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Flexor tendon repair: recent changes and current methods

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Abstract

The current clinical methods of flexor tendon repair are remarkably different from those used 20 years ago. This article starts with a review of the current methods, followed by presentation of past experience and current status of six eminent hand surgery units from four continents/regions. Many units are using, or are moving toward using, the recent strong (multi-strand) core suture method together with a simpler peripheral suture. Venting of the critical pulleys over less than 2 cm length is safe and favours functional recovery. These repair and recent motion protocols lead to remarkably more reliable repairs, with over 80% good or excellent outcomes achieved rather consistently after Zone 2 repair along with infrequent need of tenolysis. Despite slight variations in repair methods, they all consider general principles and should be followed. Outcomes of Zone 2 repairs are not dissimilar to those in other zones with very low to zero incidence of rupture.

Keywords

Flexor tendon, surgical techniques, pulleys, rehabilitation, outcomes

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Introduction

Over the past two decades, surgical treatment of lacerated flexor tendons, especially in Zone 2, has undergone enormous changes. The current clinical methods are remarkably different from those used 20 years ago. This article starts with a brief review of the current methods used by the lead author, followed by presentations of past experiences and current status of six eminent hand surgery units in four continents/regions across the globe.

Key recent changes

Primary and delayed primary repair

Primary repair is the universally preferred method of repair of a cut flexor tendon in any zone. Delayed primary repair is common, and if done with only 2–3 weeks of delay after injury, the outcomes are the same as the primary repair. With further delay, early repair is still possible and preferable, but outcomes may be slightly worse, and the surgery is certainly more difficult.

Surgical incision

Primary or delayed primary repair in the finger is approached through the laceration and a volar extension distally for 2–3 cm, just enough to expose the tendons and carry out the repair. An extension of the incision is usually in the intact skin distal to the

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laceration, as the distal tendon end commonly lies distal to the skin laceration (because the finger is commonly flexed) (Figures 1 and 2). Proximal tendon ends are not often found in this rather small incision. An incision is made in the palm to find the stump of the flexor digitorum profundus (FDP), which is delivered to the repair site in the finger. The small incision diminishes oedema in the finger and resistance to tendon gliding during rehabilitation.

Retrieval of the retracted proximal tendon stump is often required, especially for delayed primary repairs. In the past, the retracted tendon stump has been fished out from the digital laceration with a tendon retriever or through a proximal extension of the laceration. More recently, surgeons have proposed retrieval of the proximal tendon stump through a separate, 1 cm transverse incision in the distal palmar crease (Tang, 2019). The FDP tendon is found beneath the flexor digitorum superficialis (FDS) tendon and is grasped with two sets of forceps. The tendon is pushed distally with the proximal forceps with the distal ones released, and the distal forceps is then moved proximally to grasp and push again. Repeating the manoeuvre a few times usually advances the proximal stump into the digital laceration site (Figure 3).

Treatment of the sheath and pulleys

To expose the tendons and later carry out surgical repair, the sheath needs to be opened and the total length of sheath opening should be less than 2 cm (Tang, 2007; Tang et al., 2017). The sheath opening can include a part of A2 pulley or the entire A4 pulley (or combined with the A3 pulley), as judged by the level of the tendon laceration (Figure 2). If the laceration site is close to the A4 pulley, the A4 pulley is vented entirely. If the cut is at or just distal to the A2 pulley, which is 1.5–1.7 cm long in adults, the A2 pulley can be vented to 1/2 or 2/3 of its longitudinal extent. Biomechanically, such venting has no clinical functional consequence. Venting can be along the midline of the sheath and pulleys or laterally. In delayed repair, the sheath or pulleys may be fibrotic, and excision of a part of the sheath or pulleys may be needed. Occasionally, release of the entire A2 pulley may be necessary to allow tendon gliding, though in a majority of the patients, part of the A2 pulley can be preserved.

For the repair of the flexor pollicis longus (FPL) tendon, releasing the oblique pulley between the A2 and A1 pulleys of the thumb is usually necessary, or a part of the oblique pulley is vented along with venting of the entire A1 pulley. The narrow A1 pulley can be cut entirely, but this is not sufficient, and part of the sheath, or at least a part of the oblique pulley distal to the A1 pulley, needs to be incised as well. Surgeons should at least keep one of the three pulleys in the thumb, and often one intact annular pulley with a part of the oblique pulley can maintain full function of the thumb.

