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Supinator to ulnar nerve transfer via *in situ* anterior interosseous nerve bridge to restore intrinsic muscle function in combined proximal median and ulnar nerve injury: a novel cadaveric study

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ARTICLE INFO

Article history:
Received 2 September 2016
Received in revised form
1 November 2016
Accepted 1 December 2016
Available online 23 December 2016

Keywords:
Intrinsic function
Ulnar nerve
Median nerve
Nerve transfer

ABSTRACT

Background: In cases of high ulnar nerve palsy, result of nerve repair in term of intrinsic muscle recovery is unsatisfactory. Distal nerve transfer can diminish the regeneration time and improve the results. But, there was no perfect distal nerve transfer for restoring intrinsic hand function in combined proximal median and ulnar nerve injuries. This cadaveric study aims to evaluate the possibility and feasibility of supinator nerve transfer to motor branch of ulnar nerve (MUN).

Methods: Ten cadaveric upper limbs dissected to identify the location of the supinator branch, anterior interosseous nerve (AIN), and MUN. The AIN was cut from its origin and transferred to the supinator branches. Also, the AIN was distally cut and transferred to the MUN. After nerve coaptation, surface area, fascicle count, and axon number were determined by histologic methods.

Results: In all limbs, the proximal and distal stumps of AIN reached the supinator branch and the MUN without tension, respectively. The mean of axon number in the supinator, proximal stump of AIN, distal stump of AIN and MUN branches were 32,426, 45,542, 25,288, and 35,426, respectively.

Conclusions: This study showed that transfer of the supinator branches to the MUN is possible via the *in situ* AIN bridge. The axon count data showed a favorable match between the supinator branches, AIN, and MUN. Therefore, it is suggested that this technique can be useful for patients with combined high median and ulnar nerve injuries.

Introduction

The ulnar nerve injury induces severe hand malfunction due to intrinsic muscle paralysis. The ulnar nerve repair in proximal area (high ulnar nerve palsy) seldom leads to intrinsic muscle function because of long path of nerve return.[1,2]

Therefore, the best technique to restore intrinsic hand function in patients with high ulnar nerve injury is distal nerve transfer technique that minimizes the regeneration time and distance. In the presence of isolated high ulnar nerve injury, transfer of the terminal branch of anterior interosseous nerve (AIN) to the motor branch of ulnar nerve (MUN) is

Authors' contributions: H.N. drafted the article and assisted with data analysis. S.H. participated in study design and data collection. All authors read and approved the final article.

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0022-4804/$ – see front matter
http://dx.doi.org/10.1016/j.jss.2016.12.003

