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Treatment of the Non-Functional Contracted Hand

The spastic hand poses a unique challenge to the hand surgeon. Those patients who develop a clenched fist deformity experience both pain and significant hygiene problems. When conservative management for this condition fails, surgery can often be helpful. Which procedure should be performed depends on the presence or absence of volitional control of the extremity. If a patient has active function of the hand, a flexor tendon lengthening procedure might be beneficial. In the absence of volitional control, a superficialis to profundus transfer (STP) is often recommended.

Introduction

Clenched fist deformity is a condition often seen in the spastic upper extremity of patients with upper motor neuron syndromes (UMN). The deformity is caused by spastic flexor digitorum superficialis (FDS), flexor digitorum profundus (FDP), flexor carpi ulnaris (FCU), and flexor carpi radialis (FCR) muscles. It often occurs in concert with a thumb-in-palm (TIP) deformity, which is caused by hyperactivity of the flexor pollicis longus (FPL) and/or intrinsic thenar muscles, namely the flexor pollicis brevis (FPB) and adductor pollicis (AP)¹.

A clenched fist in concert with a TIP deformity is not only painful but also can cause significant hygiene problems. When nonoperative management for this condition fails, surgery can often be helpful. Which procedure should be performed depends on the presence or absence of volitional control of the extremity. If a patient has active function of the hand, a flexor tendon lengthening procedure might be beneficial¹⁻³. However, in the absence of volitional control, a superficialis to profundus transfer (STP) with concomitant wrist fusion is recommended to ameliorate problems such as pain, poor hygiene, nail bed infections, skin maceration and malodor within the palm^{1,4-6}.

While both the clenched fist and TIP deformity are corrected at the time of the STP, the resulting lengthening of the extrinsic thumb and finger flexors often unmasks intrinsic spasticity. Post-operatively, intrinsic hand deformities can be seen, necessitating additional surgical procedures such as intrinsic releases or a Matev thenar slide. A neurectomy of the ulnar motor nerve done distal to Guyon's canal has been shown to prevent an intrinsic plus deformity from hypertonicity of the lumbrical and interossei muscles⁷. In addition to the ulnar motor neurectomy, a recurrent median nerve neurectomy may be performed at the time of STP to relieve spasticity in the median innervated intrinsic thenar muscles, namely the opponens pollicis and superficial head of the flexor pollicis brevis.

Surgical Technique

The patient is placed under general anesthesia and a tourniquet applied. A 15 cm volar incision is made from the proximal forearm to the distal thenar crease (Figure 1). The palmaris longus, flexor carpi radialis, and flexor carpi ulnaris tendons are identified and released. The median nerve is identified and protected. The flexor digitorum superficialis (FDS) tendons are isolated and sutured together distally in the forearm. The tendons are transected distal to the suture and dissected proximally. The flexor digitorum profundus (FDP) tendons are next sutured together in the proximal forearm and transected. The FDS is then sutured to the FDP en masse while holding the wrist and fingers in full extension (Figure 2). The flexor pollicis longus (FPL) tendon is identified proximally and transected (Figure 3). With the thumb held in an extended position, the FPL is then sutured to the superficialis to profundus tendon transfer.

A carpal tunnel release is performed. The ulnar nerve is identified in the distal forearm and carefully dissected distally through Guyon's canal. The superficial sensory branch of the nerve is identified and protected. The deep motor branches of the nerve and the hypothenar branch are identified and transected.

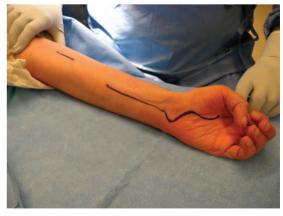


Figure 1. Standard volar incision (distal marking) for superficialis to profundus (STP) transfer with carpal tunnel release, ulnar motor branch neurectomy, and recurrent median neurectomy. The more proximal marking is used for a pronator teres slide, which is often performed at the same time as STP transfer.

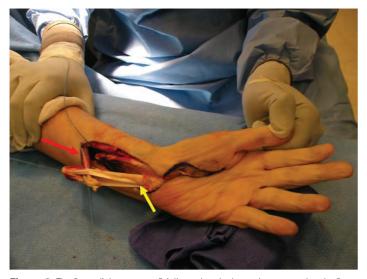


Figure 2. The flexor digitorum superficialis tendons (red arrow) are sutured to the flexor digitorum profundus tendons (yellow arrow) en masse.

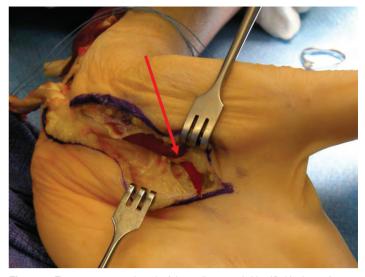


Figure 4. The recurrent motor branch of the median nerve is identified (red arrow).

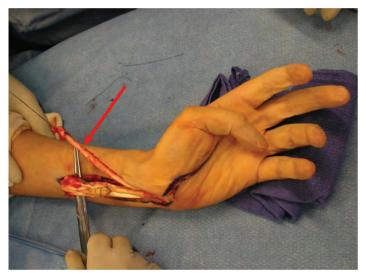


Figure 3. The flexor pollicis longus (FPL) tendon is identified (red arrow) proximally and transected.

If a recurrent median neurectomy is also to be performed, dissection is carried out to expose the thenar muscles of the thumb. The recurrent motor branch of the median nerve is identified and then transected (Figure 4).

The tourniquet is then released, hemostasis obtained and the incisions are closed. The tourniquet is then re-inflated and the wrist is arthrodesed in 10 degrees of extension using a dorsal plate⁸.

Post-operative Management

Post-operatively, the patient is immobilized in dorsal and volar splints with the thumb and fingers in full extension out to the DIP joints. This splint is used for 6 weeks, after which a removable volar wrist splint is applied and passive range of motion of the thumb and fingers begun. The volar wrist splint is used for an additional 6 weeks to protect the wrist arthrodesis. Patients are routinely seen at 2 weeks, 6 weeks, and 12 weeks after surgery. Radiographs are obtained at 6 and 12 weeks to assess the status of the wrist arthrodesis. Office visits are then done at 3 month intervals or as indicated by the overall treatment of the multiple limb deformities seen in these UMN patients.

Discussion

Spastic clenched fist with TIP deformity can be very difficult for the hand surgeon to treat and there is no agreement as to which surgical procedure is most appropriate⁹. In the non-functional hand, extrinsic tightness can be effectively addressed by an STP. However, previously unappreciated intrinsic spasticity can often cause recurrent deformity^{10,11}. Therefore, the treating surgeon should address this potential problem at the time of the index procedure. In the patient with a spastic TIP deformity, intrinsic thenar muscle tightness is often corrected via a Matev thenar slide, which typically involves release of the flexor pollicis brevis, adductor pollicis, and first dorsal interosseus muscles^{12,13}. However, given the potential morbidity of this procedure, which involves a lengthy surgical dissection and potential wound healing complications, the senior author on this paper has been performing a recurrent median nerve neurectomy instead. Only if there is a spastic intrinsic TIP deformity after the initial index procedure is a Matev thenar slide considered. The logic behind the recurrent median neurectomy is that by transecting the recurrent median nerve, one reduces the tone of superficial head of the flexor pollicis brevis and opponens pollicis, which can hopefully prevent an intrinsic TIP deformity. In a recent study of 23 patients with upper motor neuron syndrome who underwent a STP transfer, it was demonstrated that a recurrent median neurectomy at the time of the STP transfer reduced the rate of post-operative intrinsic TIP deformity from 45.5% to 16.7%¹⁴. No complications were noted from performing this additional procedure.

However, one should be aware that for the recurrent median neurectomy to be effective, the patient must have a dynamic TIP deformity due to muscle spasticity. Patients with a fixed TIP secondary to capsular or intrinsic thenar muscle scarring will not benefit from the procedure and will require alternate procedures such as a capsular release or Matev thenar slide. Examination of the thumb following the STP procedure while the patient is still under anesthesia will reveal the presence of a fixed thumb contracture. Since the majority of deformities in patients with upper motor neuron syndrome are the result of both static and dynamic forces, we recommend doing the recurrent median neurectomy to address the dynamic portion of the intrinsic TIP. If needed, a release of the contracture can be done as an adjunct during the initial procedure.

Treatment of the non-functional contracted hand clearly poses a unique challenge to the hand surgeon. Only time and future studies will elucidate the best means of affording a long-lasting surgical correction.

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