Casos Clínicos

Metro Ciencia

Beyond resection: Minimally invasive jaw in a day with nerve reconstruction. A case report

Más allá de la resección: Reconstrucción mínimamente invasiva de la mandíbula en un día con reconstrucción nerviosa. Presentación de un caso clínico

Sofía Córdova Reyes[1]; Fernando Sandoval Portilla[2]; Fernando Sandoval Vernimmen[3]

Abstract

Odontogenic myxoma is a benign but locally invasive tumor arising from the tissues that form the teeth. Its infiltrative growth pattern makes complete excision challenging, increasing the risk of recurrence. Primary treatment involves surgery, often requiring resection of a segment of bone. To reconstruct the bony defect and restore function, techniques such as the use of a free fibula flap with hard and soft tissue reconstruction and nerve grafting are often utilized. This study presents the case of a 15-year-old patient who underwent microvascular reconstruction of the mandible using a free fibula flap with immediate implants and dental prosthesis placement and nerve reinnervation with peripheral nerve allografts following resection of a mandibular odontogenic myxoma. Virtual preoperative 3D planning was employed to increase the accuracy of the surgical reconstruction. The surgical procedure involved a partial mandibulectomy, harvesting of a free fibula flap and microvascular anastomosis to the facial artery and vein in the neck, and immediate dental implant placement into the fibula in a single surgical stage procedure. To restore sensation to the lower lip and chin, an peripheral nerve allograft (Avance, Axogen, Inc, Alachua, FL, USA) was used to reconstruct the bilateral inferior alveolar nerves that were sacrificed with the mandibular resection. The nerve allograft is a cadaveric nerve that is treated with an enzymatic process that removes all cellular components from the nerve leaving only the endoneural tubes to guide and enhance nerve regeneration. The surgery and postoperative patient course was smooth and uneventful and the patient demonstrated excellent functional and aesthetic outcomes at the three-year follow-up with normal jaw function, mastication, esthetics, and neurosensory recovery. The combination of microsurgery, computer-aided planning, and immediate nerve reinnervation has been proven to be an effective approach for reconstructing large mandibular defects[1]. The study highlights the advantages of this technique, including reduced surgical time, increased precision, and improved patient outcomes.

Keywords: Fibula, Myxoma, Microsurgery, Free Tissue Flaps, Mandibular Reconstruction.

Resumen

El mixoma odontogénico es un tumor benigno, pero localmente invasivo que se origina en los tejidos que forman los dientes. Su patrón de crecimiento infiltrativo dificulta la resección completa, aumentando el riesgo de recurrencia. El tratamiento primario consiste en la cirugía, que a menudo requiere la resección de un segmento de hueso. Para reconstruir el defecto óseo y restaurar la función, suelen emplearse técnicas como

1. Maxillofacial Surgeon – San Francisco University of Quito; Ecuador; https://orcid.org/0000-0002-8846-500X
2. Surgeon and Department Head of Oral and Maxillofacial Surgery at Metropolitan Hospital of Quito, Professor of Maxillofacial Surgery at San Francisco University of Quito, Ecuador; https://orcid.org/0000-0003-0600-0936
3. Maxillofacial Surgeon at Metropolitan Hospital of Quito, Professor of Maxillofacial Surgery at San Francisco University of Quito; Ecuador; https://orcid.org/0000-0002-4345-2408

Recibido: 05-08-2025
Aceptado: 10-12-2025
Publicado: 28-03-2026
DOI: 10.47464/MetroCiencia/vol34/1/2026/74-81

***Correspondencia autor:** somicore92@hotmail.com

el colgajo libre de peroné con reconstrucción de tejidos duros y blandos y el injerto nervioso. Este estudio presenta el caso de un paciente de 15 años que fue sometido a reconstrucción microvascular de la mandíbula mediante un colgajo libre de peroné con colocación inmediata de implantes y prótesis dental, además de reinervación nerviosa con aloinjertos de nervio periférico, tras la resección de un mixoma odontogénico mandibular. Se utilizó planificación virtual preoperatoria en 3D para aumentar la precisión de la reconstrucción quirúrgica. El procedimiento incluyó una mandibulectomía parcial, la obtención de un colgajo libre de peroné y la anastomosis microvascular con la arteria y vena faciales en el cuello, junto con la colocación inmediata de implantes dentales en el peroné en un único tiempo quirúrgico. Para restaurar la sensibilidad del labio inferior y el mentón, se utilizó un aloinjerto de nervio periférico (Avance, Axogen, Inc., Alachua, FL, EE. UU.) para reconstruir los nervios alveolares inferiores de manera bilateral, que fueron sacrificados durante la resección mandibular. El aloinjerto nervioso es un nervio cadavérico tratado mediante un proceso enzimático que elimina todos los componentes celulares del nervio, dejando únicamente los tubos endoneurales que guían y favorecen la regeneración nerviosa. La cirugía y la evolución postoperatoria fueron satisfactorias y sin complicaciones, y el paciente mostró excelentes resultados funcionales y estéticos en el seguimiento a tres años, con función mandibular normal, adecuada masticación, estética y recuperación neurosensorial. La combinación de microcirugía, planificación asistida por computadora y reinervación nerviosa inmediata ha demostrado ser un enfoque eficaz para la reconstrucción de grandes defectos mandibulares[1]. El estudio resalta las ventajas de esta técnica, incluyendo la reducción del tiempo quirúrgico, mayor precisión y mejores resultados para el paciente.

Palabras claves: Peroné, Mixoma, Microcirugía, Colgajos de Tejido Libre, Reconstrucción Mandibular.

Introduction

Odontogenic myxoma (OM) is a rare benign neoplasm originating in the mesenchyme, derived from structures such as the papilla, dental follicle or periodontal ligament[2]. Clinically, it exhibits slow growth, causing bone expansion, dental mobility and, in advanced cases, cortical perforation[3]. It represents less than 10% of odontogenic tumors and is more common in young adults. Its expansion into the medullary bone and the absence of a capsule explains its high recurrence rate[4].

Treatment usually involves en bloc resection with 1 cm bony margins, although some studies suggest that a 5 mm margin might be sufficient. These tumors, not being encapsulated, tend to infiltrate the surrounding bone, making it nearly impossible to completely remove them with simple curettage. Therefore, complete resection including healthy bone and soft tissue around the tumor is recommended to ensure healing[5]. In more aggressive cases, this procedure may require resection of nerve structures, such as the inferior alveolar nerve, which is key to sensitivity to the mandibular area such as teeth, buccal and vestibular mucosa, and lower lip and chin skin[6].

The gold standard for reconstructing post-resection defects is the vascularized fibula flap, as it allows restoring the three-dimensional structure of the bone segments lost during surgery and facilitates immediate rehabilitation with dental implants, optimizing the functional and aesthetic results of the surgery[7]. In addition, to prevent oral dysfunction, such as difficulty in speech and mastication, poor saliva retention, or self-inflicted injuries to the soft tissues of the jaw, immediate reinnervation of the inferior alveolar nerve sectioned during surgery is considered[6]. This procedure can be carried out using autogenous nerve grafts, such as the sural nerve, but will leave another area of the body with numbness, or processed cadaveric nerve allografts, which will allow complete restoration of the functionality and sensitivity of the affected area[8] without a donor site morbidity or loss of sensation.

With this in mind, a case of a microsurgical mandibular reconstruction with a microvascularized fibula flap and immediate reinnervation with bilateral inferior alveolar nerve

allografts after resection of a mandibular myxoma in a 15-year-old patient, using a minimally invasive approach, is presented.

Case Report

A 15-year-old male patient with no relevant past medical history presented to the Fernando Sandoval dental clinic in Quito - Ecuador due to a marked facial asymmetry involving the lower facial third of the left side reporting 8 months of evolution. On facial examination, there was a marked asymmetry with edema of the left mandible, and upon intraoral examination, a preserved oral opening was observed, but with expansion of bone cortices at the level of the symphysis and mandibular body on the left side and induration on palpation.

On computed tomographic (CT) examination, a radiolucency of approximately 9 cm in dimension was observed that resembled "soap bubbles" at the level of the symphysis on the right side and extending to the mandibular body on the left side (FIG. 1a-b), causing displacement of teeth adjacent to the lesion, and expansion of the buccal and lingual plates of the mandible. Due to the clinical and radiographic findings, an incisional biopsy was performed under local anesthesia in the clinic, and following histopathologic examination, a definitive diagnosis of odontogenic fibromyxoma was established.

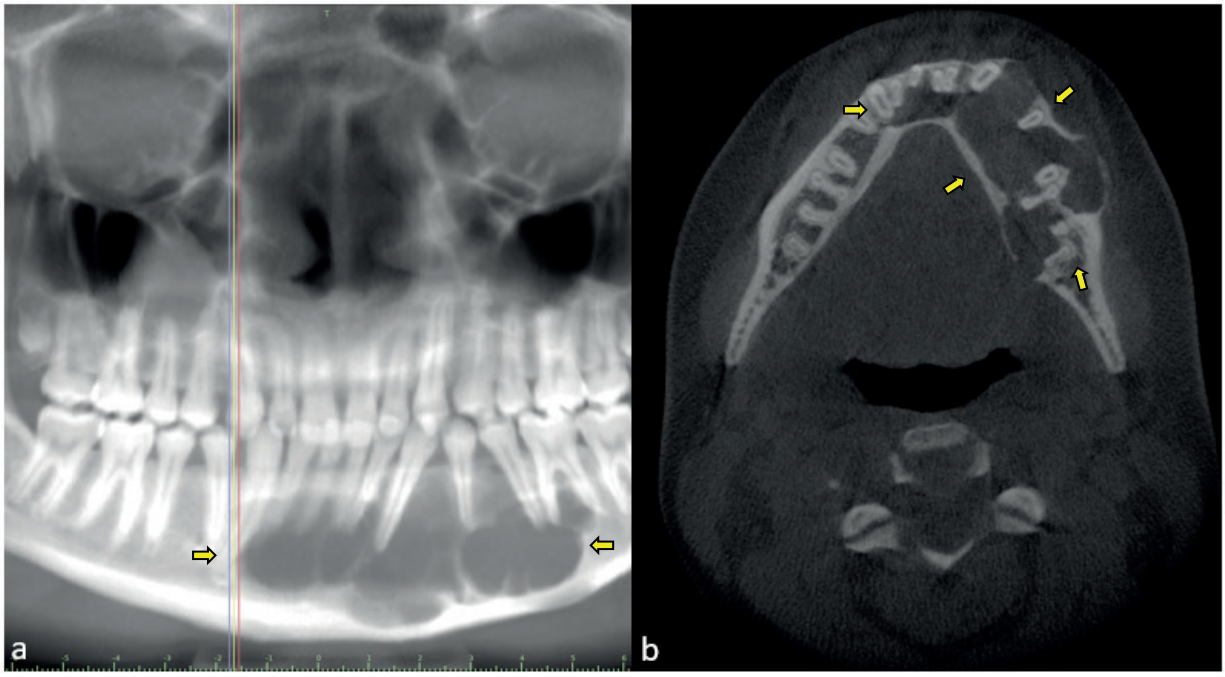

Figure 1. Panoramic reconstruction from CT scan. b) Axial CT scan indicating the extent of the mandibular lesion (yellow arrows).

Preoperative planning

In preparation for a fibula flap harvest, CT angiography (CTA) of the lower extremities (donor site) was performed showing a normal tomographic density of the fibula, and no lesions were identified in the bony structures. The CTA showed normal three vessel runoff (anterior and posterior tibial and peroneal vessels) without plaques or calcifications, and no defects consistent with thrombotic lesions were identified.

A computer-assisted surgical planning protocol was implemented, using KLS Martin IPS®

software (Jacksonville, FL, USA). This process allowed for the digital planning of several points:

- Design virtual surgical cutting guides for the mandible and fibula
- Design the custom titanium osteosynthesis plate for fixation of the fibula bone segments
- Design the surgical guide for bone drilling and dental implant placement in the fibula bone
- Perform the simulation of the nerve allograft to determine its length, diameter, and planned location relative to the fibula (FIG. 2).

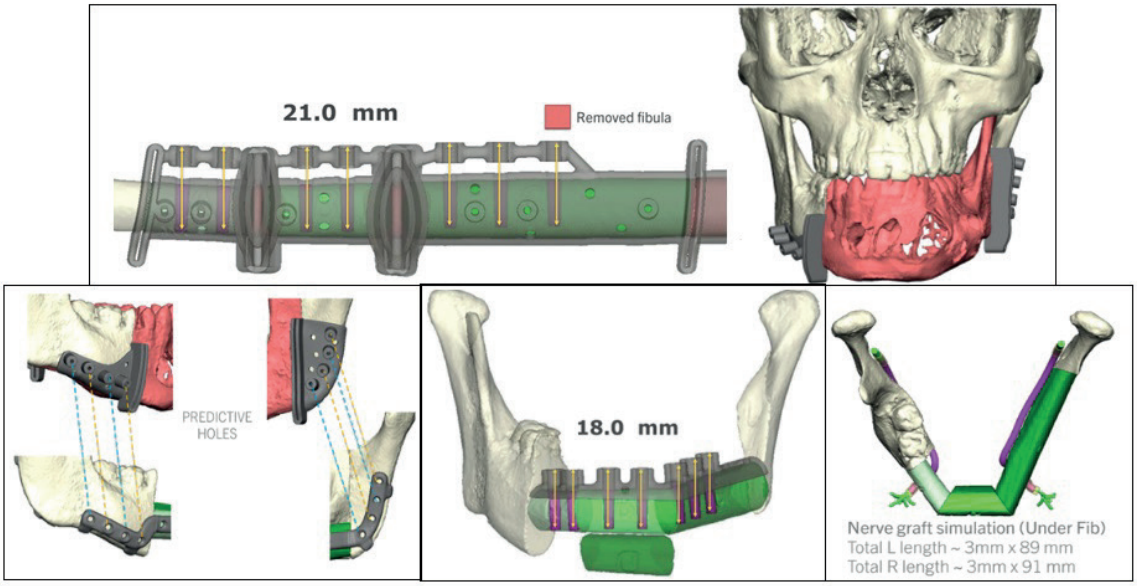

Figure 2. Virtual pre-surgical planning, IPS® software from KLS Martin, including bone, implant, and nerve reconstruction.

Surgical Intervention

a. Donor Site: Harvesting of the Autologous Graft

Under general anesthesia and nasotracheal intubation, after completion of preoperative assessments, an osteomyocutaneous fibula flap was harvested from the left leg by the reconstructive oral and maxillofacial surgery team. The flap design was guided by a patient-specific surgical guide to ensure accurate osteotomies and appropriate soft tissue inclusion.

While maintaining vascularization through the peroneal artery and venae comitantes, osteotomies were performed according to the virtual surgical plan. The fibular segments were then fixed to a preformed, custom-made titanium mandibular reconstruction plate.

Subsequently, seven osseointegrated dental implants (Zimmer Biomet, Warsaw, IN, USA) with dimensions of 3.7 mm in diameter and 10 mm in length were inserted into the fibula segments using a custom implant guide. A screw-retained, implant-supported provisional prosthesis was adapted immediately over the implants to verify prosthetic alignment and occlusion (Fig. 3a).

