

# Ulnar Superficial Slip Resection for Resistant Trigger Finger: A Minimally Invasive Technique

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**Abstract:** Primary trigger finger is a common hand disorder for which nonoperative treatment or release of A1 pulley is usually effective. For resistant or recurrent cases, there are different surgical techniques including partial or complete opening of A2 pulley, reduction tenoplasty, and resection of the ulnar slip of the flexor digitorum superficialis tendon. Here, we present our minimally invasive technique for ulnar superficial slip resection surgery. Our indications are the patients with persistent residual proximal interphalangeal joint contracture after A1 pulley release and also the recurrent cases. Then, we report the clinical outcomes of our patients operated using this technique.

**Key Words:** trigger finger, flexion contracture, flexor digitorum superficialis, ulnar slip, hemiresection

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Trigger finger is a common hand disorder. It affects 3% of the population and is more common in middle-aged women.<sup>1</sup> Most of the cases are primary. However, in case of concomitant diseases such as metabolic disorders with systemic protein deposition, diabetes, or presence of articular pathology, special attention is required for the concomitant disease management.<sup>1</sup> The A1 pulley is the main location of the disease. However, other pulleys like A2, A3, or palmar fascia are also reported as a cause of trigger finger.<sup>2</sup> In a long-standing disease, tendinosis and degenerative changes of the collagen substance of the tendon occur.<sup>3</sup> The tendons become frayed and swollen. They also may be blocked permanently below A1 or A2 pulleys, thus patients may present with fixed flexion contracture of the proximal interphalangeal (PIP) joint and no triggering can be detected.<sup>4</sup>

Treatment of trigger finger without flexion contracture consists of nonoperative measures like activity modification, analgesics, and local steroid injection. Next step is surgical release of A1 pulley and tenosynovectomy of the flexor tendons. With this surgery, the triggering and the finger flexion contracture disappear just after release of A1 pulley in > 90% of cases.<sup>4</sup> In some cases, the flexion contracture of the finger or triggering remains after A1 pulley release. In these resistant cases, several options exist including finger extension splinting,<sup>5</sup> incision of the proximal part of A2 pulley,<sup>6</sup>

incision of all of A2 pulley,<sup>7</sup> resection of ulnar slip of flexor digitorum superficialis (FDS) tendon,<sup>8</sup> reduction flexor tenoplasty,<sup>9</sup> or resection of the entire flexor superficialis tendon.<sup>10</sup>

The original technique was described by Le Viet and colleagues in 2004. Possible complications reported with the original technique include rupture of A2 pulley, scar issues and complex regional pain syndrome causing permanent PIP joint contracture.<sup>8</sup>

We use a modified technique for the ulnar superficial slip resection surgery in the event of failure of an isolated preliminary opening of the A1 pulley, and for existing lack of mobility in extension and/or in flexion before any surgery, considering there is a conflict between the tendons in zone 2 and tendinosis with conflict with A2 pulley.<sup>4</sup>

We modified the technique to be less invasive to decrease the risk of complications of this surgery. Here, we describe our technique and the clinical results of our cases series.

## ANATOMY

Flexor tendons are held close to bone by pulleys. They are tunnels through which the tendons and their synovial covering move. A1 pulley, due to its location, supports more friction force than other pulleys.<sup>2</sup> Resection of A1 pulley usually has no clinically significant consequence on movements and the finger force,<sup>11</sup> however, resection of A2 pulley is known to cause bowing of the tendon and flexion contraction and decrease in the finger force.<sup>2</sup>

Histologically, the pulley is composed of 2 layers: an inner collagen layer and a loose connective tissue coverage. In trigger finger disease, a third layer of fibrocartilage and collagen type 2 tissue is formed at the innermost layer of the pulley.<sup>12</sup> Abnormal adhesions between FDS and flexor digitorum profundus (FDP) tendons are also found in the trigger finger disease and can be responsible for decreased motion and flexion contracture of the finger.

## INDICATIONS

We suggest this surgical technique to be considered in patients who present with fixed flexion contracture of PIP joint and also in recurrent cases.

If release of the A1 pulley is insufficient to relieve the contracture of the finger, several causes can be suspected. They include PIP joint stiffness due to arthrosis or contracture of the capsule, which must be considered and verified before surgery. Other causes are adhesions between FDS and FDP tendons<sup>13</sup> or tendinosis with damaged degenerated tendons which cannot glide under A2 pulley. These 2 latter conditions can be treated by ulnar superficial slip resection technique.

Although this procedure is relatively safe, it is not indicated if the PIP joint pathology is the predominant cause of the flexion contracture.

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**TECHNIQUE**

See Supplemental Video 1 (Supplemental Digital Content 1, <http://links.lww.com/BTH/A176>).

