

The Evaluation of Results of Repair using All-Soft Suture Anchor in the Treatment of Chronic Tendinous Mallet Finger Surgery

Zhodnocení výsledků použití stehu s kotvičkou v operační léčbě inveterovaného kladívkového prstu ruky

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ABSTRACT

PURPOSE OF THE STUDY

The purpose of this study is to evaluate the results of chronic tendinous mallet finger repair with all soft suture anchors.

MATERIAL AND METHODS

In this retrospective study we evaluated 14 patients. Data included age, side of surgery, the degree of extensor lag, the ratio of the damaged articular surface, postoperative recovery period and time to return to work. We recorded extensor lag and Crawford scores of all patients at the last follow-up.

RESULTS

Mean follow-up period was 22.07 months. The preoperative and postoperative extensor lags were 27.2 (15–35) and 3 (0–19), respectively. Crawford scores of patients were moderate in 1 patient, fair in 2 patients and excellent in 10 patients. We observed only one skin complication in the postoperative period.

CONCLUSIONS

All-soft suture anchors have high patient satisfaction rates and functional results. Thus, they could be used in the treatment of patients with chronic tendinous mallet finger. The low complication rate is a major advantage.

Key words: tendinous mallet finger, hand surgery, all-soft anchor.

Level of evidence: Level-4, Retrospective case-control study

INTRODUCTION

Mallet finger is defined as the detachment of the terminal extensor tendon of the finger (4, 12, 15). The underlying mechanism includes a sudden flexion force applied on extended finger (11). Tendon injury may also accompany bone lesions (2, 4, 5, 8, 11, 15, 31). Conservative treatment have satisfactory results in the treatment of mallet finger (5, 6, 28, 30, 31). However, surgery may be indicated for cases resistant to conservative treatment or for late presenting cases (13, 16, 25). Cases presenting later than four weeks were defined as chronic in the literature (Fig. 1). Majority of these patients could be treated non-surgically (6).

However, in cases with $\geq 40^\circ$ extensor lag despite 8 weeks of conservative treatment, surgery was preferred (5, 6, 28, 30, 31). Surgical treatment options include direct repair, tenodesis and tendon reconstruction (3, 14, 17, 23, 24, 27).

The purpose of this study is to evaluate the clinical and functional scores of chronic tendinous mallet finger surgery with all soft suture anchors.

MATERIAL AND METHODS

We included 14 patients operated for chronic tendinous mallet finger using all-soft anchor between April 2016 and January 2018 in our clinic. All patients were evaluated for the presence of bony mallet with preoperative X-rays and patients with a bony mallet were excluded from the study. Patients with missing preoperative or postoperative data, not willing to participate at the last follow-up, and with an acute mallet finger were also excluded. Data including age, sex, dominant hand,



Fig. 1. Preoperative clinical view of chronic mallet finger deformity, patient had approximately 45 degree extensor lag.

involved finger, preoperative extensor lag, healing and return to work were recorded.

All patients were applied a finger splint for 5 days postoperatively and followed in a weekly basis. Motion exercises and return to work were allowed in patients with no pain. At last follow-up, Crawford score, postoperative distal interphalangeal (DIP) flexion and extensor lag degree, and complications were recorded for all patients.

Surgical technique

The detached extensor tendon was approached via a dorsal "Z" incision on the DIP joint level. The insertion point of the tendon and tendon itself were revitalized. The tendon was tensed appropriately (Fig. 2). An all-soft anchor (JuggerKnot™, Biomet, Warsaw) was inserted to a point 2 mm distal to the tendon insertion point and anchor was locked subcortically. Following that, sutures of the anchor were examined in terms of pull-out and the tendon was sutured onto the cortex. All operations were performed by a single experienced surgeon (AK).

RESULTS

The number of male and female patients in this study were 10 and 4, respectively. The mean age of the patients was 32.9 (19–53). The involved finger was on the right hand in 10 patients, and on the left hand in 4 patients. The involved finger was on the dominant hand in 11 patients, and on non-dominant hand in 3 patients (Figs. 3–4).

The mean time between the initial injury and surgery was 93.5 (44–190) days. The mean surgery time was 47.5 (20–90) minutes. The mean follow-up period was 22 (11–32) weeks.