Surgical repair methods

Tendons are now popularly repaired with a multistrand core suture method, most often a 6-strand or a 4-strand core suture method with a 4-0 or 3-0 suture and supplemented with a running peripheral suture. When a 6-strand repair is used, the peripheral suture can be very simple, with sparsely located circle or cross stitches using a 5-0 suture (Pan et al., 2019). Some surgeons do not add a peripheral suture

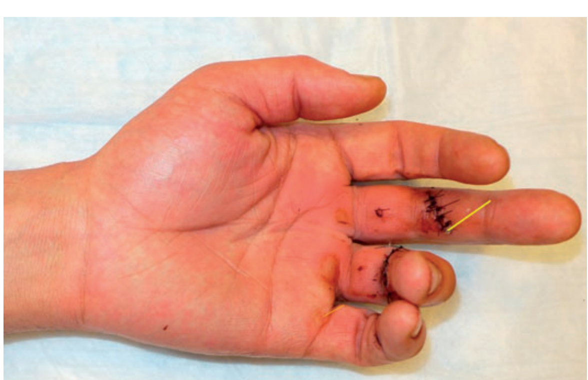

Figure 1. A small incision in the original cut site and an extension distally of a total of 2 cm long exposure. Figures 1–5 are from the same patient (copyright, Jin Bo Tang).

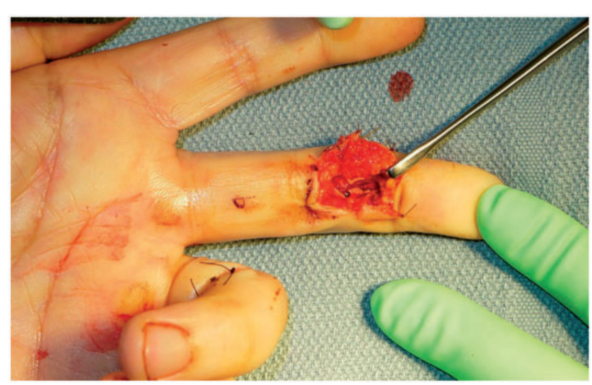

Figure 2. Venting of the entire A4 for exposure and tendon repair. The tendon was lacerated at the border of Zone 2A and Zone 1 (copyright, Jin Bo Tang).

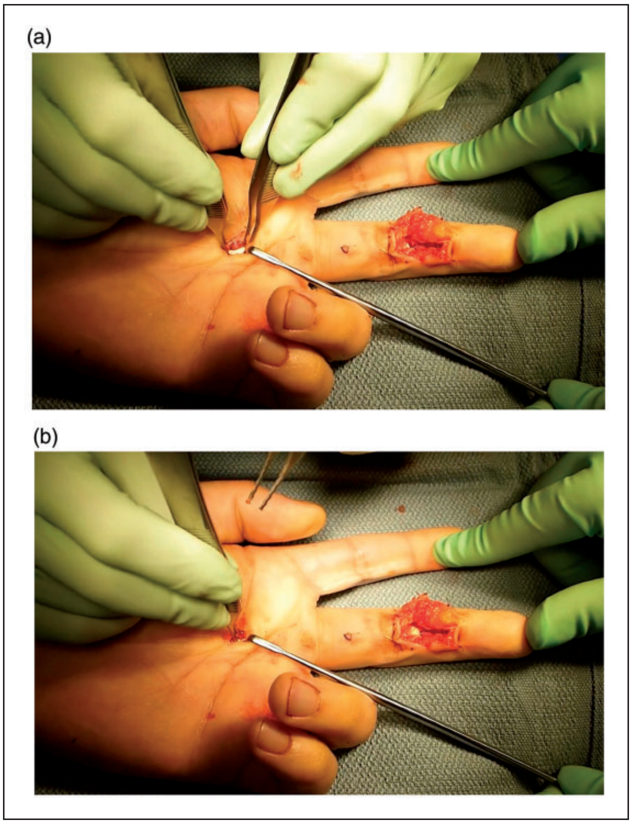

Figure 3. Delivery of the retracted FDP tendon through making a separate small incision in the palm. (a) Two sets of forceps were used to grasp the tendon in the palm through an incision in the distal palm. (b) The proximal forceps pushed the FDP tendon to the incision in the finger distally (copyright, Jin Bo Tang).

to a strong 6-strand core suture repair (Giesen et al., 2009, 2018). Common multi-strand repair methods are a 6-strand Kessler-type repairs, 6-strand M-Tang repair, 4-strand cruciate repairs, and 4-strand Strickland or 4-strand Kessler repairs. The Yoshizu #1 technique (6-strand) is the most commonly performed repair in Japan.

