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# The “nugget design”: A modified segmental gracilis free flap for small-sized defect reconstruction on the lower extremity

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## KEYWORDS

Foot reconstruction;  
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**Summary** *Background:* Little attention has been given to the segmental free gracilis muscle flap supplied by secondary proximal pedicles. We introduce a technical refinement for small-sized three-dimensional defect reconstruction on the foot.

*Methods:* Between November 2013 and August 2016, three patients with a mean age of 66 years (range 47–70 years) were included. A segmental gracilis free flap supplied by the most proximal secondary pedicle was harvested according to a modified “nugget design” to treat small-sized defects on the lower extremity requiring dead space reconstruction. Minor and major complications, sensitivity with Semmes-Weinstein monofilament test, soft tissue stability and patient satisfaction at final follow-up were recorded.

*Results:* In one case, a segmental gracilis muscle was used for dorsal foot reconstruction after debridement of metatarsal phalanx I with osteomyelitis. In two cases, the segmental gracilis free muscle was harvested for defect reconstruction on the right plantar foot after excision of a melanoma. The first patient required revision after partial failure of the initial segmental gracilis free muscle flap. Overall, good results in foot function and a high degree of patient satisfaction was achieved (Likert scale 9.7, range 9–10) after a mean follow-up of 13 months (range 3–24 months). *Conclusions:* Taken from the very proximal dorsal part of the gracilis muscle supplied by the most proximal secondary pedicle and leaving the vast majority of the muscle intact preserves the option to harvest a normal gracilis flap. This technique is especially suitable for small, three-dimensional defects on the lower extremity.

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## Introduction

The gracilis muscle is widely used in reconstructive surgery and has been described for functional muscle transfer after lower extremity post-traumatic composite structural and functional defects,<sup>1,2</sup> functional lip reconstruction,<sup>3</sup> urethral channel reconstruction<sup>4</sup> and breast reconstruction.<sup>5,6</sup> Most studies are focused on the major pedicle. Today, however, with recent advances in microsurgery and ever-growing demands for low donor-site morbidity, it is most important to ensure that each free muscle flap is harvested efficiently with minimal donor site morbidity, retained function and minimal scars.

It has been described that a segmental gracilis free flap can be harvested based on secondary pedicles.<sup>7</sup> The anatomy of the gracilis muscle is well known.<sup>8,9</sup> In a study by Magden and coworkers, the most proximal pedicle of gracilis muscle was identified as the deep branch of the medial circumflex femoral artery located 60 mm from the pubic tubercle.<sup>9</sup> The second pedicle of the muscle originates from the medial circumflex femoral artery and is located 96 mm (range 70–124 mm) from the pubic tubercle.<sup>4</sup>

Based on the constant and reliable anatomy, we describe a further technical refinement for the segmental gracilis free flap with a “nugget design”, supplied by the most proximal secondary pedicle (Figure 1). Thus, the aim of this study was to identify the versatility and feasibility of this technique in three patients. By using this technique, small-sized three-dimensional defects on the lower extremity can be reconstructed, and the part of gracilis muscle preserved in the donor site retains its functions and remains further available as a valuable back-up option for future needs.

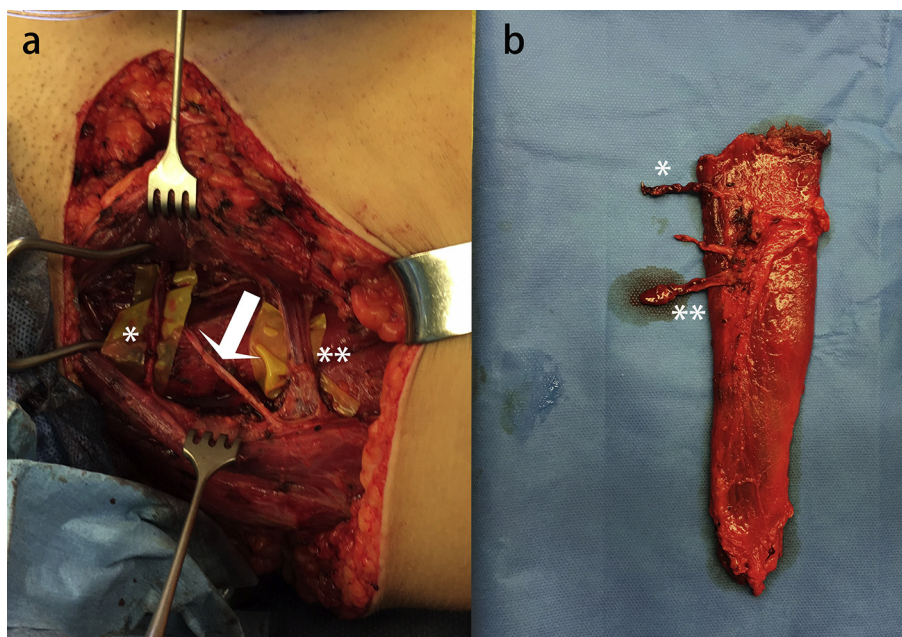
## Patients and methods

### General patient data and end points

Between November 2013 and August 2016, three patients with a mean age of 66 years (range 47–70 years) were included. Written informed consent was obtained by all patients and the procedures were performed in line with the Helsinki Declaration of 1975. Outcome measures were minor and major complications, sensitivity by the Semmes-Weinstein monofilament test at the recipient site (Aesthesio®, DanMic Global, LLC, 2013) and soft tissue stability at final follow-up. Sensitivity was determined at least three times while the patient had their eyes closed and compared to the equivalent contralateral, non-operated location. Data are presented as median and interquartile range (IQR) and in percentages compared to the contralateral measurements. At final follow-up the patients were asked about their overall satisfaction using a Likert scale from 0 to 10 (0 = poor result, 10 = very satisfied).

## Results

In two patients, the segmental gracilis free muscle was harvested for defect reconstruction on the right plantar foot after excision of a melanoma, whereas in the third patient a segmental gracilis muscle was used for dorsal foot reconstruction after debridement of metatarsal phalanx I with osteomyelitis. In the first two patients, stable soft tissue coverage was achieved with a high degree of satisfaction (Likert scale 9 and 10, respectively) after a final



**Figure 1** Intraoperative pictures of the left gracilis muscle. (a) Dissected muscle showing the minor vascular pedicle (white star) and the lower dominant, major pedicle (double white stars) and obturator nerve (white arrow). (b) After flap harvest, showing the proximal minor vascular pedicle (white star) and the major pedicle (double white stars).

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