

## Original Article

# Experience with a modified technique of free Gracilis transfer

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### ABSTRACT

Various techniques of harvesting the free Gracilis flap have been described. The authors describe their experience in the use of a 'limited' incision in harvesting this flap, as compared to the long medial incision, for both a segmental as well as total flap harvest. Whole or partial Gracilis harvest could be done using small incisions avoiding long scars using the conventional approach. Twenty-one free Gracilis muscle transfers were performed. In 12, a short proximal curved incision was used to dissect a segment of the muscle with its pedicle and with an added small incision near the knee, the whole muscle could be dissected and delivered. The described technique of tracing the vascular pedicle by retracting both the borders of the adductor longus, was followed. This gave a better and easier access to the whole length of the pedicle, vis-à-vis the classic approach of dissecting the pedicle below the adductor longus, which was performed in nine cases.

### KEY WORDS

Gracilis flap, small incision, modified harvest

### INTRODUCTION

The Gracilis muscle and musculo-cutaneous free flap, presently has a wide application in resurfacing small to medium-sized soft tissue defects.<sup>[1]</sup> It has also been used as a functional muscle transfer for restoration of function in brachial plexus injuries, Volkman's Ischemic contracture and longstanding facial nerve palsy.<sup>[1,2]</sup>

The Gracilis muscle is easily accessible on the medial aspect of the thigh and can be simultaneously harvested by a second team during reconstruction. In free muscle transfer, a long vascular pedicle is advantageous for ease of anastomosis. In the conventional harvesting technique, approach to the neurovascular pedicle is

through a narrow space deep to the adductor longus.<sup>[3]</sup> Access to the extreme distal end of the pedicle is often difficult, because of the numerous branches of the pedicle as well as the limited exposure, it being at the most extreme end of the 'tunnel'. Incisions for exposure of the muscle range from a long incision at the medial thigh to endoscopic techniques to limit the disadvantages of long scars. This article discusses certain nuances in reducing the scar using a modified incision. The authors' experience with a described, modified technique in harvesting the vascular pedicle is also discussed.

### Surgical anatomy

The Gracilis, a thin strap-like muscle, has its attachment proximally from the symphysis pubis and the pubic arch, while it inserts into the medial surface of the tibial

condyle between the sartorius and semitendinosus muscles. Antero-laterally, it is covered by the adductor longus and postero-laterally, at its proximal third, it is related to the adductor magnus.

The dominant vascular supply usually originates either from the adductor branch of the profunda femoris, or the medial circumflex femoral artery or at the junction of these two vessels. Recent interest in perforator-based Gracilis flap has highlighted the vascular anatomy of this region in detail.<sup>[4]</sup> At the hilum, situated 6-10 cm below the pubic tubercle the vessel divides into three to six branches. The vessel also supplies small muscular branches to the adductor longus, which need ligation, before the more proximal portion can be visualized. The artery is accompanied with two vena comitantes which usually merge into a single vein near its terminal end. The minor pedicles arising from the superficial femoral vessels enter the muscle 10 and 15 cm distally, to the posteromedial surface of the muscle.

Flaps of the Gracilis muscle are commonly based on the major vascular pedicle though the minor vascular pedicle can also support a segment of the flap.<sup>[5]</sup> Both the major and minor pedicle lie deep to the adductor longus which need to be retracted to get access to the pedicle.

## MATERIALS AND METHODS

A total of 21 functioning free Gracilis transfers were performed in 18 patients, 13 being males and five females. Double, staged, Gracilis-transfers were done in three patients and single transfers in five patients of failed repairs or longstanding brachial plexus injuries. The other patients where a segmental or total Gracilis transfer was performed included Volkmann's Ischaemic Contracture –three, facial palsy -five and tongue reconstruction –two. The classical approach was followed in nine Gracilis harvests and the modified approach in 12 [Table 1].

### Technique (Modified)

The patient is positioned supine, with flexion and external rotation of hip and flexion at the knee. The muscle pedicle lies at about two fingers width below a line drawn from the adductor tendon felt at the pubis and the medial femoral condyle.