Some general principles should be followed for any core suture repair to ensure strength and gap resistance: (1) sufficient suture purchase of 7–10 mm; (2) a certain tension over the repair site, ideally producing 10–20% shortening of the tendon segments within the core suture and with slight bulkiness; (3) if a locking suture is used, the lock should be of about 2 mm in diameter; and (4) slight bulkiness causing about 20–30% increase in the diameter at the approximation site of the two tendon stumps is preferable for resisting gapping, because the junction site becomes more cylindrical when the repaired tendon is loaded (Tang, 2018, 2019; Tang et al., 2017). The knots are not necessarily placed between the two tendon ends. Placing the knots outside the tendon surface does not affect tendon gliding, and this is a part of a number of current popular methods.

The FDS tendon can be repaired, but many surgeons do not regularly do so, and a *digital extension–flexion test* is performed right after tendon repair to ascertain that full extension of the digit does not produce gapping and that during digital flexion the repair can glide smoothly and that the nearby pulley does not impinge on the repair (Tang, 2018, Tang et al., 2017). Performing digital flexor tendon repair under local anaesthesia with epinephrine and without a tourniquet is a popular and often-used method (Lalonde, 2017; Lalonde and Martin, 2013a and b). In this setting, testing the gliding of the repair with active flexion and extension of the digit is possible and efficient. If any gapping is found or if pulleys block smooth gliding of the repaired tendons, the surgical repair should be revised or the pulley further vented.

Postoperative protective splint and early passive-active motion

The wrist position is the surgeon's choice, and it can be in a comfortable position without marked flexion or extension. The hand can be in a resting position, and motion exercise can start 4–5 days after surgery. The current motion protocols vary in different units, but a passive-active motion protocol is widely used, with only partial range active flexion in the first few weeks after surgery (Figure 4). After that, the aim is to have the repaired digits achieve full active motion. The splint can be discarded from week 6 or slightly later. Some units suggested a short splint, and out-of-splint motion exercise is found to be safe and efficient for compliant patients (Tang, 2021). After splint removal, relative motion splinting is effective for the patients who have mild to moderate adhesions.

Zone 1, 3-5 repairs and tenolysis

Methods of proximal Zone 1 repair are the same as for Zone 2 repairs. A distal Zone 1 (tendon–bone junction) repair can be done with mini-anchor, robust direct repair or suture suspension repair. Conventional pull-out suture repairs also work, but the other methods are easier and avoid nail complications.

The incidence of tenolysis is much lower and infrequent with these updated surgical and rehabilitation methods, though tendon repair in complex trauma conditions still often requires secondary tenolysis, and some may also need tendon grafting or staged reconstruction.

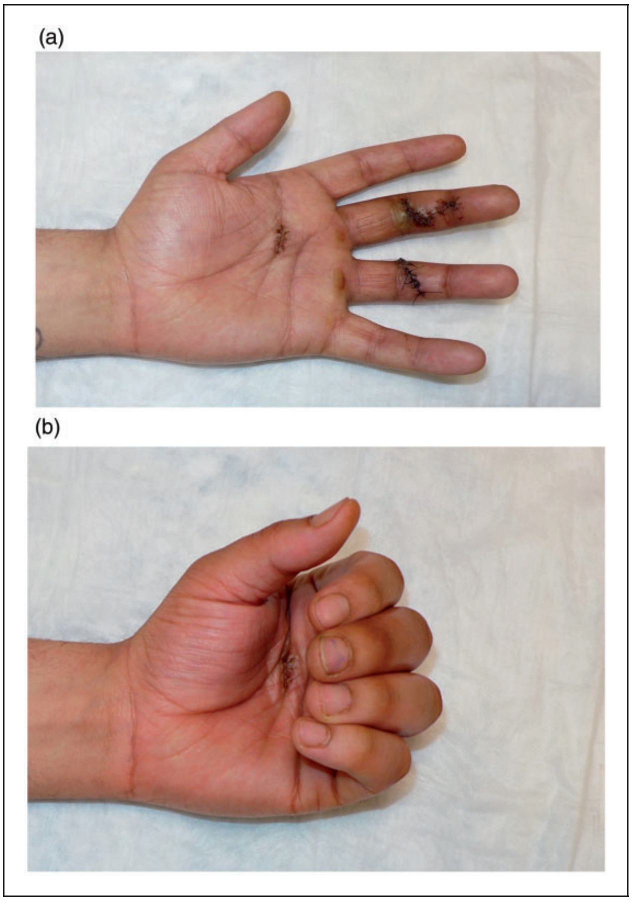

Figure 4. Out-of-splint motion in the first 3–4 weeks after repair of the same patient with very mild oedema in the finger. (a) Full extension of the finger; (b) partial range active flexion (copyright, Jin Bo Tang).

Perspectives from leading centres worldwide (in alphabetical order by city)

Heidelberg, Germany (Leila Harhaus): How to establish and standardize a new tendon suture concept in a large hand surgical department

The recent changes and innovations in the surgery of flexor tendon lesions introduced by Tang and others open new perspectives for clinical treatment concepts, including postoperative early active motion protocols. One challenge is to introduce such new surgical and therapeutic concepts into departments that have used traditional techniques for decades. Modern learning and teaching theories have shown that learning is most efficient when the trainees are involved physically and mentally in the process (Beard et al., 2002; Norman and Schmidt, 1992). Halsted's well-known adage 'see one, do one, teach one' combined in the 19th century passive audio-visual and active demonstrational elements of the learning pyramid (Kotsis and Chung, 2013). Nowadays we have learned from quality management theories that constant checking mechanisms help to maintain quality and to detect and correct process deviations.

Using the knowledge of these learning theories, we undertook changing our traditional Kirchmayr–Kessler tendon suture and postoperative Washington motion protocol to the new M-Tang repair method and Manchester motion protocol in our department of about 40 hand surgeons and 40 physio- and occupational therapists. The aim was to standardize the suture technique and motion protocols and to maintain the standards with high compliance over time.

As a first step, an in-house expert group defined and specified the techniques obtained from the recent literature and adapted them to our department structure. A detailed process description included all aspects beginning with indications, types of anaesthesia, suture material and suture technique. This included step-by-step videos up to the postoperative dressing, which were prepared and published in our in-house app (Figure 5). For practical teaching we established a training station where every surgeon had to perform the new suture technique under documented supervision of the experts. Surgeons were only allowed to start using the new suture technique in clinical routine after completing this training.

As a quality control, a re-check was performed after 6 months, when each surgeon had to demonstrate the technique again. If deviations from the taught technique were noted, they were corrected immediately. In addition, all observed problems and comments on their corrections were sent (anonymously) to all surgeons in order for them to 'learn from other's mistakes'.

Following the surgeons' quality checks, we started the change process for the postoperative motion protocol. Here we followed the same teaching structure, including specifying the in-house process in an expert round; creating process descriptions for doctors, therapists and patients; publishing them in our app and on our website; and performing oral presentations and practical teachings (especially for splinting).

For quality control we still perform close follow-up of our treated patients after 3, 6 and 12 weeks, and assess all details including wound condition, oedema, range of digital motion and patients' reports on their experiences with the Manchester protocol of the early active motion.

