



# Sutureless Reconstruction of Median Nerve Using TISSEEL Fibrin Glue

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## Introduction

Nerve injury can disrupt axonal continuity and cause a growth response in the proximal portion of the axon. When this growth is unable to reach an endoneurial tube, it proliferates in a disorganized fashion forming a neuroma.<sup>1</sup> Neuromas can be divided into two types: stump neuromas and neuromas-in-continuity. These often result in sensory and functional deficiency at the distal end of the nerve, and the neuroma must be resected.<sup>1</sup>

If the neuroma involves the entirety of the nerve, the affected segment must be cut en bloc. Historically, sutures have been used to perform neurorrhaphy in direct peripheral nerve repairs.<sup>2,3</sup> In gaps measuring 0-5mm, nerve ends may be mobilized for direct repair using sutures, or a connector can be used to bridge the defect. Gaps greater than 5mm require nerve graft. Typically, these grafts are either sutured in place or positioned inside of a conduit which is then sutured to the intact nerve ends.

Many neuromas-in-continuity do not span the entire cross-sectional area of the affected nerve. In these situations, it is desirable to preserve the viable portion to maintain intact neurologic function. In direct repairs, this segment is left as a loop, and it runs alongside the graft in larger repairs. While sutures provide tensile strength and stability, they may cause an inflammatory response resulting in scarring and postoperative loss of function.<sup>4</sup> In sutureless nerve repairs, adhesives such as fibrin glue are often used to secure the repair.

## Methods

A 35 year old female was seen 20 months after a bilateral carpal tunnel release performed by another surgeon. The patient reported persistent pain, sensory deficit in her right thumb, index, and long fingers, and weakness causing her to drop everyday objects.

Prior to the initial carpal tunnel release, the patient had a history of punching through a glass window, sustaining a laceration to her forearm just proximal to the right wrist. Since the injury, the patient experienced continued numbness in the palmar cutaneous and median nerve distributions.

Clinical examination revealed a positive Tinel's sign along the right proximal median nerve at the level of the pronator quadratus. She also exhibited >15 mm 2 point discrimination in the median nerve distribution of her right hand.

An EMG was done prior to her original surgery, and a repeat EMG revealed no changes in the right hand, with continued entrapment of the right median nerve at the carpal tunnel.

An extensile incision from the mid palm into to the distal third of the forearm was used. Distally, the common digital and motor branches were intact. The median nerve was inflamed and scarred at the level of the carpal tunnel. More proximal neurolysis revealed a neuroma-in-continuity in the distal forearm, just proximal to the carpal tunnel involving 5cm of length and approximately 75% cross-sectional area of the median nerve (Figure 1). The uninjured fascicles were on the proximal, radial aspect of the nerve. Once the neuroma was isolated, it was resected to the appropriate levels providing healthy ends for nerve grafting (Figure 2). Nerve allograft measuring 4mm x 47mm was then used to bridge the defect leaving a microscopic cleavage between the ends of the allograft and intact nerve. Intraoperatively, it was decided that the remaining 25% would provide enough length stability for placement of the graft using only fibrin glue. The graft was placed within an AxoGuard nerve conduit wrapped around the repair and secured with TISSEEL fibrin sealant spanning the nerve gap. The graft was fashioned with no tension on the nerve, and the conduit was coated in TISSEEL (Figures 3 & 4).

Figure 3



Graft laying inside of conduit prior to sizing and coaptation.

Figure 4



Photograph of repair after coaptation, wrapping, and coating with fibrin glue.

## Results

Our patient reported pain scores were: 7/10 pre-operatively, 5/10 at 3-months, 0/10 at 6 month follow-up. Preoperative grip and pinch strength were 70 pounds and 17 pounds respectively. Grip and pinch strength at 6-months were 70 pounds and 12.5 pounds on the operative (right) side respectively.

At 1-year follow-up, the patient had improving Tinel's sign at the proximal finger crease as well as improved sensitivity (2 point discrimination  $\leq$  7mm at all digits) with no pain in the affected area. At this follow-up, the patient had improved preoperative grip strength: Right = 75lbs, Left = 50lbs. The patient was able to make a composite fist and recorded palmar abduction and thumb opposition of 5/5.

## Discussion

In the literature addressing tensile strength, there are no reports of defects that do not compromise the entire cross-sectional area of the nerve. In our case, 25% of the width of the patient's nerve was preserved. This provided additional length stability and offloaded tension from the coaptation sites of the graft.

Inadequate tensile strength remains a concern in these repairs. Within the first week following repair, fibrin glue shows inferior load to failure. After two weeks, however, tensile strength is equivalent.<sup>6</sup> In cases such as ours, the intact portion of the nerve segment containing the neuroma may be sufficient to bear any tension placed on the nerve in the two weeks following surgery.

While our patient had better than expected outcomes, some studies suggest that there may be ways to further improve upon sutureless, conduit-assisted peripheral nerve repairs. A 2017 study on rat sciatic nerve repair found that hyaluronic acid provided a more effective barrier to infiltration by non-neural cells than porous conduits coated in fibrin glue.<sup>7</sup> While further research is needed to evaluate long-term outcomes following sutureless nerve grafting, this case shows that it may be effective in treating median nerve neuroma during a revision carpal tunnel release.

## References

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Figure 1



Neuroma-in-continuity found in the median nerve.

Figure 2



Median nerve after neuroma resection.