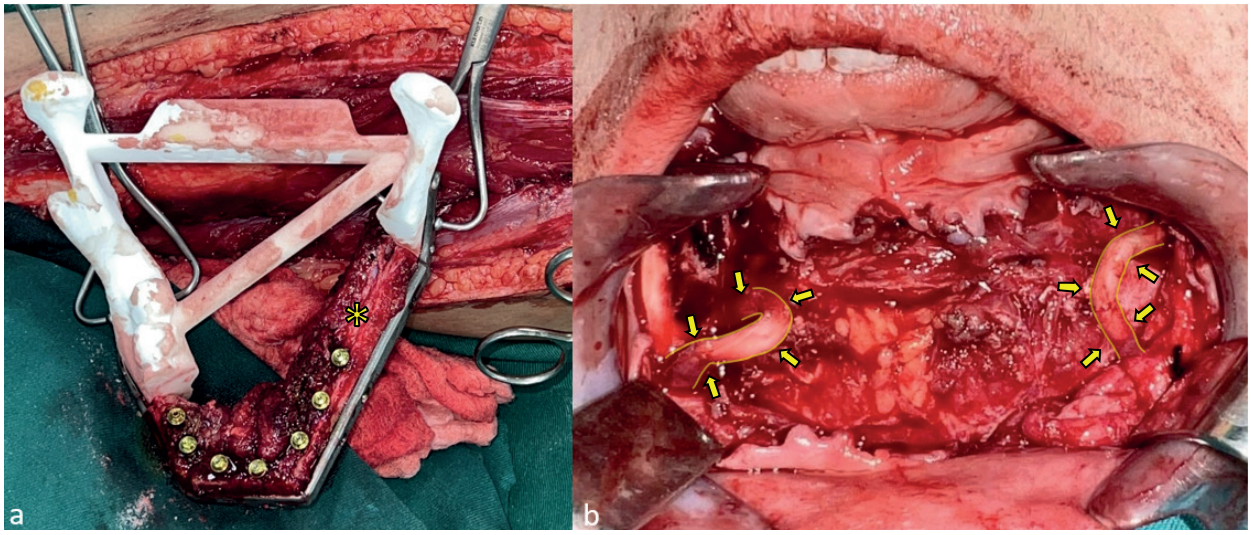

Figure 3. a) Fibula bone segments (yellow asterisk) fixed with osteosynthesis plate with dental implants placed. b) Bilateral IAN nerve allografts connecting the course of the inferior alveolar nerve to the mental nerves (yellow arrows).

b. Recipient Site: Mandibular Reconstruction and Graft Placement

Through a combined transoral and transcervical approach, a segmental mandibulectomy was performed using a custom surgical guide. The resection extended from the right mandibular symphysis to the midportion of the left mandibular ramus, while preserving the left condylar segment and articular disc in their anatomical position.

The vascularized fibula flap, prepared as described above, was then transferred en bloc to the mandibular defect. Fixation was achieved intraorally on the right side and via a submandibular approach on the left, allowing precise adaptation of the fibula segments to the remaining mandibular stumps.

Microsurgical end-to-end anastomoses were performed between the peroneal artery and venae comitantes (donor vessels) and the facial artery and vein (recipient vessels), re-establishing vascular perfusion to the flap. This approach provided adequate surgical exposure while maintaining a minimally invasive profile, thereby optimizing both functional and aesthetic outcomes.

c. Nerve Reconstruction and Provisional Prosthesis Placement

To restore sensation in the reconstructed area, immediate bilateral inferior alveolar nerve (IAN) reconstruction was performed. Two processed human nerve allografts, each 7.0 cm in length (Avance®, Axogen Inc., Alachua, FL, USA), were used to bridge the right and left IAN gaps.

Instead of conventional direct epineurial suturing, a connector-assisted nerve repair technique was employed using extracellular matrix nerve connectors (Axogen Inc., Alachua, FL, USA). This method preserves the structural and biochemical integrity of the allograft, facilitating axonal regeneration through intact endoneurial tubes. Laminin within the matrix acts as a molecular guide for axonal growth, enhancing neurosensory recovery (Fig. 3b).

Postoperatively, flap perfusion was closely monitored using Doppler ultrasonography every 2 hours for the first 48 hours in the Intensive Care Unit (ICU). The patient was subsequently transferred to the surgical ward, where monitoring continued every 4 hours for 3 days and then every 8 hours until discharge.

At the three-year follow-up, the patient demonstrated satisfactory mandibular mobility, stable occlusion, preserved speech and masticatory function, and no growth disturbance in the donor leg. Despite the loss of one implant, overall rehabilitation remained stable. Neurosensory testing—including two-point discrimination, brush-stroke direction, contact detection, thermal discrimination, and pin-prick nociception—showed recovery consistent with grade S4 on the Medical Research Council Scale, indicating normal sensory function.

Discussion

Microvascular surgery, combined with virtual surgical planning, has optimized the treatment of reconstruction of large mandibular defects. Detailed presurgical planning, based on three-dimensional images, allows for accurate simulation of the surgery, resulting in reduced surgical time, decreased donor site morbidity, and increased reconstruction accuracy. This surgical strategy has significantly improved functional and aesthetic outcomes in patients with large mandibular defects[9].

Immediate mandibular reconstruction using a microvascular fibula flap, fixated with a custom titanium plate, is considered the first-line option due to its lower complication rate compared to reconstruction using only reconstruction plates or miniplates, a claim supported by the meta-analysis conducted by N. Sobti et al[10], which highlights the advantages of this technique. Although Garajei et al[11] didn´t observe a statistically significant difference in relation to the operating time between analogous planning versus virtual planning, although they did obtain statistically significant differences in the aesthetic results. Following the line of the results obtained by Cedillo et al[7] who, comparing analogous planning versus virtual planning, determined that virtual planning has an advantage since it reduces surgical time and reduces the flap ischemia time. The meta-analysis conducted by Tang et al[12], analyzing surgical time in fourteen studies and ischemia time in ten, revealed a statistically significant reduction in both parameters. This favorable trend suggests a positive impact on bone consolidation and a substantial improvement in postoperative quality of life, which is considered a key indicator of surgical success.