A longitudinal incision over the upper 1/3<sup>rd</sup> of the thigh,

**Table 1: Indications for free functioning muscle transfers, documenting the technique followed**

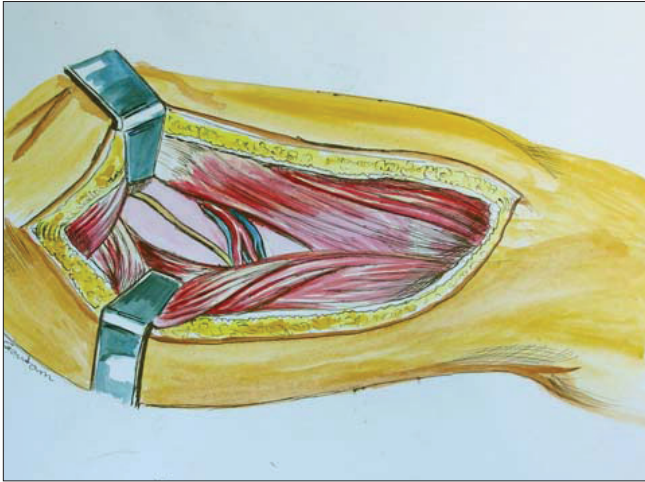
<i>Indication</i>	<i>Incision</i>	<i>Technique</i>
Failed BPI repair	Extended	Classical
Longstanding BPI	Extended	Classical
Facial palsy	Limited	Classical
BPI- double muscle	Extended	Classical
Facial palsy	Limited	Modified
Facial palsy	Limited	Modified
VIC	Extended	Classical
BPI- double muscle	Limited	Modified
BPI- double muscle	Limited	Modified
BPI	Limited	Modified
VIC	Extended	Classical
VIC	Extended	Classical
Tongue reconstruction	Limited	Modified
Facial palsy	Limited	Modified
Facial palsy	Limited	Modified
BPI	Limited	Modified
Tongue reconstruction	Limited	Modified
BPI	Limited	Modified

BPI- Brachial plexus injury, VIC - Volkmann ischemic contracture

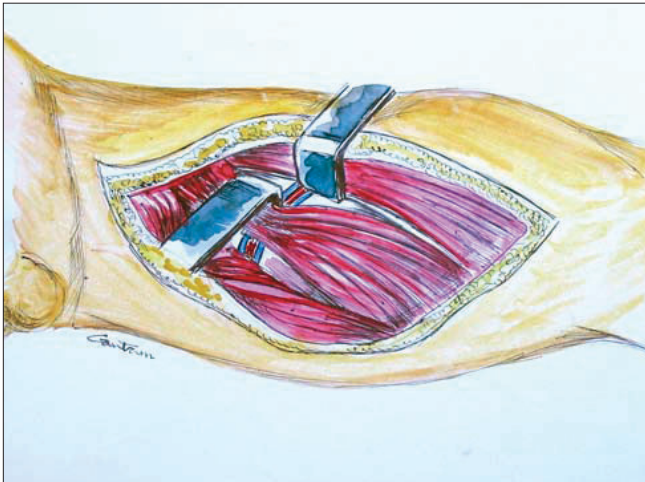
extended proximally in a curvilinear fashion towards the mid-inguinal point, is sufficient to expose the proximal muscle and the major vascular pedicle. The lateral extent of the incision stops short of the lateral border of the adductor longus, preserving the lymphatics around the femoral vessels. Wherever a skin island is necessary the incision circumscribes the island, which may be oriented longitudinally at its upper third or parallel to the groin crease. This incision suffices when only a segment of the muscle is necessary.

The incision is deepened, dividing the deep fascia over the adductor longus muscle. The fascia is then reflected medially. A portion of the adductor fascia is included when a skin island is included in the flap, to fortify its vascularity. The medial border of the adductor longus is retracted upwards and laterally exposing the neurovascular pedicle [Figures 1-2]. The pedicle is traced from distal to proximal, ligating muscular branches along its course. Through the curvilinear incision, the lateral border of the adductor longus is then defined, which is then retracted medially exposing the proximal portion of the pedicle arising from the medial circumflex femoral artery [Figures 3-4]. Tracing the vessel now, from proximal to distal, ligating the branches to the muscle frees the whole length of vascular pedicle.