The mean preoperative extensor lag was 27.2° (15–35), while it was 3° (0–10) at the last follow-up. The difference between preoperative and postoperative extensor lag was found to be statistically significant ($p < 0.05$) (Table 1).

Crawford score was moderate in 1 patient, fair in 2 patients, and excellent in 11 patients. The only complication observed through the study was skin necrosis one patient, which caused a delay in wound healing and return to work.

DISCUSSION

We observed positive results in the treatment of chronic tendinous mallet finger in terms of patient satisfaction and functionality.

Conservative treatment is recommended in the treatment of chronic mallet finger (5, 6, 28, 30). Surgical indications include the presence of extensor lag $\geq 40^\circ$ despite conservative treatment and resistance to conservative treatment (5, 6, 28, 30, 31).

Open repair is one of the surgical methods for chronic cases. Maklout et al. reported excellent outcome in a chronic case over 6 month with a 60° extensor lag using

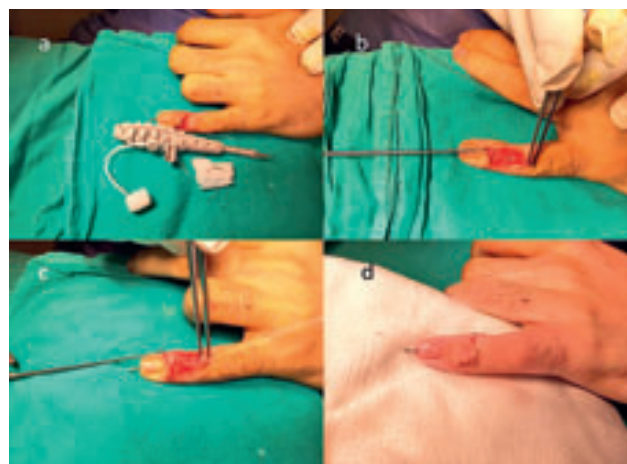


Fig. 2. a – surgical application of all-soft suture anchor to distal phalanx, b – clinical display after repair of defective tendon, c – peroperative pull-out test for measure of durability of the implant, d – post-operative view of distal phalanx after wound closure.



Fig. 3. Last clinical view of same patient with full extension of distal interphalangeal joint.



Fig. 4. Last clinical view of patient with right D4 chronic mallet deformity treated with same protocol.

Mitek anchor. They reported that the key point was revitalizing the tendon and stimulation of healing (18).

Another study evaluating outcomes of the treatment using Mitek anchor in 22 patients with chronic mallet finger reported excellent results in 15 patients. However, they reported moderate level satisfaction in 2 patients. An important point was that the mean time between initial injury and surgery was 10 months in this study (29).

One of the major problems with open repair is inability to find the retracted tendon, or repair due to retraction

Table 1. General characteristics of patients

	Age	Injury side	Dominant side	Injured finger	Mean operation day after surgery	Return to work (day)	Extensor lag (degree) (preop)	Extensor lag (degree) (post-op)
1	23	R	R	2	45	7	20	3
2	32	L	R	5	69	5	26	5
3	44	R	R	4	45	6	30	5
4	25	R	R	3	56	7	35	5
5	53	R	R	2	44	6	25	5
6	32	L	L	4	78	9	25	10
7	19	L	L	2	102	6	35	2
8	44	R	L	5	123	6	15	0
9	35	R	R	5	170	6	20	0
10	25	R	R	5	76	5	35	0
11	43	L	R	2	97	7	30	5
12	39	R	R	3	110	4	35	2
13	25	R	R	5	190	5	25	0
14	22	R	R	2	104	5	25	0
Max.	53				190	9	35	10
Min.	19				44	4	15	0
Mean	32, 93				93, 5	6	27, 2	3

particularly in chronic cases. The inappropriate shortening the tendon also may result with a residue extensor lag. Thus, it may not always be possible to achieve the desired tendon length (22, 31). We didn't observe a retraction causing difficulty in repair. This may be related to the short time between initial injury and surgery when compared to the literature.

Other disadvantages of open surgery include the skin necrosis caused by skin irritation by the implant, exposing of the implant and nail deformities (1, 26). Although this is a common complication in cases with tendinous mallet, there is no sufficient data following soft tissue repair. Nakamura et al reported no complications in their series using anchor in addition to K-wire (21).

