

Gracilis Functional Free Muscle Transfer following Brachial Plexus Injury to Restore Upper Extremity Function

At Penn Medicine, a multidisciplinary team of surgeons from the Penn Nerve Center are performing gracilis functional free muscle transfers (FFMT) to restore upper extremity movement to patients with brachial plexus injuries (such as avulsion, laceration or contusion).

Brachial plexus injuries are typically traumatic in origin and are marked by paralysis and other functional upper extremity deficits. For these patients, the restoration of shoulder and elbow function is considered a vital necessity.¹ If initiated within six to nine months of injury, nerve grafting and nerve transfers (also known as neurotization) can restore shoulder and elbow function to individuals with brachial plexus injuries. For those with brachial plexus denervation exceeding this timespan, gracilis FFMT has the potential to restore movement to the shoulder and elbow.

Located on the medial aspect of the thigh, the gracilis muscle has the advantages of a rich blood supply and reliable motor innervation (Figure 1). Gracilis FFMT surgery involves minimal donor site morbidity and little to no impairment of leg function.

Once transferred to the upper arm, the gracilis has the capacity to mimic the function of the biceps and brachialis muscles. Neurotization and vascular anastomosis of the muscle at the recipient site are achieved through microsurgery. The reported success rate for gracilis FFMT in patients with brachial plexus avulsion is approximately 70%.¹

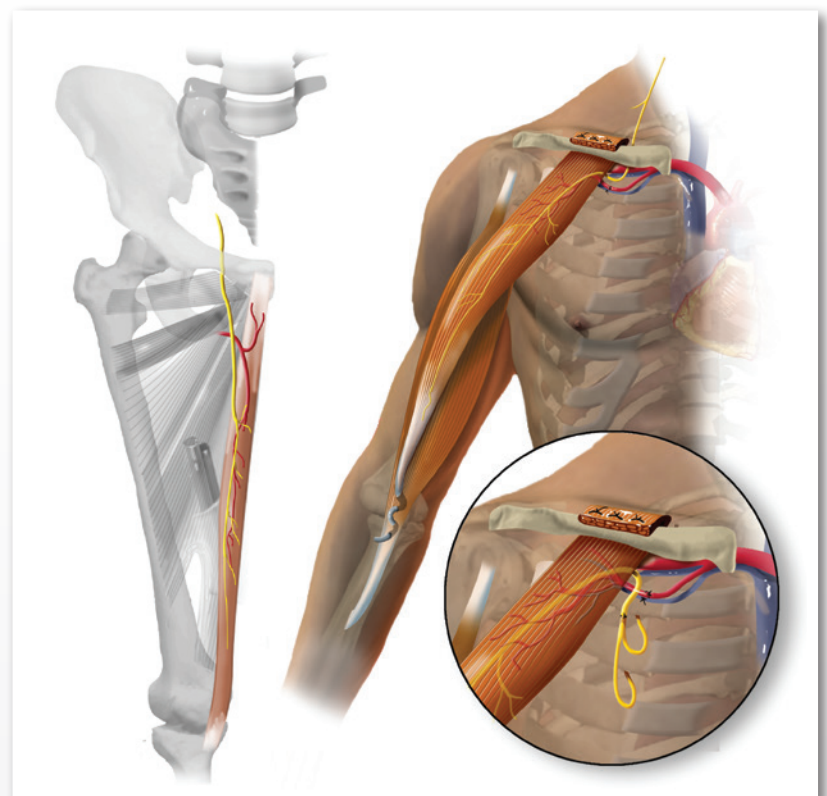


Figure 1: Gracilis functional free muscle transfer surgery involves transferring the gracilis muscle from the medial thigh (left) to the upper arm (right) to restore function in patients with brachial plexus injuries. The gracilis offers a rich source of vascular and nervous tissue and its transfer results in minimal morbidity and function loss at the donor site.

CASE STUDY

RL, a 28-year-old man, was referred to the Penn Nerve Center for restoration of movement in his paralyzed right arm. Two years prior, RL had a motorcycle accident resulting in spinal injury and complete right brachial plexus avulsion.

Following the injury, he had rehabilitative therapy, including range of motion exercises, which maintained flexibility but did not restore function in the right arm. Since direct nerve repair was no longer an option, a functioning gracilis muscle in RL's left leg and donor nerves that could serve to re-innervate the muscle transfer were selected.

At Penn, gracilis FFMT surgery proceeds in phases and involves coordinated teams of neurosurgeons, orthopaedic surgeons and plastic surgeons from the Penn Nerve Center. At the start of surgery, neurosurgeons first explored RL's brachial plexus to identify viable donor nerve sites. The spinal accessory nerve was selected as a functional donor injury nerve, maintaining several branches to the trapezius muscle to avoid loss of upper shoulder function.

(Continued on back)

Reference

¹Ali ZS, Heuer GG, Faught RWF, et al. Upper brachial plexus injury in adults: comparative effectiveness of different repair techniques. *J Neurosurg* 2015; 122:195-201.

**CASE STUDY** *(Continued from front page)*

The orthopaedic and plastic surgery teams prepared the recipient site at the upper arm; the gracilis muscle, obturator nerve, blood vessels and a skin paddle were harvested from RL's left leg. This tissue was then positioned within the recipient site and the gracilis secured via the clavicle and biceps tendons. With the completion of microvascular repair to the arteries and veins, micro-doppler probes were applied to ensure vessel patency and to measure blood flow.

The neurosurgical team then returned to attach the obturator nerve of the gracilis muscle to the donor spinal accessory nerve. After five days in the hospital for observation, RL was discharged home and had an unremarkable recovery. He is currently participating in daily range of motion rehabilitative therapy.

FACULTY TEAM

The Penn Nerve Center offers expert diagnosis and cutting edge treatment for a wide range of nerve conditions including traumatic nerve injuries such as brachial plexus, nerve entrapment, nerve compression, and nerve tumors. We offer a multidisciplinary surgical and medical team consisting of neurosurgeons, orthopaedic surgeons, plastic surgeons, neurologists, physiatrists, physical therapists, and other specialists. As an academic medical center, we conduct extensive nerve research and provide access to clinical trials. Our goal is to provide hope to our patients by creating individualized treatment plans to alleviate their symptoms and ultimately improve their quality of life.

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