Under wrist block anesthesia and pneumatic tourniquet, after incision at distal palmar crease, we perform an extended release of A1 pulley, with tenosynovectomy of flexor tendons (Figs. 1, 2). If a persistent passive flexion contracture of the PIP joint is noted, despite the absence or low impact of underlying osteoarthritis, a transverse incision is made at PIP palmar skin crease (Fig. 3). Dissection is done carefully for exploring tendons sheath and ulnar and radial neurovascular bundles. The A3 pulley is widely open (Fig. 4), preserving A2 and A4 pulleys. The FDP tendon, the most palmar at this level, is protected radially (Fig. 5) and a “tendon hook” or a “right angle clamp” is advanced between the tendons to hook Camper’s chiasma (Fig. 6). The chiasma is then incised and opened distally (Fig. 7). Then the ulnar slip of FDS tendon is incised at the distal edge of A3 pulley from the middle phalanx bone (Fig. 8). Returning to palmar incision, a gentle traction over ulnar slip of FDS tendon usually brings all of the slip to palmar incision (Fig. 9). The proximal part of the ulnar slip is incised obliquely to make a smooth tendon edge (Fig. 10).

The joint is finally checked to be completely free to extend. The 2 incisions are closed in the usual manner (Fig. 11). See Supplemental Video 2 (Supplemental Digital Content 2, <http://links.lww.com/BTH/A177>).

Physical rehabilitation program by autoexercise and physiotherapy is started from the day after surgery.

**EXPECTED OUTCOMES AND COMPLICATIONS**

**Case Series Study**

In a single-center, single-operator, retrospective observational study that was approved by our institutional review board (IRB00010835), the medical database of our center was



**FIGURE 2.** Incision of A1 pulley.

searched for patients who underwent ulnar superficial slip resection surgery between 2013 and 2021. All patients provided their informed consent to participate in this study and for use of their deidentified health data and to the anonymous use of their fingers photographs for publication.

The case series includes 39 fingers in 30 patients (Table 1). In 6 patients, multiple fingers were operated either at the same or different operative sessions. Overall, the operated fingers were 24 middle, 9 ring, and 6 index fingers.

Ten patients had diabetes: 5 had type 1 and the other 5 had type 2. Three other patients had a history of carpal tunnel release or trigger finger release. In a single case, there was



**FIGURE 1.** Design of the 2 incisions.



**FIGURE 3.** Incision of A3 pulley.



FIGURE 4. Complete opening of A3 pulley.



FIGURE 6. Advancing a "right angle clamp" on flexor digitorum profundus to catch the chiasma of flexor digitorum superficialis.

severe arthrosis of PIP joint with 30 degrees of total range of motion (ROM). Seven patients received corticosteroid injection between 1 and 3 times before surgical treatment.

The average duration of the disease from beginning of symptoms (Green's stage 1)<sup>14</sup> was 19.8 months (6 to 96 mo). The average duration of nonreducible flexion contracture of PIP joint before operation was 8 months (3 to 24 mo

and a single case of 96 mo of blockage due to failed previous trigger finger release). QuickDASH scores were measured during both preoperative and postoperative examinations.

In 2 cases, failed previous isolated A1 pulley release was revised and was combined with our ulnar superficial slip resection technique. For 1 patient, ulnar superficial slip resection for 2 fingers and De Quervain operation were done during the same session. Other concomitant surgeries included carpal tunnel release in 3 cases, release of trigger thumb in 1 case, excision of pulley synovial cyst in 2 cases and release of another trigger finger without ulnar superficial slip resection in 1 case. Physiotherapy and finger motion exercises were started from the day after surgery for all patients.



FIGURE 5. Protection of flexor digitorum profundus by "right angle retractor" and exposing the flexor digitorum superficialis.



FIGURE 7. Incision of the chiasma and separation of 2 slips of flexor digitorum superficialis.



**FIGURE 8.** “Right angle clamp” holding the flexor digitorum superficialis ulnar slip.



**FIGURE 10.** Resection of ulnar slip of flexor digitorum superficialis.

The patients were reexamined in average 18 months (6 to 96 mo) after surgery. There was a statistically significant change in extension lag, ROM of PIP, and QuickDASH score in postoperative examination. There was no flexion deficit in postoperative examination.

There were no complications, no persistent swelling. All patients were satisfied with cosmetic aspect of the incision and all returned to their usual occupations.

Comparison with previously used ulnar superficial slip resection techniques:

After popularization of reduction tenoplasty of ulnar superficial slip resection by Le Viet et al,<sup>8</sup> other surgeons used the original technique or its modifications for treatment of trigger fingers. The original technique generally yields good results. However, there are some reported complications including rupture of A2 pulley, scar issues, altered sensitivity, and algodystrophy.<sup>8</sup>

Evaluation of the indications for this procedure demonstrates several differences between different authors. According to Le Viet et al<sup>8</sup> this procedure combined with A1 pulley release is indicated when there is long-standing history of trigger finger and flexion contracture of PIP. For other authors, the indications are: a trigger finger and a painful

extension lag or painful passive extension; a history of failed trigger finger surgery in other fingers.<sup>15</sup> This procedure was used as a primary operation in diabetic patients and combined with A1 pulley release only whenever necessary according to the surgeon’s experience.<sup>16</sup> This procedure was used by other authors as a secondary operation in case of failed A1 pulley release with residual positional or fixed contracture.<sup>10</sup> Our indications include: failed previous A1 release, flexion contracture of PIP that does not disappear after release of A1 pulley intraoperatively, and fixed flexion or extension deficit of PIP joint, suggesting a tendon conflict below A2 pulley. In case of tendon adhesions beneath the A2 pulley, a nylon suture loop was used to release the adhesions and isolate proximal and distal ends of FDS slip to excise.<sup>17</sup>