Evidence suggests that immediate or postoperative dental implant placement, performed after the reconstructive surgery, shows comparable success and complication rates[13], furthermore, in flaps that will be irradiated, there is no significant risk in the osseointegration of these, whether their placement is done immediately or after a period of 6 months[14]. Studies have reported that immediate dental implant placement can improve health-related quality of life. Tumuluri et al[15]. noted that patients undergoing maxillofacial flap reconstruction, in conjunction with immediate implant placement, experienced significant improvements in functions such as salivation, feeding, swallowing, hydration, lip competence, speech, and appearance. These findings are especially relevant as they can be used to inform patients during the decision-making process regarding their treatment. However Tahmasebi et al[16] described in their research that irradiated bone had a risk of failure 2.29 times greater than non-irradiated bone, which marks a statistically significant difference. Regarding the placement of dental implants in non-irradiated fibula flaps, a high success rate has been reported, reaching 93% at five years of follow-up and 60% at twenty years. However, it has been noted that the presence of radiation or any associated pathology does not show a statistically significant difference in the implant survival rate[17].

Immediate reinnervation of the inferior alveolar nerve, a procedure supported by studies such as those of Bagheri et al[18] and Le Donnea et al[19], has been shown to be an effective strategy to optimize functional and sensory outcomes in patients undergoing

mandibular resections. By promoting faster and more complete nerve regeneration, this technique significantly improves the quality of life of patients and reduces the risk of long-term complications. Nevertheless, reinnervation of the inferior alveolar nerve and the restoration of functional sensation continue to represent a surgical challenge, mainly due to limitations such as the limited length of the available nerve graft and neurosensory compromise at the donor site. In this context, miloro[20] proposes an innovative strategy based on the use of decellularized, chondroitinase-treated nerve allografts. These allografts are available in a variety of lengths and diameters, allowing them to be adapted to the specific anatomical characteristics of each case. This technique is optimized by the incorporation of virtual surgical planning, which improves intraoperative precision, reduces surgical time, and potentially improves postoperative neurosensory outcomes. Reported results demonstrate a 100% success rate in sensory recovery at 12 months postoperatively[6].

In conclusion, odontogenic myxoma, although a benign neoplasm, exhibits locally invasive behavior that requires wide surgical resection with adequate safety margins to significantly minimize the risk of recurrence. Currently, maxillomandibular reconstruction using microvascularized flaps, combined with advanced surgical techniques and supported by virtual surgical planning, constitutes an effective, safe, and low-morbidity strategy. This comprehensive approach not only allows for structural and functional rehabilitation in a single surgical procedure, including the placement of dental implants and reinnervation of the inferior alveolar nerve, but also improves the patient's aesthetic, functional, and neurosensory prognosis, thus highlighting the importance of timely and planned surgical treatment in these complex cases.

Acknowledgments

The authors sincerely acknowledge Dr. Michael Miloro DMD, MD and Dr. Nicholas Callahan MPH, DMD, MD, for their invaluable surgical expertise and critical contributions to the operative management of this case, and further extend their appreciation to the entire surgical team, whose coordinated efforts, professionalism, and commitment to excellence were essential to the successful outcome of the reconstruction.

Conflict of interest

The authors declare that they have no conflicts of interest

Funding

There was no external funding for this study

Ethical approval

Not applied

Patient consent

Informed consent was obtained from the patient.

Bibliografía

1. Miloro M, Callahan N, Markiewicz M, Kolokythas A, Moles S, Chakraborty K. Immediate inferior alveolar nerve reconstruction with ablative mandibular resection results in functional sensory recovery. J oral Maxillofac Surg. 2024; 82: p. 126-133.

2. Juengsomjit R, Arayasantiparb R, Ghazali A, Kosanwat T. Odontogenic myxoma: A clinicopathological study over 15 years and immunohistochemical analysis. Heliyon. 2024 Octubre.

3. Yoshida S, Takeshita Y, Kawazu T, Matsumura T, Asaumi J, Nagatsuka H, et al. A Case of Odontogenic Myxoma of the Mandible with Expansion to the Alveolar Crest – Comparison of Imaging Findings and Pathological Findings: A Case Report. The Open Dentistry Journal. 2021; 16.