When harvesting the whole muscle, limited exposure is performed [Figure 5]. The Gracilis tendon is identified by a small 2-3 cm long incision on the medial aspect of the knee joint. The tendon is in direct posterior relation



**Figure 1:** Diagram illustrating retraction of the Gracilis medially and adductor longus laterally, with identification of the obturator nerve and vascular pedicle

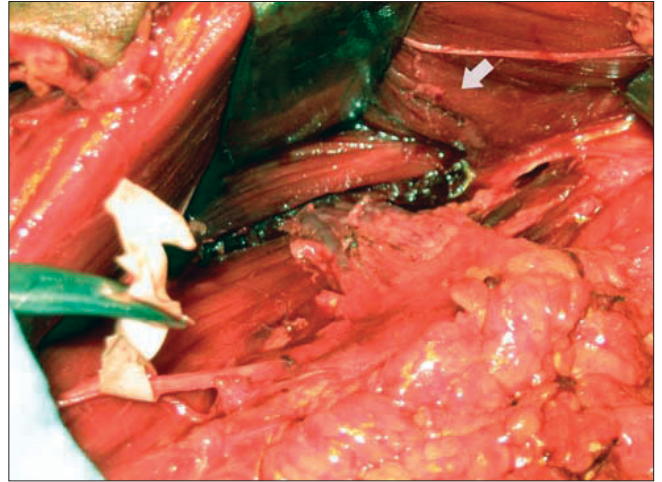


**Figure 3:** Diagram illustrating creation of plane at the lateral border of the adductor longus, displaying the proximal origin of the vascular pedicle

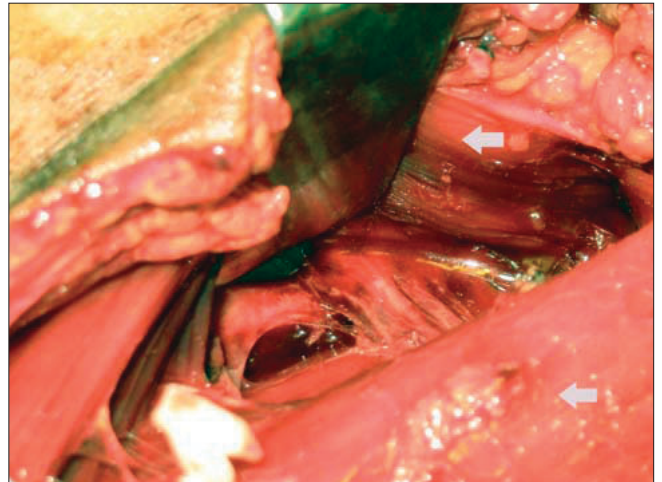
to the longitudinal fibers of the sartorius muscle and the overlying saphenous vein. The tendon is hooked and pulled outwards which makes the muscle taut along the medial aspect of the thigh. The skin island can now be designed over this taut muscle over its proximal third. Incisions are then made at the proximal third and the procedure as described above is followed. After isolation of the pedicle, the intervening segment of the muscle is harvested by deep retraction of the intervening skin and the ligating minor pedicles.

## DISCUSSION

The Gracilis muscle or musculo-cutaneous flap is the flap of choice in functional motor unit transfers.<sup>[1,2]</sup> The complete length or a segment of the muscle, based on the dominant vascular pedicle can be used in motor unit transfers. In the conventional technique of flap harvest,



**Figure 2:** Operative view demonstrating the retracted adductor longus muscle (arrow). The obturator nerve (with loop) is seen in the lower left corner



**Figure 4:** Operative view demonstrating retracted pectineus laterally (upper arrow) and adductor longus medially (lower arrow), visualizing the proximal vascular pedicle



**Figure 5:** Limited exposure technique for harvesting the whole muscle

a long incision needs to be made on the medial thigh, leaving an unsightly scar. To limit this scarring, 'limited exposure technique', using two small incisions proximally



and distally has been described.<sup>[6]</sup> The small proximal incision when modified into a short longitudinal and a long transverse limb gives an adequate exposure, besides leaving a scar just below the groin crease, well concealed within the clothing. This incision length is comparable to the endoscopic procedure where the proximal incision is long to identify the pedicle.<sup>[7]</sup>

The dominant vascular pedicle of the Gracilis is around 6-7 cm in length. In the conventional technique of dissecting the pedicle, the adductor longus needs to be retracted to trace the pedicle proximally. Muscular branches arising from this pedicle need to be ligated or clipped, deep within this 'tunnel'. Tracing the pedicle distal to proximal and then from proximal to distal after suitable retraction of the medial and lateral margins of the adductor longus makes the dissection not only easier and quicker but also permits complete harvest of the pedicle till its source vessel.