In our series, one patient had a skin necrosis which caused a delay in the treatment. We believe that the low rates of complication in our study could be due to exclusion of cases with a tendinous mallet finger and no use of metal implant. All-soft anchors don't contain any other material than suture which also provides safety and ease of use.

In a cadaver study, Mazocca et al. biomechanically compared classical solid anchors (SutureTac™, Arthrex, Naples, FL) and JuggerKnot™ anchors in 10 different cyclic loading, and reported similar biomechanic performances (19).

These anchors are widely used out of shoulder surgery including para-iliac hernia repairs and lateral instability surgery of ankle (7, 9, 20). However, limited information exists in the literature regarding the use of all-soft anchors in hand surgery.

In another cadaver study comparing biomechanical properties of 4 different fixation techniques, authors used only K-wires in first group, tension band technique in second group, pull-out wiring in third group and JuggerKnot™ anchor in the fourth group. Loading tests revealed tension band technique to be more stable than other techniques, while there was no difference between all-soft anchors and other techniques in terms of biomechanical stability. They also reported that all-soft anchors had the advantage of having ease of use, and not containing a metal implant which prevents a second surgery (10).

This study is the first study in the literature to evaluate clinical results of all-soft anchors in chronic mallet finger which we believe is the main advantage. Also, the low number of studies with classical anchors also adds to that.

The disadvantages of this study include a low number of patients, lack of a control group, and the retrospective design.

CONCLUSIONS

Surgical treatment is still a valid treatment option for patients who can not tolerate finger splint, had an unsuccessful trial of a long period of conservative treatment. Primary repair could be an alternative to reconstruction.

All-soft suture anchors have high patient satisfaction rates and functional results. Thus, we believe that they could be used in the treatment of patients with chronic mallet finger.

References

1. Acar MA, Güzel Y, Güleç A, Uzer G, Elmadağ M. Clinical comparison of hook plate fixation versus extension block pinning for bony mallet finger: a retrospective comparison study. *J Hand Surg Eur.* 2015;40:832–839.
2. Alla SR, Deal ND, Dempsey IJ. Current concepts: mallet finger. *Hand (N Y).* 2014;9:138–144.
3. Asghar M, Helm RH. Central slip tenotomy for chronic mallet finger. *Surgeon.* 2013;11:264–266.
4. Baratz ME, Schmidt CC, Hughes TB. Extensor tendon injuries. In: Green DP, Hotchkiss RN, Pederson WC, Operative hand surgery. 5th ed. New York, NY. 2005, pp 187–218.
5. Batibay SG, Akgül T, Bayram S, Ayık Ö, Durmaz H. Conservative management equally effective to new suture anchor technique for acute mallet finger deformity: A prospective randomized clinical trial. *J Hand Ther.* 2017;31:429–436.
6. Bellemère P. Treatment of chronic extensor tendons lesions of the fingers. *Chir Main.* 2015;34:155–181.
7. Blair LJ, Cox TC, Huntington CR, Ross SW, Kneisl JS, Augenstein VA, Heniford BT. Bone Anchor Fixation in Abdominal Wall Reconstruction: A Useful Adjunct in Suprapubic and Para-iliac Hernia Repair. *Am Surg.* 2015;81:693–697.
8. Bloom JM, Khouri JS, Hammert WC. Current concepts in the evaluation and treatment of mallet finger injury. *Plast Reconstr Surg.* 2013;132:560–566.
9. Brown CA, Hurwit D, Behn A, Hunt KJ. Biomechanical comparison of an all-soft suture anchor with a modified Broström-Gould suture repair for lateral ligament reconstruction. *Am J Sports Med.* 2014;42:417–422.
10. Cheung JP, Fung B, Ip WY. Peak load resistance of the JuggerKnot™ soft anchor technique compared with other common fixation techniques for large mallet finger fractures. *Hand Surg.* 2013;18:381–388.
11. Cheung JP, Fung B, Ip WY. Review on mallet finger treatment. *Hand Surg.* 2012;17:439–447.
12. Clayton RA, Court-Brown CM. The epidemiology of musculoskeletal tendinous and ligamentous injuries. *Injury.* 2008;39:1338–1344.
13. Hiwatari R, Kuniyoshi K, Aoki M, Hashimoto K, