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IDEAS AND INNOVATIONS

Hand/Peripheral Nerve

Targeted Muscle Reinnervation for Symptomatic Neuromas Utilizing the Terminal Anterior Interosseous Nerve

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Summary: Sensory nerve trauma at the level of the wrist can lead to debilitating neuromas. Targeted muscle reinnervation (TMR) is an effective therapy for the treatment of neuromas. Here we propose the use of the terminal anterior interosseous nerve (AIN) as a viable recipient for TMR. All superficial sensory nerves around the wrist, including the dorsal ulnar sensory nerve, the distal lateral antebrachial cutaneous nerve, the distal branches of the superficial branch of the radial nerve, and the palmar cutaneous branch of the median nerve were dissected in 2 cadaver specimens. The AIN branch to pronator quadratus was divided just distal to the final branch of flexor pollicis longus to preserve adequate length for TMR. The sensory nerves at the wrist were fully dissected to identify a viable location for coaptation to the AIN. After the cadaveric concept was demonstrated, the technique was successfully used in a clinical case. In summary, the distal AIN is a versatile recipient for TMR as a treatment of painful sensory neuromas at the level of the wrist, with minimal donor-site morbidity. *(Plast Reconstr Surg Glob Open 2020;8:e2979; doi: 10.1097/GOX.0000000000002979; Published online 14 July 2020.)*

INTRODUCTION

Sensory nerve injuries at the level of the wrist are commonly missed at the time of trauma or surgery and can lead to debilitating neuromas affecting 2%–60% of patients with nerve injuries.[1–3] The various treatment modalities of painful neuromas remain controversial.[4–6] At this time, there is no consensus on the optimal treatment. However, it has been shown that surgical interventions can achieve meaningful clinical improvement of pain.[7] The superficial nerves around the wrist, including the dorsal ulnar sensory nerve (USN), the distal lateral antebrachial cutaneous nerve, the distal branches of the superficial branch of the radial nerve (SRN), and the palmar cutaneous branch of the median nerve (PCB), are sources of peripheral nerve neuromas.

The surgical treatment of neuromas has been shown to significantly improve self-reported pain, depression, and quality-of-life scores.[8] Targeted muscle reinnervation (TMR) is one of the newest members of our reconstructive armamentarium and has been shown to be efficacious in treating upper-extremity neuromas in postamputation patients.[9] With this information at hand, we present a cadaveric study and a clinical case evaluating the novel use of the anterior interosseous nerve (AIN) to the pronator quadratus (PQ) muscle as a recipient for TMR around the wrist.

METHODS

An anatomic study of the AIN, SRN, USN, and PCB in 2 cadaveric specimens was performed. Terminal AIN branches to flexor pollicis longus (FPL) and flexor digitorum profundus were identified. The terminal AIN to PQ was divided just distal to these branches to gain adequate length for coaptation to the sensory nerves at the level of the wrist while sparing clinically significant muscular morbidity. The sensory nerves were then identified distally to show where along their course would be a viable option for coaptation to the distal AIN (Fig. 1). After the cadaveric concept was developed, the technique was used in a clinical case.

RESULTS

In one cadaveric upper extremity, 2 AIN branches to FPL were identified, with the most distal branch occurring 6 cm proximal to PQ and 14 cm from the wrist crease. The other cadaveric specimen demonstrated only 1 branch to FPL, which occurred 8.5 cm proximal to PQ and 18 cm

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Received for publication April 22, 2020; accepted May 23, 2020.

DOI: 10.1097/GOX.0000000000002979

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

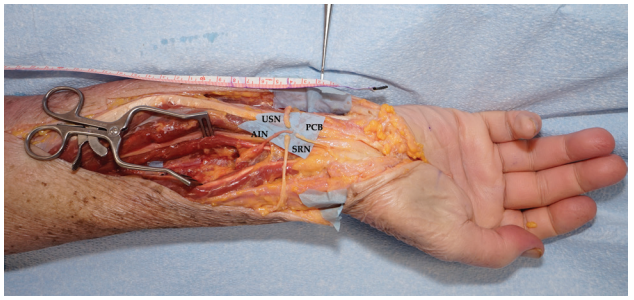

Fig. 1. Cadaveric dissection showing proximity of USN, PCB, and SRN to the anterior interosseous nerve once the terminal anterior interosseous nerve is divided proximally and reflected distally. AIN indicates anterior interosseous nerve; PCB, palmar cutaneous branch of the median nerve; SRN, superficial radial sensory nerve; USN, dorsal ulnar sensory nerve.

from the wrist crease. When divided just distal to the final FPL branch, there was adequate length for coaptation to each of the sensory nerves (SRN, USN, and PCB) at the wrist crease in both specimens.

The technique was then used clinically. A middle-aged man presented with a painful neuroma of the PCB of the left hand 2 years after carpal tunnel release and was offered exploration. A neuroma of the PCB was identified at the exact location of the painful Tinel sign. The terminal AIN was dissected proximally and divided distal to its branches to the FPL, and the PCB was transected just proximal to the neuroma. All terminal branches of the AIN were identified and preserved, including those to the FPL, except the terminal branch to PQ. Coaptation was achieved deep in the forearm just superficial to the interosseous membrane (Fig. 2). The patient continues to do well 9 months postoperatively, with complete resolution of symptoms, no clinically or functionally significant weakness or limitation in range of motion, and no recurrence of pain or hypersensitivity.

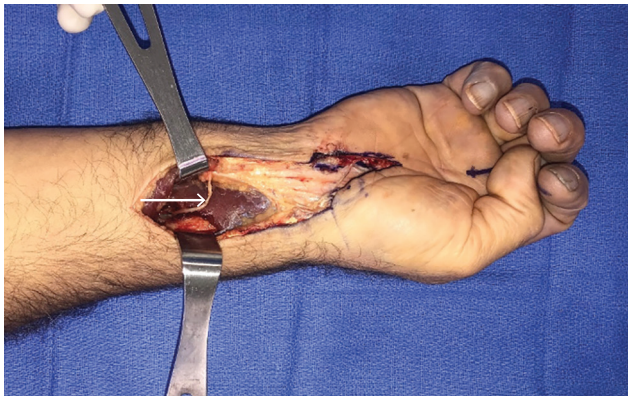

Fig. 2. Coaptation of the distal cut end of the palmar cutaneous branch of the median nerve to the proximally transected and distally reflected AIN. AIN indicates anterior interosseous nerve; PCB, palmar cutaneous branch of median nerve. Arrow indicates site of coaptation.

CONCLUSIONS

The versatility of the AIN as a target for TMR has not been explored previously. The anatomy of the AIN is well described in the literature[10] and predictable in nature. Sacrifice of PQ function is well tolerated in patients with a functioning pronator teres.[11] These characteristics make it an ideal target for TMR because all of the sensory nerves at the wrist can be coapted without tension to the terminal AIN. We will continue to investigate anatomically and clinically how the terminal AIN can be safely, reliably, and quickly mobilized as a TMR target without compromising function. This nerve transfer is an excellent option for TMR for neuromas around the wrist.

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