Journal of Hand Surgery
(European Volume)
2021, Vol. 46(3) 327–330
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DOI: 10.1177/1753193420988801
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Preferred methods which are against traditional teachings

In this article, I summarize six preferred methods that are against traditional teachings and the reasons why the teachings should not be followed.

Traditional teaching #1: Always preserve the A2 and A4 pulleys when repairing flexor tendon lacerations

This is wrong for four main reasons.

1. The A2 and A4 pulleys are too small to permit easy gliding of a repaired tendon inside their narrow tunnels. The repair therefore often gets stuck at those pulleys and frequently requires a second operation for tenolysis and pulley venting to allow the tendon to glide. If required, venting the A2 or A4 pulley at the time of repair permits a slightly bulky, sturdy four- or six-strand repair to glide without the need for 'routine' tenolysis in most cases.
2. The purpose of preserving the 'essential A2 and A4 pulley' is to avoid bowstringing. Tang (2007, 2018) and Moriya et al. (2016a, 2016b) have provided clinical evidence that clinically significant bowstringing does not occur with judicious venting of the A2 or A4 pulleys.
3. A small amount of bowstringing does not hamper hand function as much as a finger that will not move because the repair did not glide though the preserved A2 or A4 pulley. We need to examine bowstringing at the time of surgical repair to see if it is clinically significant or not. If the repaired tendon with vented pulleys creates a little visible bowstringing, but there is still full active flexion and extension by the awake patient, then the bowstringing is not clinically significant.
4. Wide awake flexor tendon repair has clearly demonstrated to me and many other surgeons that complete venting of either the A2 or A4 pulleys does not result in clinically significant bowstringing either with active movement during the surgery or in the result after the surgery. We have not only seen it repeatedly, but we have videos to prove what we have seen.

What I do

I repair the tendon solidly with a slightly bulky six-strand M-Tang repair and an epitenon suture (Tang et al., 2017). I completely vent either A2 or A4 if necessary. I only vent as much pulley as I need to, until I witness the wide-awake patient completely flex and extend the finger without having the repair gliding hampered by unvented pulleys. This usually means no more than a total of 1.5–2 cm of pulley venting.

Traditional teaching #2: K-wired phalangeal shaft fractures should be immobilized at least 3–4 weeks until the bones are healed

This is wrong for three main reasons.

1. The flexor or extensor tendons often get stuck in the callus of the healing bone with prolonged immobilization. This often results in a stiff finger that requires tenolysis to get the tendons gliding again. Early protected movement avoids this problem, as it does in flexor tendon repair (Gregory et al., 2014).
2. One purpose of 3–4 weeks of immobilization is to avoid loss of the fracture reduction. Wide-awake finger K-wiring with an intraoperative patient full-fist flexion and extension testing proves the stability of K-wire fracture fixation to the surgeon. If the fracture is still moving with full-fist flexion and extension testing during the surgery, the surgeon can add another K-wire if needed to get reliable stability. When the surgeon sees that full-fist flexion and extension testing of the K-wired finger does not lose the reduction, he gains full confidence to start up to half a fist of pain-guided, early, protected finger flexion after 3–5 days of immobilization and elevation after the surgery. He knows that half a fist will not take the fracture apart at 4 days after surgery if a full fist did not take the fracture apart at the time of surgery.
3. The second purpose of weeks of immobilization of K-wired finger fractures is to avoid skin infections

around the K-wires. If the patient is off all pain medication when he starts pain-guided, early, protected movement at 4 days after surgery, he will not move enough to cause infections around the K-wires.

What I do

For wide-awake, full-fist, flexion and extension, proven stability, K-wired phalangeal shaft fractures of the fingers, hand therapists and I allow up to half a fist of early protected finger movement in a splint at 3–5 days after surgery, just as we do for flexor tendon repairs (Higgins and Lalonde, 2016). The patient cannot do what hurts (pain-guided healing) and must be off all pain medication. I educate the patient during the surgery that the hand must always be elevated and immobilized for the first 3–5 days to allow the swelling and internal bleeding to stop, and to allow them to get off all pain medication before therapy. I may wait longer to allow unstable intra-articular K-wired fractures to get more 'sticky' before I start early protected movement.

Traditional teaching #3: K-wires should be left in phalangeal shaft fractures for at least 3–4 weeks or until there is X-ray evidence of bony healing

This is wrong for two main reasons.

1. The first is that clinical healing is more valuable than radiographic healing in finger fractures. Clinical healing means that if you apply moderate compression on the fracture (not on the K-wires) with your thumb and index finger, and there is no pain, the fracture is healed enough to take out the K-wires.
2. The second reason is that all seasoned surgeons have frequently had to open maluniting fractures at 2–4 weeks after injury. We have all observed that the fractures are frequently solidly healed at that time, even when radiologists report that there is no bony healing on plain X-ray findings (Jones et al., 2012).

What I do

I see the patients at 2, 3 and 4 weeks after K-wiring. I apply gentle increasing pressure with my thumb and index finger on the fracture, being mindful of not pressing where K-wires would cause pain. I ask patients to tell me if they feel any pain when I gently press on the fracture site. I look in the patient's eyes to see if I detect pain there while I slowly increase the pressure. If I can press firmly without causing pain, I remove the K-wires. I continue pain-guided, protected movement for another week, when I recheck them with fluoroscopy before letting them go to therapy-only follow-up. I may wait longer to remove K-wires in intra-articular unstable fractures, but most of my patients only have 2–3 weeks of fixation with the K-wires before removal.

