

Using Joint Positioning to Overcome a Nerve Gap and Avoid the Use of a Nerve Graft: Surgical Technique and Clinical Outcome

Introduction

The traditional dogma indicates that undue tension at the nerve repair site will reduce final functional recovery and should be avoided in nerve repair surgery. Although grafting is a reasonable alternative to direct repair when severe tension at the repair site is unavoidable, it presents several challenges that may downgrade the number of axons conveyed. Recent studies suggest that moderate levels of tension may, in fact, promote neuronal growth and accelerate functional recovery. Additionally, direct nerve repair has only one coaptation site for axons to cross compared to two in grafting and it ensures an anatomic and functional match to the distal stump in a primary injury that may further enhance the outcome. We present three cases of direct nerve reconstruction under mild tension with joint flexion that progressed over 3 months to full extension of that limb and we discuss the results that appear to supersede that of a similar graft repair.

Materials & Methods

A retrospective review of the patients who underwent a direct nerve repair or nerve transfer by the senior author between 2017 and 2019 was performed. Two patients with direct nerve injuries and one patient with tetraplegia who had nerve reconstruction with a gap of greater than 3 cm were identified. Intraoperatively, the joint distal to the site of nerve reconstruction was positioned in flexion, bringing the nerve ends together without a graft. The nerve gap was repaired with a nerve tube to alleviate tension at the actual site of axon crossing and to reinforce the tensile strength of the nerve repair. At the end of the procedure, a range of motion brace was used to maintain the joint in flexion with gradual extension of the joint over 12 weeks. Outcome measures included preoperative and postoperative MRC score, active and passive range of motion and sensation by 10 test.

Conclusion

Joint flexion is a simple maneuver that enables direct nerve repair under mild tension in modest nerve gaps and should be considered to avoid nerve graft. In our experience, the time delay prior to the first evidence of recovery is shortened significantly. Additionally, the ultimate strength gained has been comparable with that expected following tension free coaptation. These results appear to be reliably superior to the results of grafting in similar scenarios.

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Case Presentations

Radial Nerve Repair (figure 1)

- 18 yo female
- Gunshot wound in RUE at mid-humeral level
- Presented 3 mo post-injury
- No clinical recovery
- Exam: wrist drop and inability to extend the fingers
- EMG: no evidence of reinnervation.
- MRI of right humerus: neuroma along the radial nerve
- Surgery: direct repair of radial nerve under tension with elbow in flexion to overcome a 3.5 cm gap
- Follow up: At 4 months post-op she already had very good activation of brachioradialis and wrist extensors (at least 3/5) with very weak finger extension. By 11 months post-op she had full function with very good strength (5-) of all finger and wrist extensor muscles with good independent function.

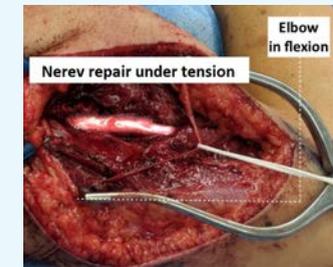
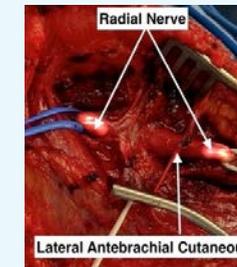
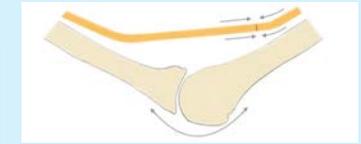


Figure 1

Peroneal and Tibial Nerve Repair (figure 2)

- 37 yo male
- Shrapnel trauma to RLE at popliteal area with sciatic nerve palsy, complicated by wound abscess
- Presented 7 mo post-injury
- No clinical recovery
- Exam: right foot drop (MRC 0/5 in dorsiflexion, plantarflexion, inversion, eversion, toes flexion and extension) and complete loss of sensation below the level of injury (except saphenous distribution)
- EMG: no evidence of reinnervation.
- MRI of right thigh and knee with neurography sequences: neuroma along the sciatic nerve with apparent loss of continuity
- Surgery: direct repair of peroneal and tibial nerves under tension with knee in flexion overcoming a 7 cm gap repaired 3 inches above the popliteal fossa
- Follow up (early): Already MRC 2/5 plantar flexion and significant recovery of sensation at 5 mo post-op (100-60% of normal sensation from the site of injury down to ankle and 10% at the ankle and dorsum of the foot)

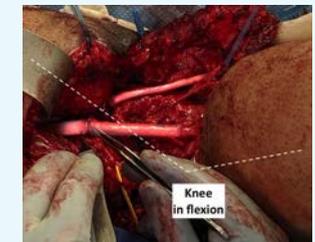
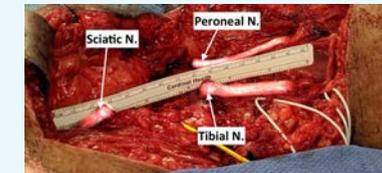


Figure 2

Nerve Transfer (figure 3)

- 22 yo male
- Presented 3 mo after C5 spinal cord injury
- No clinical recovery
- Exam: strong elbow flexion 5/5, weak wrist extension 2/5
- Surgery: Left Brachialis to AIN nerve transfer under tension with elbow in flexion to overcome a 4 cm gap for finger flexion
- Follow up: first signs of reinnervation (MRC 2/5 finger flexion and thumb extension) 4 mo post-op. 3/5 finger flexion (of digits 1-4) by 9 months



Figure 3

References

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