Recalcitrant Trigger Finger Managed With Flexor Digitorum Superficialis Resection

Sohail N. Husain, MD, Sylvan E. Clarke, MD, Glenn A. Buterbaugh, MD, and Joseph E. Imbriglia, MD

Abstract

Although trigger finger is a condition commonly treated by orthopedic surgeons, we have not found sufficient studies in the literature addressing the treatment of trigger finger that persists following A1 pulley release.

We identified 12 fingers in 11 patients with symptoms of trigger finger following A1 pulley release who subsequently underwent resection of 1 or both slips of the flexor digitorum superficialis tendon. Ten patients (11 fingers) presented for follow-up at a mean of 21 months after surgery. All patients had resolution of their symptoms with a mean visual analog score of 1.5 and a mean DASH score of 17. Grip and pinch strength were comparable to the contralateral side. Mean total active range of motion of the affected digit was 252°.

Resection of 1 or both slips of the flexor digitorum superficialis is an effective method for treatment of recalcitrant trigger finger.

Stenosing flexor tenosynovitis (trigger finger) is commonly seen in orthopedic surgery practices. It may be caused by thickening of the pulley (most commonly A1) or of the tendon. The diagnosis can be made from a history of finger stiffness, locking, and catching. Physical examination reveals visible catching as well as tenderness over the A1 pulley.

Trigger finger often is initially managed with steroid injection. When this conservative approach fails, the condition can be managed surgically, typically with A1 pulley release performed with open or percutaneous methods. In most patients who undergo A1 pulley release, symptoms resolve.

Dr. Husain is Hand Surgeon, Essex Orthopaedics & Optima Sports Medicine, Salem, New Hampshire.
Dr. Clarke is Hand Surgeon, The South Bend Clinic, South Bend, Indiana.
Dr. Buterbaugh is President, Hand & UpperEx Center, Wexford, Pennsylvania.
Dr. Imbriglia is Clinical Professor, Department of Orthopaedic Surgery, University of Pittsburgh Medical School, Pittsburgh, Pennsylvania, and Chairman of the Board, Hand & UpperEx Center.

Address correspondence to: Sohail N. Husain, Essex Orthopaedics & Optima Sports Medicine, 16 Pelham Rd, Salem, NH 03079 (tel, 603-898-2244; fax, 603-898-2227; e-mail, snhusain@yahoo.com).

Am J Orthop. 2011;40(12): 620-624. Copyright Quadrant HealthCom Inc. 2011. All rights reserved.

Despite the high success rate of A1 pulley release, trigger finger sometimes requires revision surgery. There is a paucity of literature on this topic. Review of our clinic's billing records over a 26-month period revealed 12 fingers (11 patients) that had persistent symptoms of locking, catching, or stiffness after open A1 pulley release and were subsequently managed with excision of 1 or both slips of the flexor digitorum superficialis (FDS) tendon of the involved finger.

Methods

Patients

Billing records from January 2006 through February 2008 (26 months) were reviewed to identify patients who had undergone resection of a tendon from the hand or fingers. Clinic notes and operative records were reviewed to identify patients who had undergone complete or partial FDS tendon resection after prior A1 pulley release.

Surgical Technique

All procedures had been performed by 1 of 2 hand surgeons with the assistance of either a fellow or a resident. Each procedure was performed with local anesthesia, intravenous sedation, and a forearm tourniquet. Dissection was performed, using the prior incision for A1 pulley release, until the flexor tendons were identified. A Brunner incision centered at the proximal interphalangeal (PIP) joint was then made to expose the A3 pulley, which was incised. In 2 patients who demonstrated clicking in the region of the proximal phalanx and PIP joint during the office visit before revision surgery, the approach to the A3 pulley was made before the approach to the A1 pulley. The FDS tendon was identified, and either or both slips of it were transected at the level of the middle phalanx (Figure 1). The decision to transect both slips, or only one, was made by the attending surgeon during the operation, and was based on the condition and size of the FDS tendon. The 2 slips of the FDS tendon were then separated from each other to the level of the Camper chiasm. Traction was applied to deliver the FDS tendon into the palmar wound, and the transected portion of the tendon was resected (Figure 2). The finger was passively brought through a range of motion (ROM) to ensure there was no catching. PIP contracture release was performed as necessary by incising the proximal aspect of the volar plate, though the volar plate was not formally evaluated for laxity before the FDS excision. Skin closure

