Penetrating brain injuries can lead to many complications. It is possible to divide these into early and late complications. Early complications such as hematoma, CSF leak, meningitis, seizure occur in the first week and late complications such as foreign body residue, pseudoaneurysm, arteriovenous fistula formation, and foreign body migration occur after 1 week.[2] In postoperative period, infections are the most common and difficult complications at foreign body injuries and early antibiotic treatment should be performed to have a good result.[8] We followed this patient closely for any possible complications both intraoperatively and postoperatively. No surgical intervention was necessary because of the absence of CSF leakage.

Lee et al[4] firstly reported the endoscopic treatment of transnasal intracranial penetrating foreign body. They also performed an endoscopic CSF rhinorrhea repair perioperative. We think this patient has some differences. Because most of these traumatic patients require surgical interventions due to the complications. But we only removed the knife and any complication was not detected both intraoperatively and postoperatively although the patient has suffered a great deal of trauma.

CONCLUSION

In conclusion, transnasal penetrating brain injuries are rare but highly traumatic. A fast, efficient, and multidisciplinary approach is needed in such patients. Patients should be examined with appropriate methods considering early and late complications and a rapid treatment strategy should be chosen.

REFERENCES

1. Samuthrat T, Ye K, Tong Y. Transoral intracranial injury via middle skull base by a blunt chopstick in a child. *World Neurosurg* 2017;103: 952.e11–9952.e17
2. Drosos E, Giakoumettis D, Blionas A, et al. Pediatric nonmissile penetrating head injury: case series and literature review. *World Neurosurg* 2018;110:193–205
3. Ihama Y, Nagai T, Ninomiya K, et al. A transnasal intracranial stab wound by a plastic-covered umbrella tip. *Forensic Sci Int* 2012;214:e9–e11
4. Lee DH, Seo BR, Lim SC. Endoscopic treatment of transnasal intracranial penetrating foreign body. *J Craniofac Surg* 2011;22:1800–1801
5. Kazim SF, Shamim MS, Tahir MZ, et al. Management of penetrating brain injury. *J Emerg Trauma Shock* 2011;4:395–402
6. Liebelt BD, Boghani Z, Haider AS, et al. Endoscopic repair technique for traumatic penetrating injuries of the clivus. *J Clin Neurosci* 2016;28: 152–156
7. Mzimbiri JM, Li J, Bajawi MA, et al. Orbitocranial low-velocity penetrating injury: a personal experience, case series, review of the literature, and proposed management plan. *World Neurosurg* 2016;87:26–34
8. Fama F, Cicciù M, Nastro-Siniscalchi, et al. Nonfatal cervical-neck lesion with a wooden foreign body: diagnosis and management. *J Craniofac Surg* 2016;27:175–176

Intraoral Anastomosis of Deep Circumflex Iliac Artery Perforator Flap for Maxillary Reconstruction

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Abstract: Maxillary reconstruction is one of the most challenging areas of reconstructive surgery. This report describes a case of a 33-year-old male with osteoblastic osteosarcoma of the maxillary. The patient received radical resection and reconstruction with a deep circumflex iliac artery perforator flap (DCIAPF). The flap was harvested with a $4 \times 2\,cm^2$ osseous flap and a $6 \times 8\,cm^2$ skin island supplied by terminal perforators from the deep circumflex iliac artery. Anastomosis was accomplished on the ipsilateral facial vessels with deep circumflex iliac vessels through an intraoral approach. The donor site and the flap were observed to have completed primary healing 2 weeks after the surgery. The DCIAPF may be a satisfactory single-flap option for maxillary reconstruction with less donor-site complications.

Key Words: Deep circumflex iliac artery, intraoral anastomosis, maxillary reconstruction, perforator flap

The maxillary plays a critical role in craniofacial function and esthetics. Functionally, it supports the maxillary teeth as well as the eye globe, and separates the oral and nasal cavities. Esthetically, the maxillary provides bony support for the soft-tissue midface and the nasal base, forming unique facial appearances.[1] Maxillary defects due to tumors or traumas demand bone or soft tissue reconstruction for cosmetic and functional purposes. Maxillary reconstruction is one of the most challenging areas of reconstructive surgery because of its complex anatomy and esthetic issues.

Commonly used donor sites of vascularized bone grafts include the radius, scapula, fibula, and iliac crest to better reconstruct a bony foundation for esthetic midface projection and to provide bony support. Particularly, the deep circumflex iliac artery (DCIA) flap is well suited for maxillary reconstruction because the natural appearance of the iliac crest corresponds well to that of the maxilla, and it can provide a large volume of soft tissue and bone to close the fistula and place dental implants.[2] However, certain flaws may limit its application in oral and maxillofacial surgery, including a bulky and immobile muscular flap that makes intraoral inset a difficult procedure; moreover, the relatively short vascular pedicle can make anastomosis technically difficult, and excess vascular tension may cause anastomotic bleeds or vascular occlusion and thrombus formation.[3,4] To overcome these drawbacks of the DCIA flap, we present a case of deep circumflex iliac artery perforator flap (DCIAPF) for maxillary reconstruction, in which the intraoral anastomosis technique was used.

