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CASE REPORT

# Muscle-chimaeric medial sural artery perforator flap: A new design for complex three-dimensional knee defect



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Received 27 March 2013; accepted 13 September 2013

## KEYWORDS

Chimaeric flap;  
Medial sural artery perforator flap;  
Flap design;  
Knee reconstruction

**Summary** Reconstructions of composite and three-dimensional knee defects remain challenging. Gastrocnemius musculocutaneous flaps have been widely used for complex knee-defect reconstruction, but problems of donor-site morbidity and bulkiness of flaps remain. In the present study, we designed a new muscle-chimaeric medial sural artery perforator flap and applied the technique in a clinical case. A gastrocnemius muscle segment with sufficient pedicle length was obtained by intramuscular dissection of the vascular pedicle. The muscle segment was then utilised to fill the underlying dead space and the remaining soft tissue and skin defects were reconstructed with the perforator skin flap. The flap survived completely and wound healing progressed smoothly without infection, haematoma or seroma. Our patients were satisfied with their aesthetic outcomes and did not experience any donor-site morbidity. The muscle-chimaeric medial sural artery perforator flap is a valuable option for the reconstruction of composite and three-dimensional knee defects.

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The reconstruction of complex wounds with three-dimensional tissue defects, including wounds in the knee region, is a challenging problem. These wounds are often accompanied by surface defects and underlying dead space; thus, the reconstruction of complex knee defects often requires dead-space obliteration in addition to defect coverage for successful wound healing.

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Traditionally, a muscle or musculocutaneous flap with excellent blood supply is preferred for reconstruction of complex defects; however, the availability of regional muscles for reconstruction of wounds in the knee region is limited. The medial or lateral gastrocnemius muscle or musculocutaneous flaps have been reported as viable options for knee-defect reconstruction and are widely used.<sup>1,2</sup> However, flaps created with that approach have some drawbacks, including donor-site morbidity and bulkiness.<sup>3,4</sup> Free tissue transfers also represent an excellent option for the reconstruction of complex knee defects, but require experience with microsurgery, a longer operation time, and may result in donor-site morbidity.

The chimaeric flap has been applied for various reconstructive fields using either a pedicled or a free flap. Hallock applied this chimaeric concept and reported the utility of chimaeric gastrocnemius muscle and sural artery perforator pedicled flaps for knee-defect reconstruction.<sup>5</sup> However, despite typically excellent surgical outcomes, the size of the gastrocnemius muscle harvested needs to be larger than the size of the dead space due to the lack of a full dissection in the intramuscular portion of the perforator pedicle using this approach. When chimaeric flaps are designed appropriately by minimising the volume of muscle harvested, the reconstruction goals of complex defects in the knee region, including coverage of surface defects and obliteration of dead space, can be reached with minimal donor-site morbidity. The authors presented two cases of complex knee-defect reconstruction using gastrocnemius muscle-chimaeric sural artery perforator flap of new design.

## Case reports

A 70-year-old woman with a 10-year history of left knee pain had been diagnosed as advanced osteoarthritis presented with wound dehiscence 1 month after total-knee replacement. After debridement of devitalised tissue, the skin defect measured  $4 \times 10$  cm with underlying implant exposure (Figure 1). The location of the main perforators of the medial sural artery was determined intra-operatively using a sterile Doppler probe, approximately 8 cm from the popliteal crease to the distal border of the medial gastrocnemius muscle. The skin paddle measured  $4 \times 12$  cm based on one perforator from the medial sural artery. When the perforator pedicle met the sizable intramuscular branch, this branch was dissected proximally to distally and a muscle segment of  $42 \text{ cm}^2$  in size was harvested. Pedicle dissection proximal to the confluence point was performed meticulously to gain sufficient pedicle length to avoid tethering and twisting during flap transposition. Ultimately, a muscle-chimaeric medial sural artery perforator flap with a Y-shaped pedicle configuration was harvested (Figure 2). The total length of pedicle harvested after the full dissection was 14.8 cm, with 11.5 cm for the common pedicle portion, 2 cm for the skin paddle and 3.3 cm for the muscle segment. After transposing the flap through the supra-fascial tunnel, the donor site was closed primarily. The muscle component was selectively placed into the deep space to cover the exposed knee implant. The flap was viable without any complications and the knee remained



**Figure 1** Preoperative view showing the left knee wound with exposed total-knee prosthesis.

stable. Accordingly, the patient was satisfied with both the recipient and the donor site and was very satisfied with the overall results (Figure 3).

A 69-year-old woman with periprosthetic joint infection underwent a left primary total-knee replacement. Two months later, wound dehiscence occurred with a *Staphylococcus aureus* deep infection. The orthopaedic surgeon first removed all infected components and inserted an antibiotic-impregnated spacer. This resulted in a  $6 \times 8.5$ -cm soft-tissue defect with cement spacer applied to the joint; and the medial half of the patellar tendon was removed. A  $6 \times 15$ -cm-sized skin paddle nourished by



**Figure 2** The Y-shaped pedicle configuration after full elevation of the muscle-chimaeric sural artery perforator flap.

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