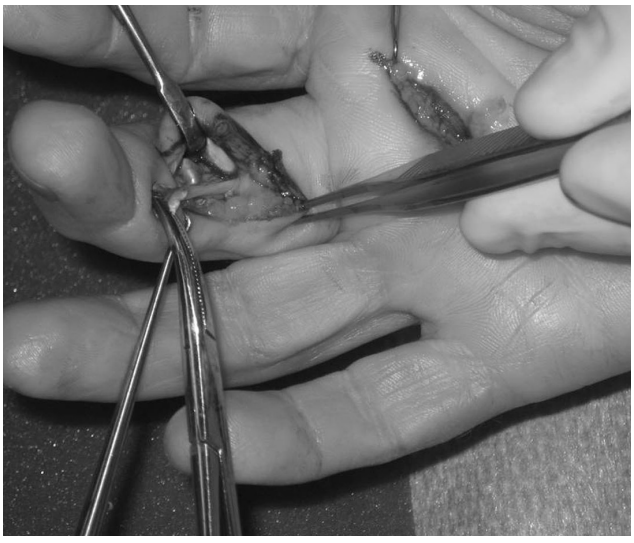

Figure 1. Identification of ulnar slip of flexor digitorum superficialis tendon, clamped in hemostat.

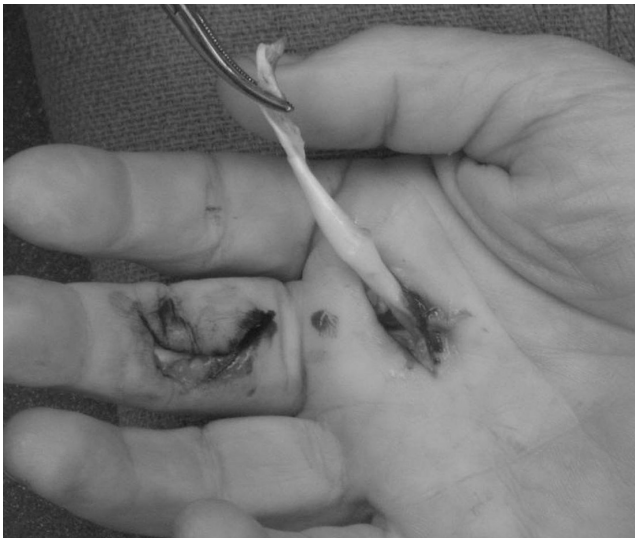

Figure 2. Delivery of ulnar slip of flexor digitorum superficialis tendon through palmar incision. Part of tendon is noticeably thickened.

was performed with nylon horizontal mattress sutures. A soft dressing was applied and the patient was allowed immediate finger motion as tolerated.

Outcomes

All patients were invited to return for evaluation at the clinic. They were questioned about symptom resolution, residual pain, and other problem reports. Scores on the DASH (Disabilities of the Arm, Shoulder, and Hand) questionnaire and on a visual analog scale (VAS) for pain were recorded. Active ROM of the involved finger was measured with a small joint goniometer (Baseline, Irvington, New York). Grip strength was measured with a dynamometer (Baseline). Tip pinch strength between the thumb and the affected finger was measured with a pinch gauge (B&L Engineering, Tustin, California). All measurements were compared with those of the uninvolved, contralateral hand.

Statistical Analysis

Values for joint ROM and grip and pinch strength on both sides were compared using a 2-sample *t* test and the statistical analysis package on Microsoft Excel (Microsoft, Redmond, Washington).

Results

Over a 26-month period, open A1 pulley release was performed on 936 trigger fingers. During the same period, 11 of the patients (12 fingers) had all or part of the FDS tendon resected because of locking, catching, or stiffness after prior A1 pulley release. Of these 11 patients, 10 (11 fingers) presented to our clinic for follow-up and measurements to be used in this study. Mean (SD) age of these 10 patients was 55.5 (12.9) years (range, 29-80 years). Medical comorbidities included diabetes (3 patients), hypothyroidism (3), and rheumatoid arthritis (1). No patient had prior significant trauma to the finger. No patient had preoperative hyperlaxity with swan-neck deformity or extensor mechanism subluxation, which would mimic a snapping trigger; 5 fingers had preoperative PIP flexion contractures of less than 30°, a sixth patient had a mild metacarpophalangeal contracture, and a seventh had generalized finger stiffness. The patient who had the procedure performed on 2 fingers was examined 7 months after the contralateral hand underwent thumb carpometacarpal arthroplasty with flexor carpi radialis graft.