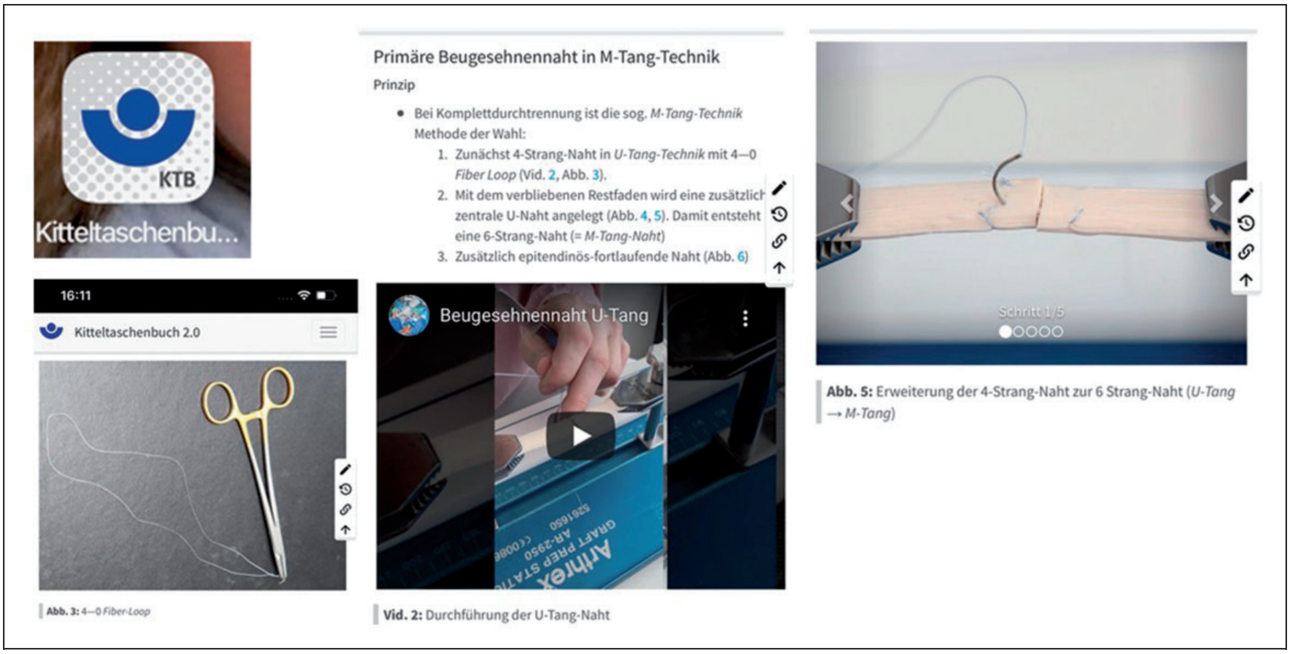

Figure 5. Flow-chart of training of a 6-strand core suture used in Heidelberg, Germany. Extracts of the dedicated chapter on M-Tang tendon suture in the in-house knowledge-App of Heidelberg, Germany.

To achieve a successful and sustainable implementation of new techniques and therapies, well-prepared and standardized training courses based on the knowledge of modern learning theories are indispensable. Continuous process reviews and quality controls are crucial to quickly detect and correct deviations and to keep a high level of treatment quality.

Minia, Egypt (Ahmed F Sadek): Adopting standard surgical technique and home-based rehabilitation protocol for Zone 2 flexor tendon repair in one hand centre

In the last decade, the results of flexor tendon repairs in our centre have been markedly improved. A total of 784 FDP tendons have been repaired with follow-up data (Zone 1 (89), Zone 2 (312), Zone 3 (35), Zone 4 (24) and Zone 5 (288)) from 2011 to 2021. Wide-awake surgery has been a standard practice since 2015 with its well-recognized advantages of: (1) reliable assessment of repair integrity and smoothness; (2) identification of any triggering or jamming of tendon gliding; (3) adequate pulley-venting (Moriya et al., 2016a, 2016b; Tang, 2013); and (4) gaining patients' confidence and instructing on therapy while they are still in the operative theatre (Ayhan et al., 2021; Lalonde and Higgins, 2016). It is now our routine practice to incorporate the distal portion of the volar plate of the distal interphalangeal (DIP) joint in distal Zone 1 repairs along with the distal remnant of the FDP. For this we use a 2-strand pull-out suture to add to the conventional 4-strand repair. We have not experienced any cases of rupture using this technique.

In our unit, a 6-strand repair is used in all repaired tendons within all 4 subzones of Zone 2. An exception is the use of 2- or 4-strand repair in FDS repair in subzones 2A and 2B and for injuries to small diameter tendons as in the little finger and in children. FDP-only repair is the rule in Zones 2C and 2D, while in Zone 2A the FDS is repaired when there is enough residual distal stump to allow for repair. In Zone 2B, repair of the FDS is an intraoperative decision according to the ease of repair and the smoothness of gliding after FDP repair.

