made from the left mandibular angle to the right mandibular angle with the exposure of the entire mandibular body (Figure 2a).

It was revealed a large area of bone necrosis in the anterior mandibular arch level (Figure 2b).

The contour of the mandibular arch was recorded with a guide plate.

Segmental anterior mandibular resection was performed with large bone bur drills under saline irrigation down to healthy bone with normal bone specific bleeding (Figures 2c, d).

The surgical specimen was sent for histopathological examination to exclude malignancy.

As the resulting defect was large, it was decided to restore the contour of the mandibular arch with titanium primary reconstruction plate covered with a pectoralis major flap to close the resulting defect (Figures 2e, f).

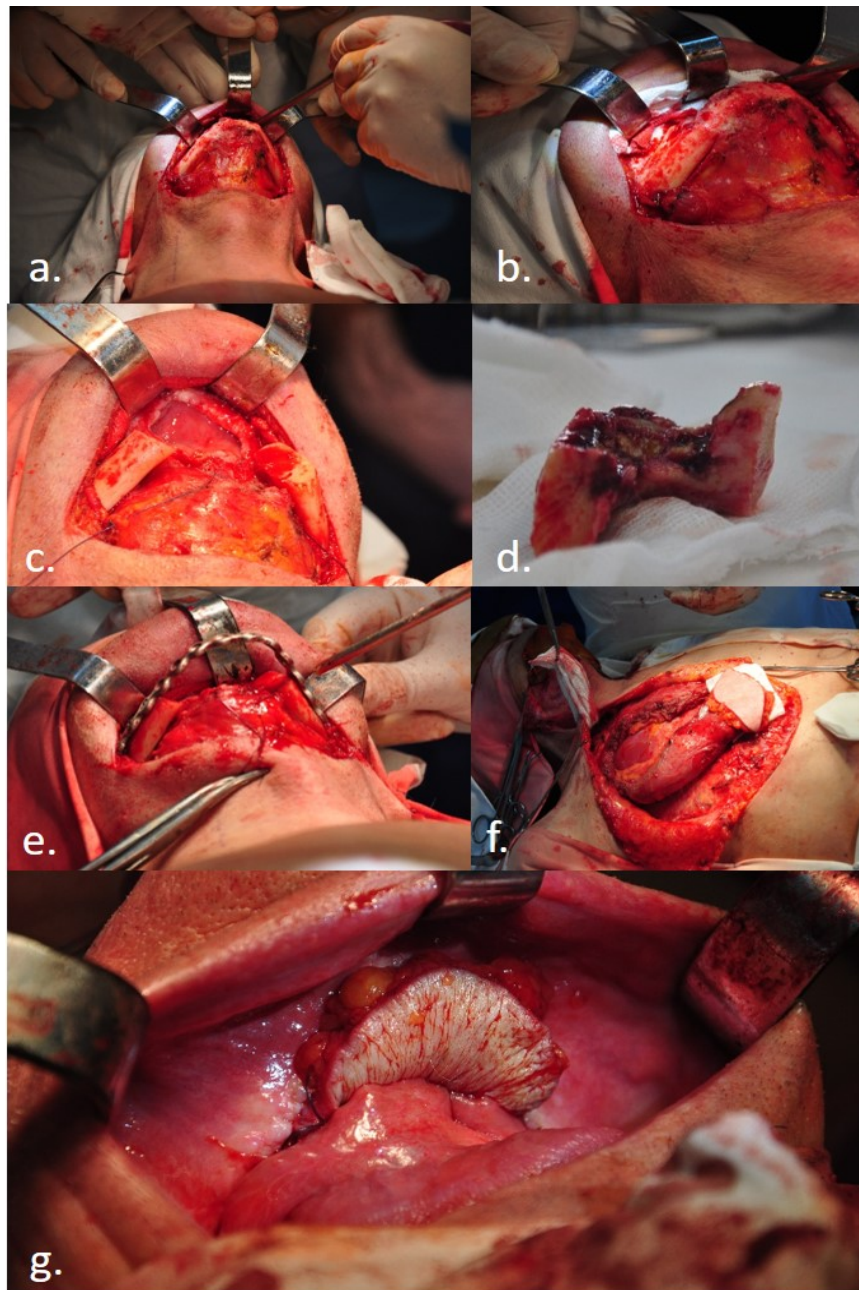
The thoraco-acromial artery was included in the pectoralis major flap (Figure 2f).

It was rotated in the oral cavity with the tegument part closing the endo-oral mucosa defect (Figure 2g).

The donor site was closed primarily after flap harvest.

Surgical treatment was associated with postoperative antibiotic therapy for a period of 7 days.

Both the endo-oral wound and the donor site wound healed without complications.



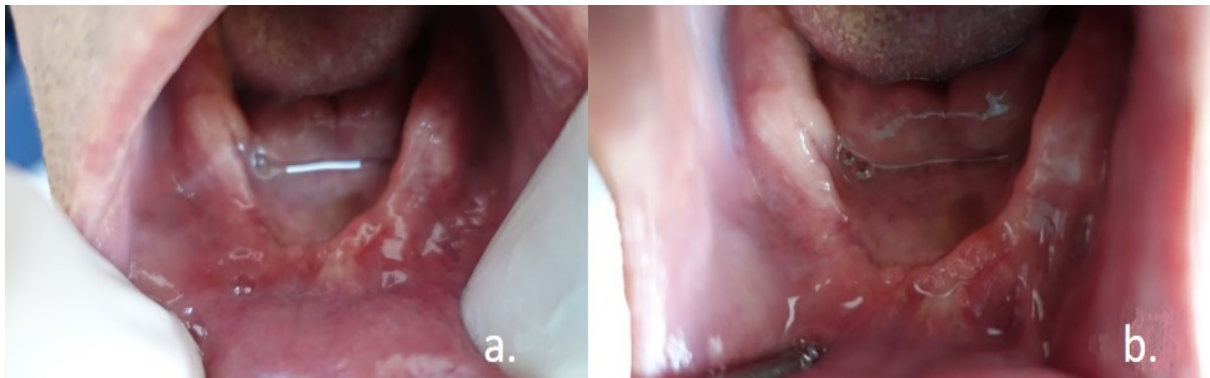
**Figure 2. Clinical images of mandibulectomy reconstruction with remote pectoralis major flap associated with primary reconstruction plate. Submandibular incision from the left mandibular angle to the right mandibular angle with the exposure of the entire mandibular body (a). Large area of bone necrosis in the anterior mandibular arch level (b). Segmental anterior mandibular resection (c). Resected fragment (d).**

**Restoration of the contour of the mandibular arch with titanium primary reconstruction plate (e). Pectoralis major flap closing the resulting defect (f). Flap rotated in the oral cavity with the tegument part closing the endo-oral mucosa defect (g).**

There were no more inflammatory areas and the patient did not complain of local pain.

The patient was monitored weekly for the first month after discharge and then monthly for up to one year after surgery (April 2019).

At 6 months and 1 year after the intervention, there were no recurrences of MRONJ (Figures 3a,b).



**Figure 3. Intraoral aspect of healed mandibular area after 6 months from intervention (a). Intraoral aspect of healed mandibular area after 1 year from intervention (b).**

## Discussion

This case highlights the main advantages of pectoralis major flap consisting in the technical simplicity of flap formation, the large amount of soft tissue it provides as well as the long and stable vascular pedicle and its anatomical location that allows the primary suture of the donor defect (site).

Other authors have preferred free vascularized flap with iliac crest or fibula due to the good aesthetic and functional results obtained [15,16,17].

The iliac crest flap has been appreciated for the large thickness of strong and healthy bone, which reduced the exposure risk of the osteosynthetic material and allowed the subsequent insertion of dental implants for complete oral rehabilitation [18,19,20].

These objectives cannot be reached through pectoralis major flap reconstruction [21].

Both the flap with the iliac crest and the one with the fibula are flaps harvested from a distance that require a more complex logistics [22].

In addition, in the case of the flap with the iliac crest, the donor site has a higher risk of morbidity, possibly leading to the appearance of an abdominal hernia.

Another disadvantage is that the vascular pedicle is short and the remodeling capacity is limited, due to the small amount of bone that can be harvested when the flap is under discussion.