Table I lists the patient demographics. There were 6 female and 4 male patients. Six right hands and 4 left hands were involved. The long finger was affected in 7 cases and the ring finger in 4 cases. Ten fingers had 1 prior surgery for the trigger finger, and 1 finger had 3 prior surgeries. Of the 11 fingers, 2 had triggering recur after a period without symptoms (6 months in 1 case, 10 years in the other). The other 9 fingers were recalcitrant, and there was no significant resolution of symptoms between FDS resection and most recent previous surgery. Five of the initial procedures were performed at our practice, and 6 were referrals from other centers. Three of the 11 fingers received steroid injections at our practice before the FDS resection was performed; in each case, symptoms did not improve. Mean (range) time from first procedure to FDS resection was 21 (1.3-121) months. Mean (range) follow-up was 8 (2-15) months. The ulnar slip of the FDS was excised in 4 fingers (3 patients), the radial slip in 2 fingers (2 patients), and both slips in 5 fingers (5 patients). Mean follow-up was 3.9 months for patients who had both slips excised and 12.4 months for patients who had a single slip excised. At the office visit before the FDS resection, 6 patients had symptoms or signs (eg, pain, swelling, tenderness, clicking, catching, nodules) over the proximal

Table I. Patient Demographics and Intraoperative Findings

Patient No.	Age, y	Sex	Hand Dominance	Involved Side	Involved Finger	Changes in FDS Tendon	Excised Portion of FDS Tendon
1	60	F	R	R	Middle	Partial rupture	Ulnar
2	60	M	R	R	Middle	None	Both
3	60	F	R	R	Middle	None	Radial
4[a]	62	F	R	R	Middle	Partial rupture	Ulnar
4[a]	62	F	R	R	Ring	Degeneration	Ulnar
5	48	F	R	R	Middle	Partial rupture	Ulnar
6	29	F	R	L	Middle	Partial rupture	Both
7	54	M	R	L	Ring	Partial rupture	Radial
8	80	M	R	L	Ring	Degeneration	Both
9	51	M	R	R	Middle	Degeneration	Both
10	44	F	L	L	Ring	Scarring	Both

Abbreviation: FDS, flexor digitorum superficialis.
[a]Patient 4 had two fingers involved

Table II. Range of Motion and Strength

	Involved Side	Contralateral Side	*P* Value
Joint range of motion, °			
Metacarpophalangeal	88.6	91.7	.60
Proximal interphalangeal	93.2	101.7	.07
Distal interphalangeal	69.7	71.1	.85
Total	252	264	.33
Strength, kg			
Grip	23.8	25.1	.78
Pinch	3.6	3.8	.81

Table III. Range of Motion and Strength: Single vs Both Slip Excision

	Excision of:	
	Single Slip (Contralateral)	Both Slips (Contralateral)
Joint range of motion, °		
Metacarpophalangeal	87 (88)	91 (98)
Proximal interphalangeal	97 (97)	88 (108)
Distal interphalangeal	65 (66)	71 (72)
Total	249 (250)	250 (278)
Strength, kg		
Grip	21.6 (19.3)	26.5 (32.1)
Pinch	3.18 (2.73)	4.09 (5.18)

phalanx and PIP joint. Three of these 6 patients had undergone initial A1 release at our practice, and in each case, symptoms prior to initial release were noted over the A1 pulley; these symptoms included tenderness, clicking, catching, and nodular masses.

In 9 fingers, significant scar tissue was noted in the A1 pulley region at time of index surgery, though a well-defined pulley structure was not identified. This scar tissue precluded evaluation of the adequacy of the prior A1 pulley release. Evaluation during index surgery revealed partial FDS rupture in 5 fingers (in 1 case accompanied by significant flexor digitorum profundus [FDP] degeneration in a rheumatoid patient with pulley attrition), significant degenerative changes without rupture in 3 fingers, and FDS scarring in 1 finger (Table I). One finger, which demonstrated synovitis and fraying of the FDS tendon, had a persistent click at the PIP joint despite smooth FDP gliding after excision of both FDS slips. This click resolved after PIP arthrotomy with synovectomy as well as excision of an osteophyte and the most dorsal portion of the adjacent collateral ligament. Pathologic analysis revealed abnormalities of the tendon slips in all but 2 fingers; 1 of these 2 fingers had a single FDS slip excised, and the other had both slips excised. The pathologic changes included fibrosis and chronic inflammation.

All patients felt relief of locking or catching symptoms. One patient, treated with resection of both FDS slips after 3 prior surgeries elsewhere, developed a mild swan-neck deformity. Mean (range) DASH score was 17 (0-45). Mean (range) VAS score for pain was 1.5 (0-5). Mean (range) ROM for the PIP joint of the affected finger was 93° (80°-110°). Mean (range) ROM for the entire finger was 252° (225°-295°). Mean (range) grip

strength was 112% (63%-200%) of the contralateral side, and mean (range) tip pinch strength was 101% (40%-200%) of the contralateral side.

