

CASE REPORT

Pedicle ossification after fibular flap reconstruction of maxillary defects: A case report and literature review

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Key Clinical Message

The phenomenon of vessel pedicle ossification is a noteworthy aspect of the repair and reconstruction of maxillofacial defects. Imaging findings typically reveal high-density shadows within the vascular pedicle pathway, which may be managed through conservative observation or surgical intervention as deemed appropriate.

Abstract

Vessel pedicle ossification is a relatively uncommon complication associated with the reconstruction of oral and maxillofacial tissue defects using free tissue flap repair. In this paper, we report a case of pedicle ossification and conduct a comprehensive review of previous literature. A 39-year-old man presented with a limited ability to open his mouth 6 months after fibular flap reconstruction of the mandible. Plain film X-ray and computed tomography (CT) indicated pedicle ossification. Two years after the initial operation, the restriction in the patient's ability to open his mouth had not worsened, although there were more pronounced radiographic abnormalities.

KEYWORDS

maxillary defects, fibular flap, pedicle ossification, reconstruction

1 | INTRODUCTION

Free tissue flap has become one of the most common methods of reconstructing oral and maxillofacial tissue defects. The term includes fibula free flap (FFF), forearm-based free flaps, and anterolateral thigh flap (ALT).¹ Even though there is a high success rate for free tissue flap, it can involve some complications, such as thrombosis of blood vessels or major bleeding.²

Vessel pedicle ossification is a relatively uncommon complication that can develop after free tissue

flap repair. It was first reported by Deschler in 1997, who described a hard, bony mass that appeared after free fibula flap repair of the mandible.³ However, the clinical presentation and disease courses of patients with pedicle ossification vary, and the mechanisms responsible for the initiation of ossification are not fully understood.

The literature on ossification remains limited. In this paper, we report a case of pedicle ossification after fibula flap reconstruction of maxillary defects and conduct a comprehensive review of previous literature.

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2 | CASE HISTORY

The patient was a 39-year-old male. On admission, the patient's chief complaint was maxillary gingival mass. The pathological diagnosis of biopsy specimens was squamous cell carcinoma. The patient received a maxillary partial resection and a reconstruction of left fibula flap. Six months after the operation, the patient found he had a limited ability to open his mouth. On specialized examination, we could see that the patient's face was basically symmetrical, but there was a slight swelling in the area of the right mandibular angle, which was hard to the touch and had no obvious tenderness (Figure 1A). The degree of mouth opening was about 2 cm, the skin island in the mouth was well healed, and a hard mass shaped like a rope was palpable in the right buccal mucosa (Figure 1B).

3 | METHODS

X-ray films showed a globular, high-density shadow on the right side of the mandibular angle (Figure 2). Postoperative three-dimensional computed tomography (CT) revealed a dense, cord-like, bony shadow that sloped backward from one end of the fibula to the mandibular angle (Figure 3).

4 | CONCLUSION AND RESULTS

This was consistent with pedicle ossification. The patient declined surgical ablation, and instead opted for careful observation.

As of 2 years after the observation, the restriction in the patient's ability to open his mouth had not worsened, although the radiographic abnormalities were found to be more pronounced (Figure 3).

5 | DISCUSSION

Vessel pedicle ossification is a relatively uncommon complication that can occur after repair of maxillofacial defect with vascularized free tissue flap. There have been few reports on pedicle ossification in the literature, most of which are case reports, though some are retrospective studies. These retrospective studies revealed that 9.25%–28% of patients undergoing maxillofacial defect reconstruction showed vessel pedicle ossification on X-ray.^{4,5} Despite the relatively high prevalence of pedicle ossification detected through imaging during follow-up, the percentage of vessel pedicle ossification presenting with clinical symptoms was estimated to be lower, approximately 2%.^{6,7}

Common clinical symptoms of pedicle ossification include trismus, hard swelling in the surgical region (submandibular, cheek, and submental region), pain, or discomfort during swallowing or chewing.^{7–9} The earliest occurrence of pedicle ossification was 1 month after the operation, and the latest presentation was 9 years.^{9,10} It has been reported that ossification might stop after some time, so many scholars have suggested that secondary surgical interventions should be primarily symptom-driven and that prophylactic resection should not be performed.¹¹ The same was true for the case study presented in this paper: no clinically relevant worsening of symptoms was observed 6 months later. Patients with symptoms severe enough to affect normal life, however, have seen good outcomes after subsequent corrective surgery.

Vessel pedicle ossification can occur in the reconstruction of tissue defects attributable to any of several causes, including squamous cell carcinoma, infection, injury, osteosarcoma, adenoid cystic carcinomas, and ameloblastoma. It has been reported that gender, smoking history, post-operation infection, and adjuvant therapy do not significantly correlate with vessel pedicle ossification.⁶

