Reconstruction of composite oromandibular defects with a rib-major pectoralis myocutaneous flap carrying costal parietal pleura: a forgotten option?

Y He¹, SF Jin¹, HG Zhu¹, YX Zhang², ZY Zhang¹*

Abstract

Introduction

Reconstruction of composite oromandibular defects of oral malignancy is a challenging problem for oral and maxillofacial surgeons. Revolutionary microvascular surgical techniques permit surgeons to use two free flaps in one stage—one for the bone and inner lining and one for the skin or soft tissue. But in some cases with poor quality of recipient vessel site and heavily irradiated neck condition, these flaps also have some problems, especially in ablative surgical cases with large soft-tissue loss. The aim of this article was to report a case of reconstruction of composite oromandibular defects with a rib-major pectoralis myocutaneous flap carrying costal parietal pleura.

Case report

In this article, a rib-major pectoralis myocutaneous flap was used to reconstruct a composite oromandibular defect with excellent cosmetic and functional outcome. It provided a suitable and cost-effective reconstruction with low microsurgical risk, relatively short operative time, sufficient soft-tissue replacement and minimum donor site morbidity.

Conclusion

This reconstructive method of the compound osteomyocutaneous flap should not be forgotten when two free flaps in one reconstructive stage are gaining in popularity.

Introduction

Reconstruction of composite defects of oral malignancy is a challenging problem, and large composite oromandibular defects resulting from excision of T3 and T4 cancer are the most challenging reconstructions for maxillofacial surgeons. Numerous flaps have been described in the literatures to reconstruct these defects, including (1) pedicled flaps with or without reconstructive plate: pectoralis myocutaneous flap, latissimus dorsi flap and trapezius flap; (2) free flaps with or without reconstructive plate: radial forearm flap and rectus abdominis flap; (3) double flaps or flow-through flaps: radial forearm or rectus abdominis combined fibula flap and anterolateral thigh combined fibula flap; (4) composite vascularized osteomyocutaneous flaps: fibula flap and scapular flap; (5) composite myocutaneous flap with bone: latissimus with scapular and pectoralis major-rub flap.

The many and varied flaps so far used to reconstruct the composite oromandibular defects demonstrate not only the multiple choice of transferable tissue, but also the complexity of the defects that require reconstruction. However, with increased experience, it was recognized that the large composite defects of the oromandibular area need not only a bone but also a large amount of soft tissue for total reconstruction. Although the composite vascularized osteocutaneous flap can provide bone, intraoral and external face reconstruction, it usually is inadequate for soft-tissue volume replacement. Pectoralis major and latissimus dorsi flaps are the most versatile composite flaps for major reconstruction with sufficient soft-tissue transfer after extensive ablative or oral cancer. Since ribs can be incorporated as a stable vascularized bone graft on the pectoralis major composite flap, and Bell in 1981 successfully utilized the rib-pectoralis major flap in 14 patients’ composite defect reconstruction after oral cancer surgery, this article prefers the rib-major pectoralis flap as a useful composite myocutaneous flap with bone in extensive reconstruction of the defects from oral cancer.

Case report

A Chinese 26-year-old female patient underwent extensive resection of an osteosarcoma of the right ramus invaded by the surrounding soft tissue and received 7000 cGy radiation therapy 5 years earlier. The oral and maxillofacial team performed wide resection of the involved areas of masseter muscle, parotid gland, facial soft tissue and right segmental mandibulectomy with a simultaneous bridge of a reconstructive plate (Stryker, Freiburg, Germany) in that surgery. Follow-up result, up to now, was negative in the operative area and neck region by clinic examination and panoramic radiograph (Figure 1). The patient has a severe
cosmetic problem in the right facial region due to the loss of soft tissue and mandibular hard tissue (Figures 2 and 3). The subcutaneous reconstructive plate that looks likely to be exposed also has a great psychological impression on the patient. Because of the cosmetic and psychological reasons, the patient was most inquiring of any procedure that could improve her appearance.

Operative technique

The standard pectoralis major composite flap design was used with a vertical extension of the medial incision to expose the second to sixth chondrosternal junctions. The skin island of 3.5 cm × 7.5 cm used to replace the intraoral lining was centred on the fifth rib transversely (Figure 4). After surgical access to the entire clavicular origin of the muscle and musculotendinous junction in the axilla, which is subsequently divided, the sternal origin of the pectoralis major muscle was gained by raising a laterally based flap of about 10 cm width at the level of the anterior axillary line to the medial sternum (Figure 5). The pectoralis major muscle was raised from the chest wall along its lateral and bottom margin. The right fifth rib was approached through the fifth interspace and divided lateral to the margin of the pectoralis major muscle. Periostium attached to the rib was preserved to ensure maximum blood supply, and the rib was elevated from the underlying periosteum and pleura, dissecting lateral to medial according to the 10-cm bone length required (Figures 6 and 7). The rib-major pectoralis osteomyocutaneous flap was then raised on its neurovascular bundle and tunnelled beneath the skin in the supraclavicular area into the neck and head (Figure 8). Bleeding would be observed from the perichondrium and periosteum of the rib. After surgical exposure of oromandibular

**Figure 1:** Panoramic radiograph of mandible before reconstructive operation.

**Figure 2:** Lateral views of facial defects preoperatively.

**Figure 3:** Lateral views of facial defects preoperatively and incision designed.
defect, ipsilaterally residual mandible and condyle, the rib was tailored to the appropriate length and fixed with stainless steel wire to the mandibular remnants in the desired contour of the new mandible. The muscle of the major pectoralis flap was filled into the soft-tissue defect in the pectoral and ramus region, and the distal part of the muscle was folded to cover the reconstructive plate. The skin island of the flap that was in the right position when turned over the clavicle was used to relax the intraoral lining and as an observe window of the myocutaneous flap. The chest wall donor area was closed primarily after mobilization of the skin flaps.