4. Tumours WCo. Head and neck tumours (WHO classification of tumours series). 5th ed. Lyon - France: Editorial Board; 2022.

5. Miloro M. Peterson's Principles of Oral and Maxillofacial Surgery. Fourth Edition ed. Gewerbestrasse: Springer; 2022.

6. Miloro M, Zuniga J. Does Immediate Inferior Alveolar Nerve Allograft Reconstruction Result in Functional Sensory Recovery in Pediatric Patients? J Oral Maxillofac Surg. 2020.

7. Cedillo M, Córdova S, Larralde S, Martinez F, Sandoval Portilla F, Suntaxi F. A Comparative Study of Analog Preoperative Planning Versus Virtual Preoperative Planning for Mandibular Reconstruction With Fibula Free Flap. The Journal of Craniofacial Surgery. 2022 Octubre; 33(7).

8. Akbari M, Miloro M. The Inferior Alveolar Nerve: To Graft or Not to Graft in Ablative Mandibular Resection? J Oral Maxillofac Surg. 2019.

9. Pucci R, Weyh A, Smotherman C, Valentini V, Bunnell A, Fernandes R. Accuracy of virtual planned surgery versus conventional free-hand surgery for reconstruction of the mandible with osteocutaneous free flaps. Int J Oral Maxillofac Surg. 2020.

10. Sobti , Ahmed K, Polanco , Chilov , Cohen , Boyle , et al. Mini-plate versus reconstruction bar fixation for oncologic mandibular reconstruction with free fibula flaps: A systematic review and meta-analysis. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2022.

11. Garajei A, Modarresi A, Arabkheradmand A, Shirkhoda M. Functional and esthetic outcomes of virtual surgical planning versus the conventional technique in mandibular reconstruction with a free fibula flap: A retrospective study of 24 cases. Journal of Cranio-Maxillo-Facial Surgery. 2024.

12. Tang NSJ, Ahmadi , Ramakrishnan. Virtual surgical planning in fibula free flap head and neck reconstruction: A systematic review and meta-analysis. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2019.

13. Tumuluri V, Leinkram D, Froggatt C, Dunn M, Wykes J, Singh J. Outcomes of immediate dental implants in vascularised bone flaps for mandibular reconstruction. ANZ Journal of Surgery. 2023.

14. Patel S, Kim D, Ghali G. Maxillofacial Reconstruction Using Vascularized Fibula Free Flaps and Endosseous Implants. Oral and Maxillofacial Surgery Clinics of North America. 2019.

15. Tumuluri , Charters , Venchiarutti R, Leinkram , Froggatt , Dunn. Quality of life outcomes in patients receiving dental implants. British Journal of Oral and Maxillofacial Surgery. 2025.

16. Tahmasebi E, Keykha , Hajisadeghi , Moslemi H, Shafiei , Kalantar Motamedi MH, et al. Outcomes and influential factors in functional and dental rehabilitation following microvascular fibula flap reconstruction in the maxillomandibular region: a systematic review and meta-analysis. Maxillofacial Plastic and Reconstructive Surgery. 2023.

17. Malik M, Brandon B, Rui F. Long-Term Outcomes of Dental Implants Placed in Fibula-free Flaps Used for Reconstruction of MaxilloMandibular Defects. Oral and Maxillofacial Surgery Clinics of North America. 2025.

18. Bagheri S, Meyer R, Hee S, Thoppay J, Khan H, Steed M. Microsurgical Repair of the Inferior Alveolar Nerve: Success Rate and Factors That Adversely Affect Outcome. J Oral Maxillofac Surg. 2012.

19. Le Donnea , Jouan R, Bourlet J, Louvrier A, Ducret M, Sigaux N. Inferior alveolar nerve allogenic repair following mandibulectomy: A systematic review. Journal of Stomatology oral and Maxillofacial Surgery. 2021.

20. Miloro M. WhatDoIDoifThereisNoDistalNerve Stump for Inferior Alveolar Nerve Reconstruction? Journal of Oral and Maxillofacial Surgery. 2023.

Cómo citar: Córdova Reyes S; Sandoval Portilla F; Sandoval Vernimmen F. Beyond resection: Minimally inv asive jaw in a day with nerve reconstruction. A case report. MetroCiencia [Internet]. 30 de marzo de 2026;34(1):74-81. Disponible en: https://doi.org/10.47464/MetroCiencia/vol34/1/2026/74-81