CLINICAL REPORT

A 33-year-old male (Fig. 1A–B) was admitted to the hospital complaining of a mass in his right maxillary region. At the time of the current presentation, the mass had been present for >1 month without pain or numbness. His past medical history and family

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Received May 10, 2018.
Accepted for publication July 12, 2018.
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This study was supported by Program for New Clinical Techniques and Therapies of Peking University School and Hospital of Stomatology (Number: PKUSSNCT-16A02).
The authors report no conflicts of interest.

ISSN: 1049-2275
DOI: 10.1097/SCS.0000000000004941

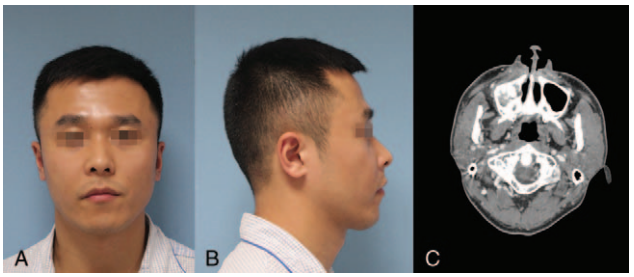

FIGURE 1. Images show symmetrical facial profiles before surgery (A, B). Computed tomography showed a bony mass in the right maxillary region (C).

history were not significant. On physical examination, there was a suspicious soft mass covered with normal mucosa in the right maxillary region. A contrast-enhanced computed tomography (CT) scan showed an ill-defined bony mass in his right maxillary region (Fig. 1C). The mass presented as tissue ossification surrounded by soft tissue infiltration; the alveolar bone that had bone erosion was obviously involved. The cervical lymph nodes and other organs were negative according to the CT scan. A diagnosis of osteosarcoma was suspected. Histological examination of the biopsy confirmed the diagnosis of osteoblastic osteosarcoma. After discussion, the treatment strategy was surgery and adjunctive chemotherapy.

The surgical treatment was radical resection and reconstruction with the deep circumflex iliac artery perforator flap (DCIAPF). After subtotal resection of the right maxillary, the classification of the maxillary defect was Class IIb (Fig. 2A). The vessels were prepared through an intraoral approach, that is, the facial artery and the accompanying vein. The anatomy of the terminal perforators from the deep circumflex iliac artery (DCIA) was clarified using a Doppler flow meter before the operation (Fig. 2C). The DCIAPF was prepared by retrograde dissection. The flap was harvested as shown with a $4 \times 2\,cm^2$ osseous flap and a $6 \times 8\,cm^2$ skin island (Fig. 2D). After tumor resection and vessel preparation, the flap was transferred from the donor site, and the donor site was closed. The osseous flap was harvested to reconstruct the maxillary, whereas the skin island reconstructed the soft tissue defect of the palate. Anastomosis was accomplished on the ipsilateral facial

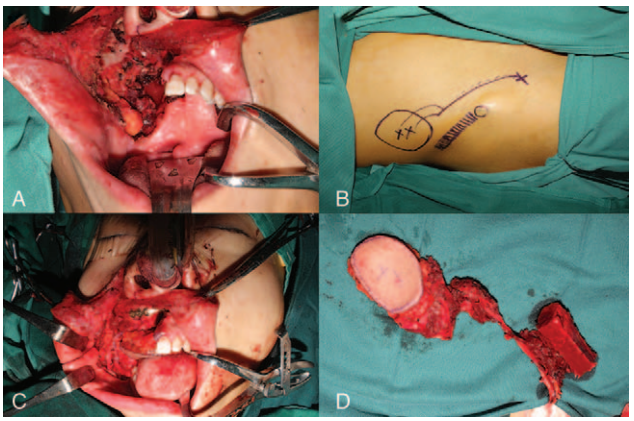

FIGURE 2. The maxillary defect was Class IIb (A). Anastomosis was accomplished on the ipsilateral facial vessels with deep circumflex iliac vessels through an intraoral approach (B). Anatomy of the terminal perforators, the iliac crest and the deep circumflex iliac artery were marked on the skin before the operation (C). The flap was harvested with a $4 \times 2\,cm^2$ osseous flap and a $6 \times 8\,cm^2$ skin island supplied by terminal perforators from the deep circumflex iliac artery (D).

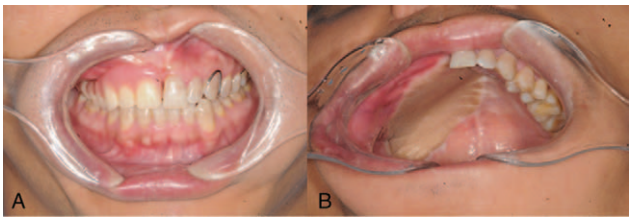

FIGURE 3. A good outcome after prosthetic restoration with a temporary denture (A). The flap was observed to have completed primary healing with no necrosis (B).

vessels with deep circumflex iliac vessels through an intraoral approach (Fig. 2B). The donor site and the flap were observed to have completed primary healing 2 weeks after the surgery (Fig. 3A). The oral and nasal cavity fistula was closed. Compared with 2 months afterward, the appearance was satisfactory (Fig. 4A–B), whereas the CT scan showed that the iliac reconstructed the maxillary and alveolar defect (Fig. 4C). A good outcome after prosthetic restoration with a temporary denture is shown in Fig. 3B.

DISCUSSION

Taylor et al[5,6] demonstrated the applied anatomy of DCIA osteomusculocutaneous flap and introduced the flap for reconstruction in 1979. However, the application rate of the DCIA flap was relatedly low, most likely because of its complicated anatomy and anatomical variation of vessels. In addition, the DCIA flap has been limited by the unnecessary bulk of the muscular layer because it is bulky and immobile.[3] A bulky flap is difficult when reconstructing small defects and may impede the ability to eat and speak.

The DCIAPFs were occasionally introduced because of reduced flap bulk without the obligatory internal oblique muscle, thus increasing mobility while reducing donor-site morbidity.[7–11] The anatomical basis of the DCIAPF was established in previous publications.[3,12,13] Bergeron et al[12] reported that an average of 1.6 DCIA perforators was present in 92% of specimens. Moreover, according to Zheng et al,[13] 3 kinds of perforators arise, including the abdominal muscular branches, the iliac osteomuscular branches, and the terminal musculocutaneous perforator. The blood supply of the skin and bone of conventional DCIA osteomusculocutaneous flaps are from the several minute osteomusculocutaneous perforators of DCIA.[3,13] The skin paddle of the modified DCIA osteocutaneous flap is nourished by the terminal musculocutaneous perforator, and the bone is nourished by the osteomusculocutaneous branches.[13]

Kimata et al[10] reported 10 patients with oromandibular defects reconstructed with DCIAPF in 2001. In this case, the patient was a

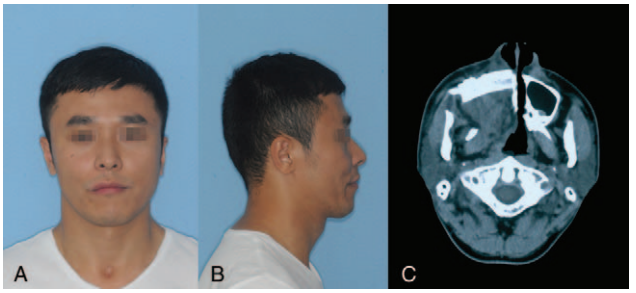

FIGURE 4. Good esthetic and functional results were shown compared to the images before operation (A, B). Computed tomography showed the iliac reconstructed the maxillary and alveolar defect well (C).

young male, suffering from maxillary osteosarcoma. The bone and soft tissue defect required reconstruction. The patient desired to be treated with less impact on facial appearance and calf function. However, the traditional iliac osteocutaneous flap has limited indications for intraoral reconstruction because the subcutaneous component includes a large amount of abdominal musculature that results in unnecessary potential for donor site morbidity. In this case, DCIAPF was harvested for the reconstruction of maxillary bone and soft tissue defects with less donor site morbidity.

According to a previous study,[4,14] a vessel graft or facial incision was performed to accomplish vessel anastomosis. As another method, intraoral anastomosis could be considered and could be preferred in certain cases[15,16] because it can spare potential facial nerve hazards as well as visible scars when compared with submandibular approaches. The supplying vessels were the facial artery regularly found in the buccal planum. In addition, the surgical site was less clear because of potential bleeding and the narrow space; this method may require more experience and technique. Intraoral anastomosis is a reliable technique for microvascular reconstruction according to the clinical results in the literature.[17,18] In this case, intraoral microvascular anastomosis solved the problem of a short vascular pedicle.