Several authors<sup>[3,6,7]</sup> have described other techniques like endoscopic harvesting, minimally invasive harvest technique without the use of endoscopes, to tackle the issue of scar length. In the endoscopic technique, though the scar length is decreased to the tune of  $11.84 + 0.95$  cm,<sup>[8]</sup> two incisions are needed. Specialized instrumentation and expertise is also necessary. In the 'minimally invasive harvest technique' without using the endoscope, the incision size can be decreased to 6.5 cm<sup>[6]</sup> but requires retraction for blunt dissection of the distal part of the muscle. In the described modification, the proximal incision is curved medially, proximally, which gives a better access to the pedicle with minimal retraction of either borders of the adductor muscle. The mean length of the incision with this procedure is 8.5 cm. which is comparable to the endoscopic technique.

In the conventional approach to the pedicle, once the Gracilis muscle is freed from the surrounding muscle groups, the dominant vascular pedicle is exposed on the inner surface of the Gracilis and traced proximally to its source – the profunda vessel. This dissection is tedious and is like working in a 'dark hole' beneath the adductor muscle. In the modified technique, the pedicle is exposed both at the medial and lateral border and underneath the adductor longus muscle, by minimal retraction and

then traced to its source vessel.

This technique has also been described by O'Brien and Morrison, Holle and Hattori *et al.*<sup>[8-10]</sup> Hassen *et al.* described a similar modification of extensively dissecting the adductor longus muscle, freeing both its borders and then passing the already detached Gracilis muscle, below the dissected adductor and 'out between the adductor longus and sartorius'. This, the authors felt gave an added exposure to the distal pedicle.<sup>(11)</sup> This methodical approach to the pedicle not only gives a better exposure but also helps to avoid tedious dissections under the muscle.

## CONCLUSION

Through limited exposure incisions the Gracilis can be conveniently harvested reducing scarring and complete and easy harvest of the pedicle can be performed by defining both margins of the adductor longus muscle.

## REFERENCES

1. Zukowski M, Lord J, Ash K, Shouse B, Getz S, Robb G. The Gracilis free flap revisited: A review of 25 cases of transfer to traumatic extremity wounds. *Ann Plast Surg* 1998;40:141-4.
2. Manketlow RT, Zuker RM. Muscle transplantation by fascicular territory. *Plast Reconstr Surg* 1984;73:751-7.
3. Lin CH, Wei, FC, Lin YT. Conventional versus endoscopic free gracilis muscle harvest. *Plast Reconstr Surg* 2000;105:89-93.
4. Cavadas PC, Sanz-Gimenez JR, Landin L, Martinez-Soriano F. Segmental Gracilis free flap based on secondary pedicles: Anatomical study and clinical series. *Plast Reconstr Surg* 2004;114:684-91.
5. Lykoudis EG, Spyropoulou GA, Vlastou CC. The anatomic basis of the free Gracilis perforator flap. *Br J Plast Surg* 2005;58:1090-4.
6. Jeng SF, Kuo YR, Wei FC. Minimally invasive harvest of Gracilis muscle without endoscopic assistance. *Plast Reconstr Surg* 2001;108:2061-5.
7. Hallock GG. Minimally invasive harvest of Gracilis muscle. *Plast Reconstr Surg* 1999;104:801-5.
8. O'Brien BM, Morrison WA. *Reconstructive microsurgery*. Churchill Livingstone: New York;1987.p.272.
9. Holle J, Worsing A, Kuzbari R, Wuringer E, Alt A. The extended Gracilis muscle flap for reconstruction of the lower leg. *Br J Plast Surg* 1995;48:353-9.
10. Hattori Y, Doi K, Abe Y, Ikeda K, Dhawan V. Surgical approach to the vascular pedicle of the gracilis muscle flap. *J Hand Surg Am* 2002;27:534-6.
11. Hasen VK, Gallegos ML, Dumanian AG. Extended approach to the vascular pedicle of the Gracilis muscle flap. Anatomical and clinical study. *Plast Reconstr Surg* 2003;7:2203-8.