The postoperative motion protocol is modified to be fully supervised by the surgeon. Until the end of 2019, a rubber band was attached to the tip of the nail to guard against undesired digital extension. However, this was abandoned due to the high incidence of the proximal interphalangeal flexion contracture. Now we splint the wrist in neutral, the metacarpophalangeal joints in 70° flexion and the interphalangeal joints in extension until the fourth postoperative week. The protocol consists of the following steps. (1) Week 1: initiating full or near full active flexion and extension starting on day 1 within the splint for only 5 minutes daily. In the session of 5 minutes, the patients do over 40–50 runs of finger motion, but in the patients with severe oedema, the number of runs usually are often less than 40–50. Anti-oedema measures, including hand elevation and gentle passive motion, are applied. (2) Weeks 2–4: differential flexion in the form of flat fist, hook fist and holding stabilized cylinders with gradually decreasing increments at home (two session daily, 5 minutes in each session). (3) Active flexion and extension without splinting in weeks 5 and 6. (4) Start resistive exercises after week 12. Combined FDP and FDS repairs are preferable due to higher grip strength, however, this is not mandatory due to similar function with the Tang grading system and degrees of total active motion (Sadek, 2020).

During the past 10 years, the good and excellent results according to the Tang grading system after surgical repair was 87% of the fingers in Zone 2. Thirty digits (10%) had remarkable adhesions, which were rated as either fair or poor, and nine fingers (3%) had rupture of the repaired FDP tendons and were rated failure. Repair ruptures occurred in nine digits (3% out of 312 fingers) in Zone 2. Forty-four fingers with Zone 2 FDP repairs were lost in follow-up after surgery; the outcomes in 44 fingers are not known. Later tendon grafting was done for seven fingers, and DIP arthrodesis was performed for the other two fingers that had isolated FDP ruptures 6 weeks after repair and after the patients refused tendon grafting. Among 30 fingers (10%) with remarkable adhesions, some patients refused surgery, so we performed tenolysis in 20 fingers, either 6 months after repair or after the patients had reached a plateau in rehabilitation after the third postoperative month.

Nantong, China (Jin Bo Tang): Tendon rupture or tenolysis are no longer a major concern

We have used the M-Tang repair as the core suture repair plus rather sparsely located peripheral suture or a simple running peripheral suture for FDP tendon repair followed by combined early passive-active motion from 4–6 days after surgery beginning 20 years ago and unchanged since. Four strand repair, such as a U-shaped repair, using one looped suture is occasionally used if the FDP tendon is small. In rare cases, in which the tendon ends after trimming the ragged ends are still not sharp, we add another group of U-shaped repairs or a single Tsuge suture with a looped suture after M-Tang repair, so a total of eight strands are used. The core sutures are made with 4-0 looped nylon, and the peripheral repairs (sparse or running) are made with 5-0 or 6-0 material. We do not often trim the tendon ends more than about 5 mm in each stump, so the tendon repair would not be under a great tension, though occasionally a slightly longer trimming is needed for cases with local crushing. We consider a standard running peripheral suture unnecessary with a strong reliable 6-strand repair, and any peripheral suture stitches can be made with 5-0 suture instead of 6-0. We also use a Kessler repair sometimes for the tendon repair in Zones 3, 4 and 5. We do not use a modified Kessler repair because the suture knots between tendon ends would interfere with healing and contribute to gapping. In using the Kessler repair in Zones 3–5, at least a double Kessler repair is used, and often three groups of Kessler repair (6-strand) are used.

Early active motion exercise is applied to these tendons in repairs in Zones 1 to 5, except for very distal Zone 1 injuries beyond the DIP joint, where adhesion formation does not affect tendon gliding. We detail the consideration for proposing a slight increase in the number of motion runs in each session when the instruction is given to the patients for home-based exercise (Tang, 2021), as they may not follow instruction strictly. This increase creates a safety margin for exercising *at home*, and such an increase is easy and safe. We instruct the patients to do at least 40 runs of active flexion in each session with 4–5 sessions a day, distributed into morning, afternoon, before dinner and in the evening. Patients with different backgrounds are much safer with these instructions. Even if the patients reduce the number of exercises to 20 runs of active motion in each session, this is still efficient. We ask the patient to set a clock of 15 or 20 minutes for each session rather than counting the runs, and motion can be with normal speed or slower. Passive digital extension and flexion are needed for patients with oedema or stiffness before starting early active motion. Out-of-splint motion exercise is safe and easy, which we have used for the majority of our patients in the past decade, and the splint is used between exercise intervals and when going out. The wrist position in the splint can be at any comfortable position, at or close to neutral position. We have never use place and hold exercise.