In summary, the DCIAPF has the advantages of a satisfactory appearance and plenty of bone for future dental implants. Second, the skin paddle can be freely adjusted for the best coverage of the soft-tissue defects, and thus the oral and nasal cavity fistula was closed. The DCIAPF has less potential for cosmetic and function morbidity. Anastomosis through an intraoral approach is difficult; however, it effectively solves the problem of a short vascular pedicle. Potential injury to the submandibular gland and the marginal mandibular branch was avoided. The skin paddle is also hairless, which is ideal for intraoral coverage. We draw the conclusion that the DCIAPF may be a satisfactory single-flap option for maxillary reconstruction with fewer donor-site complications.

REFERENCES

1. Futran ND, Mendez E. Developments in reconstruction of midface and maxilla. *Lancet Oncol* 2006;7:249–258
2. Brown JS. Deep circumflex iliac artery free flap with internal oblique muscle as a new method of immediate reconstruction of maxillectomy defect. *Head Neck* 1996;18:412–421
3. Kim HS, Kim BC, Kim HJ, et al. Anatomical basis of the deep circumflex iliac artery flap. *J Craniofac Surg* 2013;24:605–609
4. Grinsell D, Catto-Smith HE. Modifications of the deep circumflex iliac artery free flap for reconstruction of the maxilla. *J Plast Reconstr Aesthet Surg* 2015;68:1044–1053
5. Taylor GI, Townsend P, Corlett R. Superiority of the deep circumflex iliac vessels as the supply for free groin flaps—experimental work. *Plast Reconstr Surg* 1979;64:595–604
6. Taylor GI, Townsend P, Corlett R. Superiority of the deep circumflex iliac vessels as the supply for free groin flaps—clinical work. *Plast Reconstr Surg* 1979;64:745–759
7. Bisase B, Sloane J, Coombes DM, et al. The deep circumflex iliac artery perforator flap (DCIAP)—a reconstructive option for the large composite oro-mandibular cutaneous defect. *Br J Oral Maxillofac Surg* 2013;51:962–964
8. Ting JW, Rozen WM, Chubb D, et al. Improving the utility and reliability of the deep circumflex iliac artery perforator flap: the use of preoperative planning with CT angiography. *Microsurgery* 2011;31:603–609
9. Shaw RJ, Brown JS. Osteomyocutaneous deep circumflex iliac artery perforator flap in the reconstruction of midface defect with facial skin loss: a case report. *Microsurgery* 2009;29:299–302
10. Kimata Y, Uchiyama K, Sakuraba M, et al. Deep circumflex iliac perforator flap with iliac crest for mandibular reconstruction. *Br J Plast Surg* 2001;54:487–490
11. Safak T, Klebuc MJA, Mavili E, et al. A new design of the iliac crest microsurgical free flap without including the "obligatory" muscle cuff. *Plast Reconstr Surg* 1997;100:1703–1709
12. Bergeron L, Tang M, Morris SF. The anatomical basis of the deep circumflex iliac artery perforator flap with iliac crest. *Plast Reconstr Surg* 2007;120:252–258
13. Zheng HP, Zhuang YH, Zhang ZM, et al. Modified deep iliac circumflex osteocutaneous flap for extremity reconstruction: anatomical study and clinical application. *J Plast Reconstr Aesthet Surg* 2013;66:1256–1262
14. Baliarsing AS, Kumar VV, Malik NA, et al. Reconstruction of maxillectomy defects using deep circumflex iliac artery-based composite free flap. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010;109:e8–e13
15. Landes C, Cornea P, Teiler A, et al. Intraoral anastomosis of a prelaminated radial forearm flap in reconstruction of a large persistent cleft palate. *Microsurgery* 2014;34:229–232
16. Nkenke E, Agaimy A, von Wilmowsky C, et al. Mandibular reconstruction using intraoral microvascular anastomosis following removal of an ameloblastoma. *J Oral Maxillofac Surg* 2013;71:1983–1992
17. Gaggl A, Burger H, Virnik SA, et al. An intraoral anastomosing technique for microvascular bone flaps in alveolar ridge reconstruction: first clinical results. *Int J Oral Maxillofac Surg* 2009;38:921–927
18. Brandtner C, Burger H, Hachleitner J, et al. The intraoral anastomosing technique in reconstructive surgery of the face—a consecutive case series of 70 patients. *J Craniomaxillofac Surg* 2015;43:1763–1768

Evaluation the Efficacy of Hilotherm Cooling System in Reducing Postoperative Pain and Edema in Maxillofacial Traumatized Patients and Orthognathic Surgeries

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Abstract: Surgical treatment in patients with facial bone surgeries governs a meaningful extent of tissue trauma prompting prevalent postoperative portents of pain, facial swelling, and inconvenience.

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Received November 12, 2017.
Accepted for publication July 17, 2018.

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The authors report no conflicts of interest.

ISSN: 1049-2275
DOI: 10.1097/SCS.0000000000004951