Unlike the flap with the iliac crest, the flap with the fibula can provide a longer pedicle and a larger amount of bone, but it has the

disadvantage of not being able to be used in patients with peripheral circulation problems or orthopedic issues [23].

Theoretical assumptions have drawn attention over the possible adverse effects of bisphosphonates on the bone harvested from the iliac crest or fibula.

This would limit their use as flaps in patients with various forms of bone cancer, but clinically, it appears that MRONJ is limited to facial bones [24].

The harvesting of the pectoralis major flap does not imply difficulties, from a technical point of view, compared to the other mentioned flaps [22].

It can be harvested with various sizes of the cutaneous component and continuing to the sizes of the pectoralis major muscle.

It is formed as an island flap on the vascular pedicle, which allows the primary suturing of the donor defect.

The flap can be easily migrated in the cranial direction for the plasticization of cervical-facial defects [22].

As a disadvantage, the pectoralis major flap compromises the breast. In female patients, this treatment remains only a back-up alternative in planning the intervention.

There are studies that have shown that postoperative treatment with hyperbaric oxygen helps in rapid healing and prevents MRONJ recurrence, but logistically this case could not benefit from this option [13].

## Conclusion

The case presented reconfirmed the potential to obtain an excellent result using an invasive surgical method despite the unfavorable prognosis.

Considering that some studies showed that in a significant percentage of patients with MRONJ stage 3 where free vascularized bone flaps were used failures have been registered, it is necessary to conduct more in-depth studies on these cases.

Pectoralis major flap treatment may be a more effective treatment option for resolving stage 2 MRONJ lesions.

## Conflict of interests

None to declare.

