INTRODUCTION

Trigger finger is an entrapment tendinopathy in which the flexor tendon catches within a thickened or narrowed A1 pulley. With a lifetime incidence between 2% and 3% in the general population, trigger finger is one of the most common causes of disability and pain in the hand.

Initial treatment is conservative, but definitive treatment often requires release of the A1 pulley through an open, percutaneous, or endoscopic approach. The described surgical techniques fall short in 1 of the 2 ways: they require an incision of the palm, and the underlying palmar fascia or the release is performed blindly.

The purpose of the study was to prove feasibility of a new retrograde endoscopic technique for release of the A1 pulley through a single incision at the proximal digital crease. Similar to endoscopic carpal tunnel release, the technique avoids an incision in the palmar fascia, which can be a source of significant and long-lasting morbidity.

MATERIALS AND METHODS

Release of the A1 pulley was performed in the fingers of 4 embalmed cadaveric hands (Innoved Institute, LLC). First, the proximal digital crease was identified, and the width was incised transversely. Blunt dissection was then performed down to the level of the flexor tendon sheath. With the finger held in extension, a 2.7-mm arthroscope with EndoSleeve attachment (A.M. Surgical, Inc.) was inserted retrograde and situated on the distal edge of the A1 pulley. The endoscope was advanced proximally (retrograde) along the length of the pulley to a point just distal to the A2 pulley. Complete release was noted in 16 of 16 fingers. No significant injuries to the A2 pulley and flexor tendon were found, and no injuries to the digital nerves or vasculature occurred. The described technique, as demonstrated in cadaveric specimens, is a feasible alternative approach in the treatment of trigger finger.

From the *Division of Plastic and Reconstructive Surgery, Keck School of Medicine of USC, Los Angeles, Calif.; and †Department of Orthopedic Surgery, Cedars-Sinai Medical Center, Los Angeles, Calif.

Received for publication August 26, 2020; accepted October 14, 2020.

Presented at California Society of Plastic Surgeons (CSPS) 2019, June 1, 2019, Sacramento, Calif., and at Plastic Surgery The Meeting (ASPS) 2019, September 22, 2019, San Diego, Calif.

Copyright © 2020 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/GOX.0000000000003294

www.PRSGlobalOpen.com

Summary: Trigger finger is one of the most common causes of disability and pain in the hand. Current surgical techniques for trigger finger release fall short in that they are performed blindly with trauma to, or require incision of, the palmar fascia, which can be a source of significant and long-lasting morbidity. Retrograde endoscopic release of the A1 pulley was performed through a single incision at the proximal digital crease in cadaveric specimens. The fingers were then dissected to assess for completeness of release and inspected for injury to nearby structures. Complete release of the A1 pulley was noted in 16 of 16 fingers. No significant injuries to the A2 pulley and flexor tendon were found, and no injuries to the digital nerves or vasculature occurred. The described technique, as demonstrated in cadaveric specimens, is a feasible alternative approach in the treatment of trigger finger. The technique allows complete visualization of A1 pulley release through a single palmar fascia sparing incision. (Plast Reconstr Surg Glob Open 2020;8:e3294; doi: 10.1097/GOX.0000000000003294; Published online 21 December 2020.)
RESULTS

Results are summarized in Table 1. Complete release of the A1 pulley was noted in 16 of 16 fingers (100%).

DISCUSSION

The advantages and disadvantages of each surgical technique are well known, yet controversy remains as to which is superior. Studies comparing open surgery versus percutaneous release, for example, show that the treatments are overall equal in their success and complication rate, but the quality of evidence is low. Endoscopic release seemingly offers the best of both the open and percutaneous techniques, offering complete visualization while minimizing soft tissue damage and incomplete or excessive release. The approach remains the least popular, however, owing to its steep learning curve and the cost of the instruments.