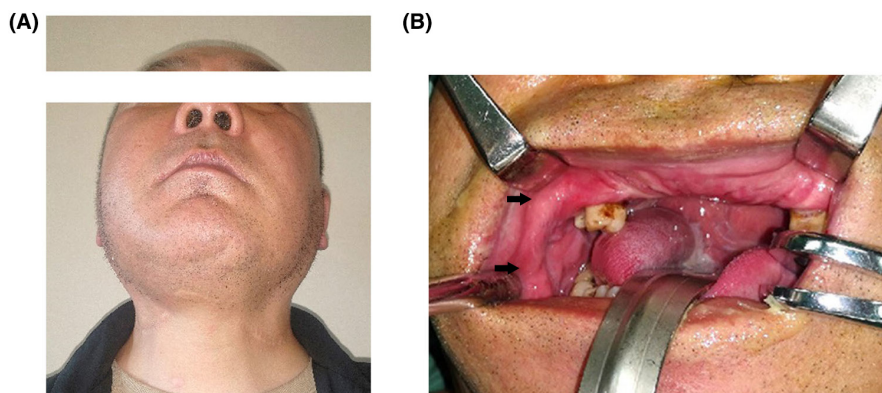
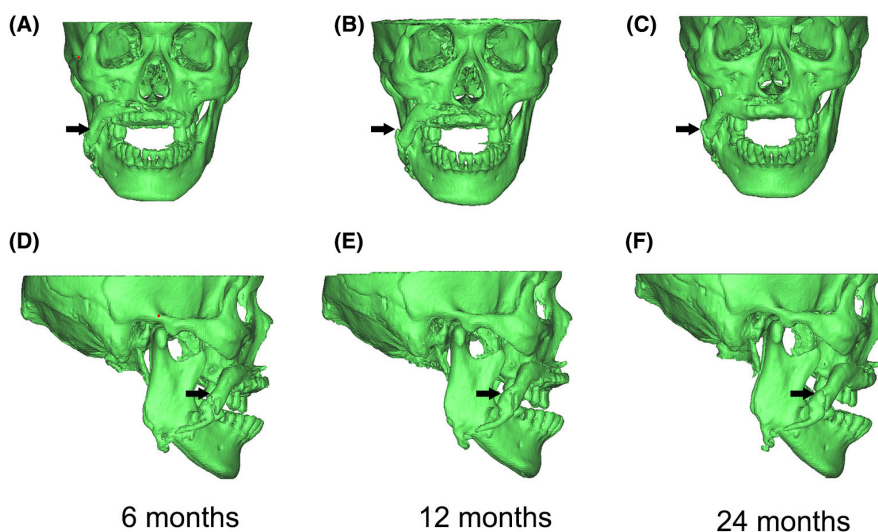


FIGURE 1 Specialized examination of the patient. (A) The patient's face was basically symmetrical, but there was a slight swelling in the area of the right mandibular angle. (B) The degree of mouth opening was about 2 cm, and a hard mass shaped like a rope was palpable in the right buccal mucosa.



FIGURE 2 X-ray films showed a globular, high-density shadow on the right side of the mandibular angle (A) Six months after the operation (B) 12 months after the operation (C) 24 months after the operation.

FIGURE 3 Preoperative three-dimensional computed tomography (CT) revealed a dense, cord-like, bony shadow that sloped backward from one end of the fibula to the mandibular angle. Front (A) and right side (D) view of the 6-month postoperative CT. Front (B) and right side (E) view of the 12-month postoperative CT. Front (C) and right side (F) view of the 24-month postoperative CT.



However, a significant correlation has been observed between ossification and the type of free flap used during reconstruction. Most cases of ossification are associated with fibula flap.

Though the mechanism underlying ossification is not fully understood, there are four primary possibilities. First, the generally accepted mechanism underlying the generation of ossification is vascularized periosteal osteogenesis, which can explain why most cases of ossification occur in the fibula flap. When harvesting a fibula flap, in order to obtain a long enough vessel pedicle, it is usually necessary to strip from the central end of the fibula segment, which might contain a part of the periosteum, forming a vascularized periosteum. It has been reported that vascularized periosteum can accelerate bone graft substitution into a newly formed bone.¹² Second, fracture repair theory maintains that mesenchymal stem cells from the broken end of the osteotomy could become distributed along the vascular pedicle, where they differentiate into osteoprogenitor cells and then into osteoblasts, leading to the new bone formation.¹³ Third, in general, the head and neck have better capillary perfusion than the limbs, which could enhance an existing osteogenic effect and related cell signaling. Fourth, ossification may be the response of

the vessel pedicle to the continuous mechanical stimulation caused by the movement of facial muscles and of the mouth opening and closing.

The prevention of ossification may require some changes. Patients requiring fibula flap repair can be divided into two groups. None of the patients whose vessel pedicle had been harvested from the periosteum showed ossification, while 17% of the patients whose vessel pedicle had been removed from the subperiosteum showed ossification.¹⁴ It has also been reported that the traditional method of making fibula flap has been improved. Before surgery, virtual software is used to calculate the length of the required fibula, beyond which no muscle sleeve is retained.¹⁵ This technique has been proven to be feasible, but a large number of samples are still needed to provide data support.

In conclusion, ossification after surgery is an interesting phenomenon associated with reconstruction using free flap. It is mostly diagnosed on routine follow-up imaging, usually has no obvious symptoms, and can be addressed conservatively with observation. However, patients whose symptoms affect their quality of life should consider surgery. Reducing the amount of periosteum on the vessel pedicle to the greatest extent possible may prevent ossification.

AUTHOR CONTRIBUTIONS

Bo Zou: Conceptualization; data curation; resources; software; visualization; writing – original draft; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

Relevant data are available in the manuscript.

ETHICS STATEMENT

Not applicable.

CONSENT

The patient has provided informed consent for the publication of the case.

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