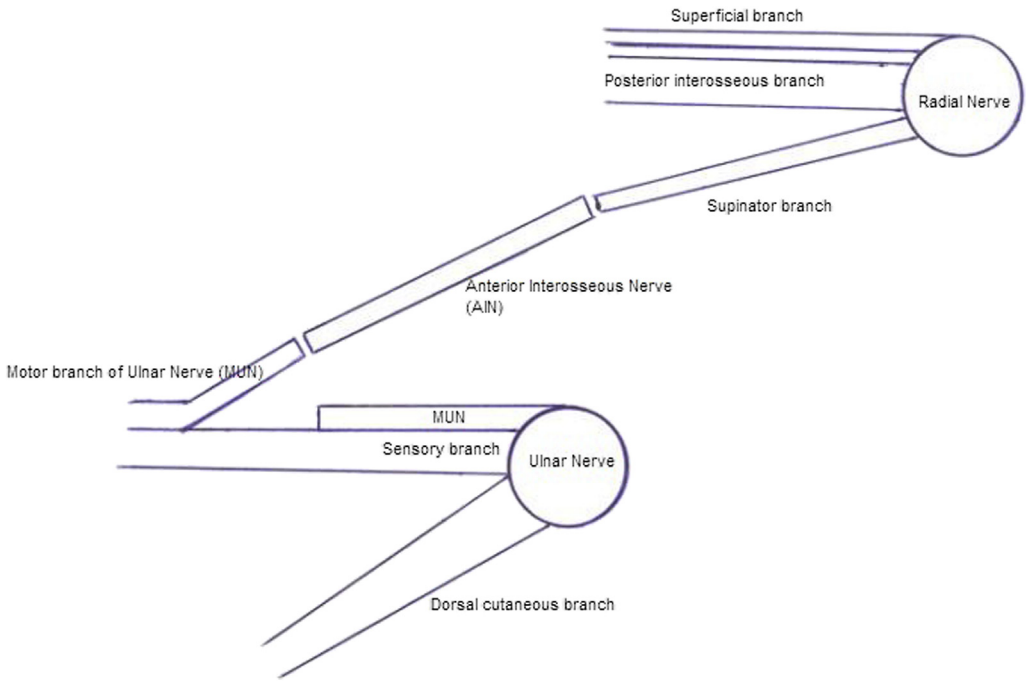

Fig. 1 – Schematic of the procedure showing transfer of the supinator nerve to the MUN via the AIN. Colour version figure is available online.

preferable treatment. But in the case of combined high median and ulnar nerve injury, this transfer technique is inapplicable, and the selection of donor nerve is not easy.[3,4]

There are few studies to perform distal nerve transfer in cases of combined high median and ulnar nerve injuries but these proposed options have major limitations.[5,6]

This cadaveric study was designed to investigate the possibility and feasibility of using the *in situ* AIN bridge to transfer the supinator nerve to the MUN (Fig. 1).

Materials and methods

Ten upper limbs of seven fresh frozen male cadavers were used for this study. After cleaning, preparation, and drape of the cadaver extremity, an incision was made on 5 cm proximal to the elbow joint to expose the radial nerve and its branches between the brachialis and brachioradialis muscles. Then, dissection extended distally at the elbow region to show the nerve division into superficial and deep branches. After that, branches of the supinator muscle were dissected, labeled, and transected just before its entrance to the muscle (Fig. 2).

Also, the median nerve and the origin of the AIN were explored at proximal of the forearm through the Henry approach. The AIN was cut from its origin and transferred to supinator branch. End-to-end coaptation of the supinator, proximal stump of AIN was done using a 9-0 nylon suture.

Another dissection was done at distal third of the forearm, and the MUN was isolated in the Guyon's canal, and with internal neurolysis, the nerve dissected till proximal to the pronator quadratus muscle. After the identification of the proximal border of the pronator quadratus muscle, the AIN nerve was dissected and cut at the branching point in the muscle. The distal stump of AIN transferred to MUN. End-to-end coaptation of the distal stump of AIN to the MUN was done using a 9-0 nylon suture (Fig. 3).

Histologic analysis

After completion of nerve transfer, the nerve stumps were cross-sectioned and prepared. The prepared sections were divided in two parts: one part was stained with hematoxylin–eosin and the other was stained with Heidenhain's AZAN trichrome method. The hematoxylin–eosin–stained sections were studied by EchoLAB stereo microscope (SM B12; made in Italy) for fascicle counts (26× magnification), and the

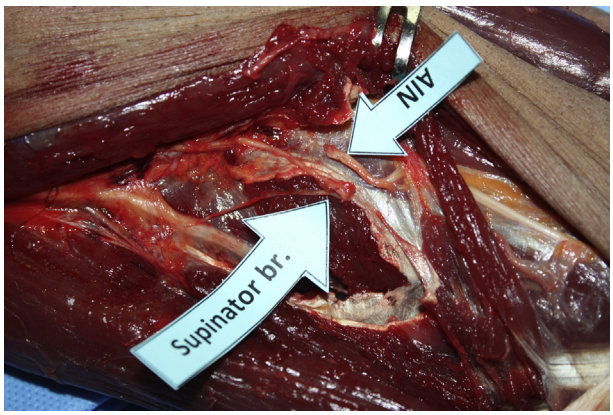

Fig. 2 – Intraoperative photograph of dorsal proximal forearm with exposure of the supinator nerve and the transferred AIN. Colour version figure is available online.