Table II compares the active ROM, grip and pinch strength of the involved and contralateral sides, and lists the *P* values from the 2-sample *t* test. Finger ROM and grip and pinch strength were not statistically different between sides when all patients were pooled together. A trend of decreased grip and pinch strength was found for the 5 fingers that had both FDS slips excised compared with the 6 fingers that had a single FDS slip excised. The number of cases, however, was too small for meaningful statistical analysis (Table III).

Discussion

Open surgical treatment of trigger digits has been reported to have a success rate of 97% to 98%.[1,2] The need for revision surgery after A1 pulley release is rare. Lim and colleagues[3] did not find any recurrence of triggering among 483 digits that underwent open A1 pulley release. Four patients had postoperative stiffness that resolved with therapy. Le Viet and colleagues[4] noted 19 cases over a 17-year period but did not discuss these separately from the primary cases in their series. Blyth and Ross[5] reported only 1 revision surgery among 142 A1 pulley releases and did not specify which type of reoperation. Turowski and colleagues[1] described 1 reoperation for persistent triggering among 59 patients who underwent open A1 pulley release. Complete excision of the A1 pulley led to complete resolution of symptoms. In our practice, over a 26-month period, 936 open A1 pulley releases were performed, and 5 revision procedures (0.5%) with FDS resection were required for patients initially treated at our practice.

The etiology of the symptoms that led to revision surgery were not consistent among our patients. Degenerative FDS changes, including partial ruptures, were noted during surgery in 8 of the 11 fingers, while pathologic analysis revealed abnormalities in 9 fingers. Although these changes are more substantial than those noted by other authors,[4] tendon ruptures without triggering may be seen in other conditions, such as inflammatory tenosynovitis. Two fingers in our series had persistent intraoperative triggering with no clear source after revision A1 release; partial FDS excision resolved the triggering.

We could not identify any English-language articles on revision surgery after open A1 pulley release. Most review articles do not offer a protocol for what to do in case of recurrent triggering.[6,7] Some authors have advocated partial release of the A2 pulley if A1 pulley release alone does not completely relieve triggering when tested during surgery.[8,9] The effect of this release on ROM or strength has not been described. Although symptoms of triggering may resolve, joint ROM may remain decreased in the presence of a PIP joint flexion contracture.

Resection of part of the FDS tendon has been suggested in several circumstances. Ferlic and Clayton[10] advocated resection of the ulnar slip of the FDS with preservation of the A1 pulley to prevent worsening of ulnar drift in patients with rheumatoid arthritis. Le Viet and colleagues[4] described their results with ulnar slip resection of the FDS in 228 fingers with PIP flexion contracture over a 17-year period. Nineteen patients had a prior A1 pulley release. ROM was described, but there was no comment on the effects of FDS resection on pinch or grip strength, nor any report of patient-based outcome scores. Marcus and colleagues[11] described excision of the ulnar slip of the FDS with and without A1 pulley release for triggering in 37 diabetic fingers. They reported postoperative active ROM of 218°. Although no quantitative analysis was offered, they noted "consistently equal" pinch strength. Excision of a slip of the FDS has also been recommended for treatment of trigger finger in the pediatric patient population.[12,13] Other authors have reported cases in which either the FDP or the FDS tendon was debulked, but none have reported quantitative measurements on the effects on ROM or grip strength.

One weakness of our study is its small number of patients (trigger finger after A1 pulley release is an infrequent outcome). In addition, there was no formal process for deciding whether the radial slip, the ulnar slip, or the entire FDS tendon should be excised. The senior hand surgeon based this decision on intraoperative findings. All patients who had a single slip excised were treated by one attending hand surgeon, and, with the exception of 1 patient with a prior single-slip excision, all patients who had both slips excised were treated by the other attending hand surgeon. During analysis, we pooled our data for patients who had 1 or both slips resected. A larger patient population may have allowed analysis for a difference in outcomes between patients with 1 slip excised and those with both slips excised. Complete FDS resection should be performed with caution because of the potential for postoperative grip and pinch weakness.