The technique described here has the advantage of complete visualization. Completeness of release is easily confirmed with the endoscope, and injury to the digital neurovascular bundle, the flexor tendon, and the A2 pulley is minimized. The direction of release, however, is novel. Release of the A1 pulley in a distal-to-proximal (retrograde) fashion decreases inadvertent injury to the A2 pulley. In our hands, 2 clinically insignificant injuries occurred. The A2 pulley was partially lacerated in a transverse direction one time. This occurred during blunt dissection before the endoscope was introduced. A minor longitudinal laceration was also noted in one of the flexor tendons. Similar injuries have been described during both routine flexor tendon repair and percutaneous trigger release in clinical and cadaveric studies, and result in no perceptible adverse outcomes. Pope and Wolfe, for example, report scoring of the flexor tendon in most of their described cases but consider the injury to be of no consequence. Although the difference among scoring, abrasion, and minor laceration is difficult to compare between studies, no observable complications have been reported. The minor injuries reported in this study

The average length of release was 1.4 cm (SD 0.2). No significant injuries to vital structures occurred. A partial transverse laceration to the A2 pulley was noted in one finger, and a minor longitudinal cut occurred in one of the flexor tendons. No injuries to the nerves or vasculature occurred.

Fig. 1. The surgical incision (yellow line) is placed at the proximal digital crease at the base of the proximal phalanx.

Fig. 2. Release of the A1 pulley is well visualized on endoscope.

Fig. 3. After endoscopic treatment, specimens were opened to examine for completeness of release and to inspect for injury.
are not clinically significant, occurred less frequently than reported elsewhere, and would otherwise go undetected in humans.

The second advantage of our technique—and the most significant compared with those previously described—is the placement of the incision. Rates of major complications associated with open release range from 0.6% to 7.5% and include persistent or recurrent triggering, nerve damage, synovial fistula, and joint arthrofibrosis.19–22 Minor complications are reported to occur in up to 30% of patients treated with the open surgical approach, with the most common complaint after open release being pain and tenderness associated with the surgical scar.21–23 These symptoms may limit a patient’s hand use for weeks after surgery.10,13,21,22 In the open approach, an incision is made in the palm, most commonly at or slightly distal to the distal palmar crease, which violates the palmar fascia and causes great discomfort to patients.21,25 We believe this pain is analogous to the tenderness experienced with open carpal tunnel release, which is lessened through use of a non-palmar incision during endoscopic release.24

The previously described endoscopic techniques for trigger release similarly violate the palmar fascia, requiring an incision at the proximal digital crease and also at the proximal palmar crease. Although the authors’ results support use of endoscopic technique, it is our belief that incision of the palmar fascia, no matter the location, increases the patient’s risk for long-term pain and disability associated with the scar.19,25

To date, endoscopic treatment for trigger finger has been used the least of the treatment options because many believe that the technique has a greater learning curve.11,13 Our results suggest the contrary by demonstrating feasibility, without clinically significant injury, in first-time users. Our study is limited by use of the technique in cadaveric specimens, which limits our ability to examine the aesthetic and functional outcomes of the proximal digital crease incision. Future studies will aim to explore these outcomes with in vivo use of this retrograde non-palmar endoscopic technique. Other areas for future study include operative time and cost–benefit analysis of the technique.

Table 1. Success and Clinically Significant Injury Rates by Finger

|                  | Complete Release, n (%) | Average Length of Release (cm) | Neurovascular Injury | Laceration of A2 Pulley | Flexor Tendon Injury |
|------------------|-------------------------|-------------------------------|----------------------|-------------------------|---------------------|
| Index            | 4 (100)                 | 1.2 ± 0.2                     | 0                    | 0                       | 0                   |
| Middle           | 4 (100)                 | 1.3 ± 0.2                     | 0                    | 0*                      | 0†                  |
| Ring             | 4 (100)                 | 1.5 ± 0.2                     | 0                    | 0                       | 0                   |
| Little           | 4 (100)                 | 1.2 ± 0.3                     | 0                    | 0                       | 0                   |
| Total            | 16 (100)                | 1.4 ± 0.2                     | 0                    | 0†                      | 0†                  |

*A One transverse cut noted of the A2 pulley.
†One longitudinal incision of the flexor tendon.

REFERENCES

1. Sampson SP, Badalamente MA, Hurst LC, et al. Pathobiology of the human A1 pulley in trigger finger. J Hand Surg Am. 1991;16:714–721.
2. Wolfe SW. Tendinopathy. In: Wolfe SW, Pederson W, Kozin SH, Cohen M, eds. Green’s Operative Hand Surgery. 7th ed. Philadelphia, PA: Elsevier/Churchill Livingstone; 2017:1904–1925.
3. Ryzewicz M, Wolf JM. Trigger digits: Principles, management, and complications. J Hand Surg Am. 2006;31:135–146.
4. Makkouk AH, Oetgen ME, Swigart CR, et al. Trigger finger: etiology, evaluation, and treatment. Curr Rev Musculoskelet Med. 2008;1:92–96.
5. Patel MR, Bassini L. Trigger fingers and thumb; when to splint, inject, or operate. J Hand Surg Am. 1992;17:110–113.
6. Murphy D, Failla JM, Konitch P. Steroid versus placebo injection for trigger finger. J Hand Surg Am. 1995;20:628–631.
7. Rhoades CE, Gelberman RH, Manjarris JF. Stenosing tenosynovitis of the fingers and thumb. Results of a prospective trial of steroid injection and splinting. Clin Orthop Relat Res. 1984;190:236–238.
8. Eastwood DM, Gupta KJ, Johnson DP. Percutaneous release of the trigger finger: An office procedure. J Hand Surg Am. 1992;17:114–117.
9. Quinncell RC. Conservative management of trigger finger. Practitioner. 1980;224:187–190.
10. Kloeters O, Ulrich DJ, Bloemsema G, et al. Comparison of three different incision techniques in A1 pulley release on scar tissue formation and postoperative rehabilitation. Arch Orthop Trauma Surg. 2016;136:731–737.
11. Fiorni HJ, Tamaoki MJ, Lenza M, et al. Surgery for trigger finger. Cochrane Database Syst Rev. 2018;2:CD009860.
12. Wang J, Zhao JG, Liang CC. Percutaneous release, open surgery, or corticosteroid injection, which is the best treatment method for trigger digits? Clin Orthop Relat Res. 2013;471:1879–1886.
13. Pegoli L, Cavalli E, Cortese P, et al. A comparison of endoscopic and open trigger finger release. Hand Surg. 2008;13:147–151.
14. Pope DF, Wolfe SW. Safety and efficacy of percutaneous trigger finger release. J Hand Surg Am. 1995;20:280–283.
15. Tang JB. Indications, methods, postoperative motion and outcome evaluation, and treatment. J Hand Surg Br. 1995;20:628–631.
16. Hoang D, Lin AC, Essilie A, et al. Evaluation of percutaneous first annular pulley release: Efficacy and complications in a perfused cadaveric study. J Hand Surg Am. 2016;41:e165–e173.
17. Ucak BY. Percutaneous surgery: A safe procedure for trigger finger? N Am J Med Sci. 2012;4:401–403.
18. Wray RC Jr, Holtman B, Weeks PM. Clinical treatment of partial tendon lacerations without suturing and with early motion. Plast Reconstr Surg. 1977;59:231–234.
19. McGeorge DD, Stilwell JH. Partial flexor tendon injuries: To repair or not. J Hand Surg Br. 1992;17:176–177.
20. Al-Qattan MM. Conservative management of zone II partial flexor tendon lacerations greater than half the width of the tendon. J Hand Surg Am. 2000;25:1118–1121.
21. Will R, Lubahn J. Complications of open trigger finger release. J Hand Surg Am. 2010;35:594–596.
22. Bruijnzeel H, Neuhaus V, Fostvedt S, et al. Adverse events of open A1 pulley release for idiopathic trigger finger. J Hand Surg Am. 2012;37:1650–1656.

23. Thorpe AP. Results of surgery for trigger finger. J Hand Surg Br. 1988;13:199–201.

24. Sayegh ET, Strauch RJ. Open versus endoscopic carpal tunnel release: A meta-analysis of randomized controlled trials. Clin Orthop Relat Res. 2015;473:1120–1132.

25. Duncan SFM, Kakinoki R, Dunbar R. Endoscopic trigger finger release: Surgical technique. J Hand Surg Asian Pac Vol. 2018;23:158–161.