## References

- Mănea HC, Urechescu HC, Balica NC, Pricop MO, Baderca F, Poenaru M, Horhat ID, Jifcu EM, Cloșca RM, Sarău CA. Bisphosphonates-induced osteonecrosis of the jaw-epidemiological, clinical and histopathological aspects. *Rom J Morphol Embryol*, 2018, 59(3):825-831.
- Ruggiero SL, Dodson TB, Fantasia J, Goodday R, Aghaloo T, Mehrotra B, O'Ryan F, American Association of Oral and Maxillofacial Surgeons. American Association of Oral and Maxillofacial Surgeons position paper on medication-related osteonecrosis of the jaw-2014 update. *J Oral Maxillofac Surg*, 2014, 72(10):1938-1956.
- Marx RE. Pamidronate (Aredia) and zoledronate (Zometa) induced avascular necrosis of the jaws: a growing epidemic. *J Oral Maxillofac Surg*, 2003, 61(9):1115-1117.
- Licata AA. Discovery, clinical development, and therapeutic uses of bisphosphonates. *An Pharmacother*, 2005, 39:668-677.
- Drake MT, Clarke BL, Khosla S. Bisphosphonates: mechanism of action and role in clinical practice. *Mayo Clin Proc*, 2008, 83(9):1032-1045.
- Escobedo MF, Cobo JL, Junquera S, Milla J, Olay S, Junquera LM. Medication-related osteonecrosis of the jaw. Implant presence-triggered osteonecrosis: Case series and literature review. *J Stomatol Oral Maxillofac Surg*, 2020, 121(1):40-48.
- Ruggiero SL, Fantasia J, Carlson E. Bisphosphonate related osteonecrosis of the jaw: background and guidelines for diagnosis, staging and management. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 2006, 102:433-441.
- Migliorati CA, Casiglia J, Epstein J, Jacobsen PL, Siegel MA, Woo SB. Managing the care of patients with bisphosphonate-associated osteonecrosis: an American Academy of Oral Medicine position paper. *J Am Dent Assoc*, 2005, 136(12):1658-1668.
- Liu SS, Lin TY, Fu E, Hsia YJ, Chiu HC, Tu HP, Chiang CY. Immediate hyperbaric oxygen after tooth extraction ameliorates bisphosphonate-related osteonecrotic lesion in rats. *J Periodontol*, 2019, 90(12):1449-1456.
- Freiberger JJ, Padilla-Burgos R, Chhoeu AH, Kraft KH, Boneta O, Moon RE, Piantadosi CA. Hyperbaric oxygen treatment and bisphosphonate-induced osteonecrosis of the jaw: a case series. *J Oral Maxillofac Surg*, 2007, 65(7):1321-1327.
- Stockmann P, Vairaktaris E, Wehrhan F, Seiss M, Schwarz S, Spriewald B, Neukam FW, Nkenke E. Osteotomy and primary wound closure in bisphosphonate-associated osteonecrosis of the jaw: a prospective clinical study with 12 months follow-up. *Support Care Cancer*, 2010, 18(4):449-460.
- Williamson RA. Surgical management of bisphosphonate induced osteonecrosis of the jaws. *Int J Oral Maxillofac Surg*, 2010, 39(3):251-255.
- Ghazali N, Collyer JC, Tighe JV. Hemimandibulectomy and vascularized fibula flap in bisphosphonate-induced mandibular osteonecrosis with polycythaemia rubra vera. *Int J Oral Maxillofac Surg*, 2013, 42(1):120-123.
- Kaoutzanis C, Yu JW, Lee ZH, Davary A, Fleisher KE, Levine JP. Mandibular Reconstruction with Free Fibula Flap for Medication-related Osteonecrosis of the Jaw in Patients with Multiple Myeloma. *Plast Reconstr Surg Glob Open*, 2020, 28;8(10):e3186.
- Sacco R, Sacco N, Hamid U, Ali SH, Singh M, Blythe JSJ. Microsurgical Reconstruction of the Jaws Using Vascularised Free Flap Technique in Patients with Medication-Related Osteonecrosis: A Systematic Review. *Biomed Res Int*, 2018, 7; 2018:9858921.
- Mücke T, Jung M, Koerdts S, Mitchell DA, Loeffelbein D, Kesting MR. Free flap reconstruction for patients with bisphosphonate related osteonecrosis of the jaws after mandibulectomy. *J Craniomaxillofac Surg*, 2016, 44(2):142-147.
- Bedogni A, Saia G, Bettini G, Tronchet A, Totola A, Bedogni G, Ferronato G, Nocini PF, Blandamura S. Long-term outcomes of surgical resection of the jaws in cancer patients with bisphosphonate-related osteonecrosis. *Oral Oncol*, 2011, 47(5):420-424.
- Pautke C, Otto S, Reu S, Kolk A, Ehrenfeld M, Stürzenbaum S, Wolff KD. Bisphosphonate related osteonecrosis of the jaw-manifestation in a microvascular iliac bone flap. *Oral Oncol*, 2011, 47(5):425-429.
- Seth R, Futran ND, Alam DS, Knott PD. Outcomes of vascularized bone graft reconstruction of the mandible in bisphosphonate-related osteonecrosis of the jaws. *Laryngoscope*, 2010, 120(11):2165-2171.
- Nocini PF, Saia G, Bettini G, Ragazzo M, Blandamura S, Chiarini L, Bedogni A. Vascularized fibula flap reconstruction of the mandible in bisphosphonate-related osteonecrosis. *Eur J Surg Oncol*, 2009, 35(4):373-379.
- Kim BC, Kim S, Nam W, Cha IH, Kim HJ. Mandibular reconstruction with vascularized osseous free flaps: a review of the literature. *Asian Pac J Cancer Prev*, 2012, 13(2):553-538.

22. Bussu F, Gallus R, Navach V, Bruschini R, Tagliabue M, Almadori G, Paludetti G, Calabrese L. Contemporary role of pectoralis major regional flaps in head and neck surgery. *Acta Otorhinolaryngol Ital*, 2014, 34(5):327-341.
23. Hanasono MM, Militsakh ON, Richmon JD, Rosenthal EL, Wax MK. Mandibulectomy and free flap reconstruction for bisphosphonate-related osteonecrosis of the jaws. *JAMA Otolaryngol Head Neck Surg*, 2013, 139(11):1135-1142.
24. Verduyck H Jr, Backer Td, Mommaerts MY. Outcomes of osseous free flap reconstruction in stage III bisphosphonate-related osteonecrosis of the jaw: systematic review and a new case series. *J Craniomaxillofac Surg*, 2014, 42(5):377-386.

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