The incidence of tenolysis is very low with these methods, about 3% in clean-cut or locally crushed cases and ruptures in Zone 2 for the exceptional patients who used the hand forcefully. We observed that the patients who not strictly follow instruction of 'not using the hand' after Zone 2 repair did not rupture the repair with some light hand use after surgery. These who ruptured the repair are the patients who went back to heavy labour or forcefully grasping the object within several weeks after surgery. The total rupture incidence in Zone 2 is less than 1%, and excellent and good results are around 85% (Chen et al., 2021). In the patients with extensive trauma in the distal forearm or palm, tenolysis is often needed and its incidence is higher because multiple structures, including multiple tendons, are repaired.

Niigata, Japan (Koji Moriya): Flexor tendon repair in Zone 2 and rehabilitation: the Niigata experience

The most effective methods of Zone 2 flexor tendon repair employ different treatments for the tendons, sheaths, pulleys and subcutaneous tissues of each region (Tang and Shi, 1992). A good margin of safety during early active mobilization is crucial. We aim to release the sheath/pulley complex adequately by reference to the required excursion of the FDP tendon.

The injured and adjacent pulleys are opened to expose the cut tendon over a length of about 18 mm (sometimes less, depending on the size of the finger). After repair, we usually further release the pulley by 8–10 mm proximally to eliminate the risk of tendon overloading when the tendon glides against the pulley rim. Thus, the A4 pulley is completely released together with the C2 and A3 pulleys when the C1 and A2 pulleys are intact (Moriya et al., 2016a). We occasionally incise the entire A2 pulley together with the adjacent C1 pulley, provided that the A1 pulley and the pulleys distal to the A3 pulley are intact (Moriya et al., 2016b). The FDS tendon is repaired as often as possible. The FDP tendon is always repaired using the 6-strand suture of the Yoshizu #1 technique (Moriya et al., 2015).

No patient has evidenced subjective or objective tendon bowstringing regardless of the extent of pulley release; however, all ruptures of the flexor tendon repair occurred in Zone 2B (Moriya et al., 2017). A total of 6% of fingers required tenolysis after early active motion (Moriya et al., 2019). The outcomes in Zone 2C were significantly inferior to those in Zones 2B and 2D (Moriya et al., 2017).

We find that FDS excision compromises the clinical outcomes of repair because the total extension deficit increases (Moriya et al., 2015). We prefer to perform partial or complete release of the A2 pulley (rather than resection of the FDS tendon) when repairing tendon injuries in Zone 2C. The repaired FDS serves as an additional sheath for the FDP in Zone 2C (Tang, 1995). The area covered by the A2 pulley in Zone 2 creates the most problems; even on early active motion after surgery, tendon repair in Zone 2B is associated with the highest risk of rupture. A repaired FDP tendon in Zone 2B is likely to impinge on the distal edge of the A2 pulley, which may trigger rupture if the extent of A2 pulley release is inadequate to allow free tendon excursion.

Saint John, Canada (Don Lalonde): Saint John experience and outcomes

Make short incisions with a separate incision in the palm if needed to decrease adhesions and the need for tenolysis. Push the palm tendons distally with two forceps so the FDP stays inside the FDS decussation. Grab the cut tendon ends as little as possible because you should not injure the cells you are asking to heal.

To decrease tenolysis incidence to almost zero, make sure you vent enough pulley that a slightly bunched, very sturdy repair does not impair full-fist active flexion and full extension testing in the awake patient. Vent either A2 or A4 as required, but avoid clinically obvious bowstringing by venting no more than a total of 1.5–2 cm of pulley (Prsic et al., 2016; Tang et al., 2017). Small amounts of bowstringing demonstrated in wide-awake surgery with active full-fist flexion and extension testing are well tolerated and not clinically important.

To decrease rupture incidence to almost zero, make very solid 6-strand M-Tang repairs with 1-cm bites. Test all repairs with active full-fist flexion and extension in a wide-awake setting. Patients need to look at their hand to be able to know where their numb fingers are in space. If you see a gap form with testing, do not leave it as it will lead to rupture. To repair a gap: (1) do not remove the first loose suture as this is unnecessary tendon trauma that will lead to more scarring and decreased tendon blood supply. (2) Insert a second tighter suture but leave the ends long when you tie the knot of the second suture. (3) Tighten the first loose suture by pulling on one of its loops or its knot until it is as tight as it should be. (4) Take the loose loop or knot of the first tightened suture and tie it to the long ends of the second suture.