Traditional teaching #4: Repaired extensor tendons on the dorsum of the hand should be immobilized for 3–4 weeks until the tendon is healed

This is wrong for two main reasons.

1. Relative motion extension splints (RMES) have been shown to decrease tension on the extensor tendon as well as the excursion of extensor tendon gliding with active movement during wide-awake surgery (Merritt et al., 2020). Many patients can return to work using the injured hand in a RMES as early as 3–5 days after surgery if they follow pain-guided healing.
2. I have allowed reliable patients to move freshly repaired extensor tendons over the hand (zones 5–8) at 3–5 days after surgery with RMES for over 25 years and still no ruptures.

What I do

After 3–5 days of immobilization and elevation to let swelling and internal bleeding to subside, I allow patients off all pain medication to start pain-guided, early, protected movement with RMES under the care of hand therapists. See Merritt et al. (2020) for greater detail, illustrations and videos.

Traditional teaching #5: The most important part of boutonniere treatment is proximal interphalangeal (PIP) joint extension splinting and surgery

This is wrong for three main reasons.

1. It does not recognize the importance of keeping the metacarpophalangeal (MP) joint relatively

flexed compared with the adjacent MP joint. This is done with a relative motion flexion splint (RMFS) that is worn at all times during boutonniere treatment. MP flexion is good for boutonniere healing because it allows (a) the lateral slips of the long extensor to pull the lateral bands dorsal to the axis of the PIP joint, and (b) the relaxation of the intrinsic muscles and the lateral bands so they can migrate dorsal to the axis of the PIP joint. MP extension, and especially hyperextension, are bad for boutonniere because they allow (a) laxity of the lateral slips of the long extensor tendon, which allows the lateral bands to slip volar to the axis of the PIP joint, and (b) tightening of the intrinsic muscles and the lateral bands, which pulls them volar to the axis of the PIP joint.
2. The RMFS keeps the lateral bands dorsal to the axis of the PIP joint to permit the PIP extensor hood to heal like a mallet finger extensor hood heals with proper splinting.
3. The RMFS has provided me with very good success in the non-surgical treatment of both acute and chronic boutonniere fingers in well over 100 patients since Wyndell Merritt showed me this technique more than 15 years ago. Most do not need surgery, just as most mallet fingers do not need surgery.

What I do

For boutonniere deformity after acute extensor tendon disruption, I start with percutaneous large bite dermatotenodesis removable nylon sutures so there are no internal sutures to become exposed after healing. I then treat them like acute closed boutonniere fingers. See Merritt et al. (2020) for greater detail and videos.

For fingers with acute closed boutonniere deformity, I do a pencil test to see if keeping the MP joint of the injured finger relatively flexed keeps the PIP joint extended. If it does, I go directly to pain-guided movement with RMFS for 8 weeks or more. If the pencil does not keep the PIP extended, I add a PIP extension splint to the RMFS.

For chronic boutonnieres, our hand therapy team starts with serial casting to stretch the PIP collateral ligaments until we get almost full passive extension of the PIP joint. We then apply a PIP extension splint inside a RMFS for 2 months, followed by RMFS for an additional 2 months. Timing is variable depending on the healing of the extensor mechanism.

Traditional teaching #6: You need a tourniquet to avoid operating in a 'sea of ink'

This is wrong for many reasons (Lalonde, 2017); the three main reasons are as follows.

1. The tourniquet is unnecessary for good visibility when a surgeon injects tumescent local anaesthesia with epinephrine wherever there will be dissection or hardware insertion.
2. The tourniquet forces patients to have costly unnecessary sedation or proximal nerve blocks, which in turn forces surgeons to perform hand surgery in the expensive main operating room environment. These unnecessary costs prohibit many patients in developing countries from getting hand surgery to restore function (Behar et al., 2019). In addition, sedation and general anaesthesia add unnecessary adverse risk in patients with severe medical comorbidities.
3. The tourniquet is unnecessarily painful. The tourniquet and proximal nerve blocks do not allow patients to comfortably move reconstructed tendons and bones during the surgery to permit surgeons to assess and modify the reconstructions for better outcomes.

What I do

I do almost all hand surgery without a tourniquet. I inject 2–3 patients before they enter the procedure room to give the epinephrine vasoconstriction and lidocaine time to work. I use a very safe maximal dose of 7 mg/kg of lidocaine with 1:100,000 epinephrine. For large volume procedures, I dilute 50 ml of this solution in up to 150 ml of saline (Lalonde and Wong, 2013). In a minimally painful fashion, I inject as much tumescent local anaesthesia as required to have numbness and vasoconstriction at least 2 cm beyond wherever I will be likely to cause pain with fracture manipulation, surgical dissection or hardware insertion (Lalonde, 2016). This approach has enabled Canadians to perform a lot of our hand surgery outside of the main operating room, at a greatly reduced cost, with much less trash going to the environment (Leblanc et al., 2007; Yu et al., 2019).

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