Results
The patient got a significant cosmetic improvement from the reconstructive surgery (Figures 9 and 10). The rib-major pectoralis myocutaneous flap survived without any evidence of flap crisis and partial necrosis. The vascularized rib bone had no obvious absorption in postoperative panoramic radiograph (Figure 11). Pneumothorax was not observed postoperatively, and there was a rapid return of oral competence and function 5 days after surgery. This reconstructive procedure needed only 3 to 4 h of time, and the patient’s recovery from general anaesthesia was safe and quick.

Discussion
Advanced malignancies of the oral cavity often require extensive ablative procedures as part of combined therapy. Surgical resection can leave composite defects with loss of facial soft tissue, mandible and oral mucosa, posing a difficult reconstructive challenge cost-effectively. The option of reconstruction of the composite oromandibular defect not only in soft tissue but also in hard tissue simultaneously is gaining in popularity, since the relatively simple reconstruction with plate and soft-tissue flap...
Case report

has plate-related problems, such as common exposure and loosening. Revolutionary microvascular surgical techniques, now permit surgeons to use two free flaps in one stage—one for the bone and inner lining and one for the skin or soft tissue, although a single osteocutaneous flap such as fibula flap or iliac crest flap is available for some composite oromandibular defects with less soft-tissue loss, the skin island of which may be adequate for the coverage of both the inner and the outer lining in extensive defects but inadequate to replace the soft-tissue loss. Wei described the successful use of fibula osteoseptocutaneous-radial forearm fasciocutaneous flap and fibula osteoseptocutaneous-rectus abdominis myocutaneous flap in the reconstruction of extensive composite mandibular defects in head and neck cancer, and applied flow-through anterolateral thigh flap for a free osteocutaneous fibula flap in secondary composite mandible reconstruction. The disadvantages of two microvascularized flap combination reconstruction often quoted are the high risk of the microsurgery, receipt vessel problem in radiation patients, relatively long-time operation, more surgical injury and two flaps' donor site morbidity.

Since Medgyesi in 1973 demonstrated an extensive vascular network connecting muscle, periosseum and bone in a variety of osteomyocutaneous flaps, including ribs, the pectoralis major myocutaneous flap incorporating the underlying vascularized rib was spreading in the 1980s and 1990s. Vascular anatomy by highlighted the possibility of a composite tissue transfer to the head and neck region. Bhathena and Kavarana described the utilization of rib-major pectoralis myocutaneous flap as a safe and quick method of reconstruction to rehabilitate the patient with composite oromandibular defect. Therefore, the

Figure 6: Intraoperative view of the rib-major pectoralis myocutaneous flap raising: the pectoralis major muscle was raised from the chest wall attached, with fifth rib carrying costal parietal pleura.

Figure 7: Intraoperative view of the rib-major pectoralis myocutaneous flap raising: the attached fifth rib with peristomal blood supply from intercostal.

Licensee OA Publishing London 2013. Creative Commons Attribution License (CC-BY)

compound rib-major myocutaneous flap should not be a forgotten choice in reconstructive surgery, since the advantages are distinct which are as follows: (1) stable vascular anatomy of the pectoralis major myocutaneous flap and the vascularized rib bone where periosteal blood supply has been proved by viability studies of the flurochrome markers; (2) free of high risk of two free flaps simultaneously used in one oromandibular defect reconstructive surgery and the shorter operative time gains relatively quick recovery of the local and general functions; (3) the musculofasical nutrient pedicle lying in the neck provides good protective coverage for the bared carotid system especially for some cases had radical neck dissection and needed postoperative radiotherapy; (4) provides the available reconstructive opportunity for cases with poor head and neck recipient vessel condition including the transverse cervical vessel system from the ablative surgery and radiotherapy; (5) provides sufficient soft-tissue replacement and filling of dead space which is needed after ablative surgery of oral cancer; (6) the minimum functional loss at the donor site; (7) reduces the microsurgical risk due to radiation patients’ bad receipt vessel situation.

Conclusion
In the current case, the rib-major pectoralis osteomyocutaneous flap provided a suitable and cost-effective reconstruction to a composite oromandibular defect with low surgical risk, relatively short operative time, excellent cosmetic and functional outcome of patient and minimum donor site morbidity. This reconstructive method of the compound osteomyocutaneous flap should not be forgotten in case of poor receipt vessel condition when two free flaps in one reconstructive stage are gaining in popularity.

Figure 8: Intraoperative view: the rib-major pectoralis osteomyocutaneous flap was tunnelled over supraclavicular area into the neck and head, the vascularized rib was fixed with the residual mandible and muscle was filled into the soft-tissue defect.

Figure 9: Lateral view of the reconstruction intraoperatively.
Case report

Consent
Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Acknowledgement
This work was supported by grants of the National Natural Science Foundation of China (NSFC: 30600714, 30973341) and Shanghai Rising-Star Program (07QA14039).

References

Figure 10: Lateral views of appearance 4 years postoperatively.

Figure 11: Panoramic radiograph of mandible 2 weeks postoperatively.

Licensee OA Publishing London 2013. Creative Commons Attribution License (CC-BY)