After surgery, keep the hand quietly elevated and splinted in a position of comfort for 3–4 days before starting early protected movement. This prevents internal bleeding to avoid peritendinous hematoma, which turns to scar and adhesions. It allows the swelling and work of flexion to decrease. It lets patients get off all pain medication so they can follow pain-guided movement when they start up to half a fist of true active movement. Do not use Kleinert rubber bands or full-fist place and hold because passive movement of the finger may not mean passive movement of the FDP. It often buckles and jerks (Meals et al., 2019).

Try to be there the first day the patient moves at 3–4 days after surgery. After you wrap the finger with Coban so patients are not seeing sutures and cuts, show them how to loosen the joints with several rounds of passive movement. Then, importantly, you should force the patient to actively flex the DIP no more than half a fist to break up the fibrin clot. You need to make sure you see FDP active gliding that day or the tendon might get stuck in early scar formation. You should also get them to actively and completely extend their interphalangeal joints with the metacarpophalanngeal joints flexed on that first day.

Yixing, China (Zhang Jun Pan): Our methods used and outcomes

Our methods used and outcomes have been detailed in recent reports (Pan et al., 2019, 2020). We performed regular audits in all of our patients with Zone 2 repair in the fingers and thumbs after we implemented updated methods and motion protocols over the past 8 years (Pan et al., 2020). We only had ruptures of three FDP tendons in fingers out of more than 200 fingers and thumbs with Zone 2 FDP or FPL repair, no rupture in the patients who did out-of-splint early active motion and no rupture in FPL tendons. We typically use sparsely located separate stitches of peripheral suture with 5-0 suture, as this is fast and strong (Pan et al., 2017, 2019, 2020). We do not repair the FDS tendon except a partial FDS cut, and the pulleys are vented with a length limit of 2 cm. The early motion exercise (Nantong protocol) starts from day 4–6 after surgery.

The patients with finger stiffness improve over months, and follow-up after a year usually reveals good finger motion even if these fingers are graded as fair initially. Therefore, there is no rush for tenolysis for the mild cases.

Our team had several young surgeons at the time of starting the above surgical and motion protocols. These methods were implemented quite easily after they watched videos, had been supervised by senior surgeons and learned from each other through discussion. The outcomes by the young attending surgeons are similar to those of the senior ones. We repair these tendons in emergency settings and in wide-awake settings, the outcomes are not different from those in a delayed repair setting. We do not consider the surgery more difficult for a junior hand surgeon.

The setting can be simple, but the keys are *surgeon's mastery of surgical techniques and adherence to all needed principles*. A strong repair method must be used and an extension–flexion test is performed, followed by true active flexion exercise after surgery (with or without therapists' involvement). The surgeons should understand *all* these key considerations should be met, and senior surgeons need to teach the junior colleagues to adhere to *all, not part*, of these requirements. Teaching these is actually not difficult. We did that through carefully reading the updated textbooks and articles and watching surgical videos (provided by colleagues in Nantong). With these key steps, we changed from an incidence of 20% ruptures of the Zone 2 repair before 2014 to 0% rupture in Zone 2 of those who followed instructions starting in 2014. Over the past 8 years from 2014, rupture occurred in three FDP tendons (1.2%) of Zone 2 in the first a few weeks after surgery in those who forcefully used the hand.

Summary

Many units are using or are moving toward using the recent strong (multi-strand) core suture method together with a simpler peripheral suture. The outcomes after these repairs and current motion protocols lead to remarkably more reliable outcomes, with over 80% good or excellent rating rather consistently after Zone 2 repair and infrequent need of tenolysis. The passive-only motion protocols are abandoned in these hand surgery units reviewed above, and although repair methods vary slightly, all contributors agree that general principles should be followed and that outcomes of the Zone 2 repair are not dissimilar to those in other zones with very low or zero rupture incidence, though all of us consider that the surgical repair is more challenging and technically very demanding if ideal outcomes are to be expected. Multi-strand strong repairs should also be used or considered in other zones, but technically surgical repair and rehabilitation are easier for repairs in these areas.

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