Complete FDS resection also has the potential to lead to a swan-neck deformity. We noted this deformity in only 1 patient who underwent complete FDS resection. The follow-up of this subgroup of patients was short, and, potentially, more patients could have developed the deformity over time. On the other hand, development of the deformity may have been limited by the presence of PIP contractures, which occur in some patients with chronic trigger fingers and in some patients who undergo surgical treatment. Lim and colleagues[3] reported that 14% of patients who underwent open trigger release had PIP flexion contractures before surgery. Le Viet and colleagues[4] noted that 214 of 883 patients seen for trigger finger over a 17-year period demonstrated preoperative PIP contractures, and 87 of these 214 patients had PIP contractures of more than 5° after A1 pulley release, with or without resection of the ulnar slip of the FDS. In another study, PIP flexion contractures were noted in 2 of 46 patients who were examined after surgical trigger finger release.[1] Marcus and colleagues[11] noted PIP flexion contractures in 3 of 11 diabetic patients treated

with ulnar FDS excision with or without A1 pulley release. They also noted no swan-neck deformities in these patients a mean of 48 months after partial FDS resection. The stiffness from PIP contractures may limit development of swan-neck deformities in FDS-absent surgically released trigger fingers. Conversely, although PIP volar plate tightness is one of the main causes of PIP joint stiffness, partial or complete FDS excision may help address a PIP flexion contracture in a trigger finger. Le Viet and colleagues[4] reported a mean gain of 26° in passive PIP extension with this technique.

When managing persistent symptoms of trigger finger, the physician should carefully examine the wrist and palm, as masses at this proximal level can cause the same symptoms.[14,15] We believe that, if there is no evidence of pathology proximal to the finger, resection of all or part of the FDS should be the procedure of choice after failure of open A1 pulley release to resolve symptoms. Patients with triggering after surgery often report of persistent locking or catching, but they may also feel a grating sensation as the FDP and FDS tendons rub against each other in the tendon sheath. The examiner can appreciate this if the finger is palpated while the patient actively flexes the finger. Resection of a slip of the FDS will alleviate symptoms originating from the level of the A1, A2, A3, or A4 pulley.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

References

1. Turowski GA, Zdankiewicz PD, Thomson JG. The results of surgical treatment of trigger finger. *J Hand Surg Am.* 1997;22(1):145-149.
2. Gilberts EC, Beekman WH, Stevens HJ, Wereldsma JC. Prospective randomized trial of open versus percutaneous surgery for trigger digits. *J Hand Surg Am.* 2001;26(3):497-500.
3. Lim MH, Lim KK, Rasheed MZ, Narayanan S, Beng-Hoi Tan A. Outcome of open trigger digit release. *J Hand Surg Eur Vol*. 2007;32(4):457-459.
4. Le Viet D, Tsionos I, Boulouednine M, Hannouche D. Trigger finger treatment by ulnar superficialis slip resection (U.S.S.R.). *J Hand Surg Br.* 2004;29(4):368-373.
5. Blyth MJ, Ross DJ. Diabetes and trigger finger. *J Hand Surg Br.* 1996;21(2):244-245.
6. Ryzewicz M, Wolf JM. Trigger digits: principles, management, and complications. *J Hand Surg Am.* 2006;31(1):135-146.
7. Saldana MJ. Trigger digits: diagnosis and treatment. *J Am Acad Orthop Surg.* 2001;9(4):246-252.
8. Al-Qattan MM. Trigger fingers requiring simultaneous division of the A1 pulley and the proximal part of the A2 pulley. *J Hand Surg Eur Vol*. 2007;32(5):521-523.
9. Nagaoka M, Yamaguchi T, Nagao S. Triggering at the distal A2 pulley. *J Hand Surg Eur Vol*. 2007;32(2):210-213.
10. Ferlic DC, Clayton ML. Flexor tenosynovectomy in the rheumatoid finger. *J Hand Surg Am.* 1978;3(4):364-367.
11. Marcus AM, Culver JE Jr, Hunt TR III Treating trigger finger in diabetics using excision of the ulnar slip of the flexor digitorum superficialis with or without A1 pulley release. *Hand (N Y).* 2007;2(4):227-231.
12. Bae DS, Sodha S, Waters PM. Surgical treatment of the pediatric trigger finger. *J Hand Surg Am.* 2007;32(7):1043-1047.
13. Cardon LJ, Ezaki M, Carter PR. Trigger finger in children. *J Hand Surg Am.* 1999;24(6):1156-1161.
14. Carneiro RS, Velasquez L, Tietzman A. Trigger wrist caused by a tumor of the tendon sheath in a teenager. *Am J Orthop*. 2001;30(3):233-234.
15. Kernohan JG, Benjamin A, Simpson D. Trigger wrist due to anomalous flexor digitorum profundus muscle in association with fibroma of tendon sheath. *Hand.* 1982;14(1):59-60.