The mean age of our patients was  $60.8 \pm 16.8$  years, and the middle finger was the most common which are in accordance with other reports.<sup>8,15,16</sup> Like other reports, we noticed significant increase in postoperative ROM of PIP joint<sup>8,10,16</sup> and also significant decreases of extension lag<sup>8,10,15</sup> and the QuickDASH score was decreased significantly.<sup>15</sup> There was no flexion deficit postoperatively in our patients. In the study of Le Viet et al,<sup>8</sup> the mean duration of the disease before surgery was 48 months (6 to 120 mo) and 11% of cases were failed previous A1 release. In our



**FIGURE 9.** Extraction of ulnar slip of flexor digitorum superficialis from proximal incision.



**FIGURE 11.** Closure.

**TABLE 1. Preoperative and Postoperative Data of the Patients**

	Mean ± SD/Median (Range)	P
Sex ratio (females/males)	13/17	
Dominancy (left-handed/right-handed)	1/29	
Laterality (left/right)	17/22	
Diabetes (type I/type II)	5/5	
Age at surgery (y)	60.8 ± 16.8	
Duration of disease before surgery (mo)	19.8 (6-96)	
Duration of nonreducible flexion contracture of PIP (mo)	8 (3-24)	
Duration of follow-up (mo)	18 (6-96)	
Preoperative extension deficit (deg.)	25.5 ± 9.4 (10-50)	
Preoperative flexion deficit (deg.)	12 (10-50)	
Preoperative ROM of PIP (deg.)	74.4 ± 21 (30-100)	
Preoperative QuickDASH	30 ± 10/100 (13.6-40.9)	
Postoperative extension deficit (deg.)	6 (0-30)	0.00002
Postoperative flexion deficit (deg.)	0	
Postoperative ROM of PIP (deg.)	104 (90-110)	0.00002
Postoperative QuickDASH	3.5/100 (0-20.5)	0.0005

PIP indicates proximal interphalangeal joint; ROM, range of motion.

patients' population, the duration of disease before surgery was 19.8 months (6 to 96 mo) and we had only 1 case of previous failed A1 release.

The original technique consists of incision of the ulnar slip of FDS tendon at distal edge of carpal tunnel and passing the tendon below A2 pulley for excision.<sup>8</sup> In long-standing trigger finger, the degenerative FDS tendons can be bulky and cause damage or rupture of the A2 pulley while attempting to pass the enlarged tendon into the A2 tunnel.<sup>8</sup> The modifications to this technique include distal incision of ulnar slip from middle phalanx and pull of the tendon below A2 pulley<sup>16</sup> or total cut of FDS tendon from middle phalanx.<sup>10</sup> With these modifications the risk of A2 pulley damage is minimized and the authors did not report any pulley issues.<sup>10,16</sup> In our technique we section the tendon first at the distal attachment to middle phalanx and pull the tendon proximally. We did not excise all of the FDS tendon because we believe that preservation of the function of the FDS is important for normal finger function<sup>15</sup> and resection of a single slip of FDS is sufficient and makes enough space for free movements of the remaining radial slip. The technique of distal first cut of the ulnar slip was described previously<sup>16</sup> but the size of incision is smaller in our technique.

Like any other hand surgery, scar healing issues like hypersensitivity or hypertrophic scar problems and algodystrophy are among the concerns of any surgeon. Le Viet et al<sup>8</sup> reported 27 scar issues and 9 algodystrophy cases in 127 patients (20%), Degreef et al<sup>15</sup> using the technique of Le

Viet and colleagues reported 1 case of cold intolerance and sensitive disturbances in 18 patients. Marcus et al<sup>16</sup> reported 3 cases of sensation deficit of the operated finger. They used a V-shape incision along the volar side of the proximal phalanx.

Although the occurrence of these complications is multifactorial and not well understood, the size of surgical incision may play a role. Smaller surgical incisions and less tissue damages may reduce postoperative pain and nociception.<sup>18</sup> This can enhance patient's recovery by improving his/her active participation for postoperative physiotherapy and self-motion exercises. In addition, minimally invasive techniques can decrease chronicity of pain.<sup>19</sup> In our technique, we used 2 small incisions one over distal palmar crease and another in the PIP skin crease. We believe that the reduced incision size in our technique is helpful not only for postoperative rehabilitation and recovery of the finger motions but also for cosmetic aspect of the surgery and patient's satisfaction.

In our case series, all of the patients recovered functional extension and near normal ROM of the PIP joint at final follow-up. We had no complications. One patient with severe degenerative arthritis of PIP joint recovered 70 degrees of motion.

### CONCLUSION

Our modification of technique of ulnar superficial slip resection surgery for resistant trigger fingers may decrease complications and improve the patients' recovery.

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