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The Neurovascular V-Y Advancement Flap: Revisiting a Novel Technique to Bridge Segmental Digital Nerve Defects up to 13mm.

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Abstract

Digital nerve injuries can result in significant morbidity and loss of earning potential. This should ideally be repaired primarily but may require the use of grafting, conduits or allografts. We present a technique to achieve a tension free primary digital nerve repair using a homodigital V-Y advancement flap. Follow up at 3 months showed no difference in 2-point discrimination compared to the contralateral side. This technique adds to the surgeon's armamentarium when faced with nerve defects that are less than 13mm but still too large for a conventional primary repair.

Keywords: nerve repair, advancement flap.

Introduction

Digital nerve injuries can result in substantial disability and resultant loss of income and earning potential. The sooner the distal stump of the nerve is reconnected to the proximal, the more favourable the outcomes. In order for a primary repair to be successful there should be a clean wound, appropriate vascularity distal to the injury, a stable soft tissue bed and the gap between the nerve endings small enough to ensure the repair is under minimal tension. When a tensionless repair is not possible then autologous grafting, conduits or allografts may be considered, however these techniques have shown inferior results compared to primary repair.

We present a technique using a homodigital V-Y advancement flap to achieve a tension free primary digital nerve repair of up to 13mm and appropriate soft tissue coverage with an excellent result. The flap is designed and raised similar to a Venkataswami flap [1], to include the neurovascular bundles but the whole complex is used more proximally to reconstruct the lateral aspect of the digit and reduce the gap between the neurovascular bundle stumps.

The Venkataswami flap which is usually used to provide sensate soft tissue reconstruction of fingertip injuries, has been modified previously by Scerri et al to repair nerves with defects up to 10mm [1,2]. We are revisiting this technique to show that as you can achieve an advancement of up to 13mm with these flaps, especially if the apex is brought more proximal towards the metacarpophalangeal joint, nerve defects up to the same length can be bridged this way to facilitate a primary repair without the need for grafts or conduits.

Case Report

A 48-year old, right hand dominant director of a building company sustained a circular saw injury to his left thumb and index finger with resultant tissue loss. He had no significant past medical history. On clinical examination of his index finger he had a 15mm area of soft tissue loss on the radial border of the finger between the proximal and distal interphalangeal joints with loss of sensation in radial digital nerve territory. His left thumb had a dorsal soft tissue defect over the distal phalanx with loss of the nail bed and extensor pollicis longus tendon.

Figure 1: Left index finger defect after debridement illustrating a 15mm wound with 13mm segmental nerve defect.

Figure 4: Left index finger with sutured V-Y flap on radial digit with dorsal full thickness skin graft. Left thumb Foucher flap.

Figure 2: Design of the V-Y Advancement flap. In this case the apex was altered to be adjacent to the con current Foucher flap designed for the thumb defect.

Figure 5: Three months post-op, completely healed with 7mm 2-point discrimination at the left index fingertip.

Figure 3: Raised V-Y flap (held in forceps) with radial neurovascular bundle, nerve defect (illustrated by tenotomy scissors) and dorsally raised Foucher flap.

The procedure was performed under general anaesthetic using an arm tourniquet. Intraoperatively, he was found to have a soft tissue defect of 15mm with a nerve defect of 13mm. A V-Y advancement flap of the index finger was designed and raised to include the neurovascular bundle to enable primary repair of the digital nerve with minimal tension. The nerve was repaired under 3.5 times loupe magnification with a 9-0 nylon for epineural repair (Figures 1 to 4). A Foucher flap was also designed from the index finger to provide soft tissue cover to the thumb following an EPL turnover flap. This had no impact on the radial digital nerve repair. Follow up at 3 months showed a 2-point discrimination of 7mm which was identical to the contralateral side. (Figure 5)

Discussion

The cardinal rule in any nerve repair is to avoid tension at the repair site because if a nerve is stretched by 8%, there is a 50% reduction in its blood flow [3]. If a tension free neurorrhaphy is not possible, a graft or conduit must be used, and this has been shown to have less favourable outcomes.

This technique adds to the surgeon's armamentarium when faced with nerve defects that are less than 13mm but still too large for a conventional primary repair. With this technique, the tension is in the overlying skin and soft tissues and not at the nerve repair site, it also reduces the gap and tension in the digital artery should a vascular repair be required.

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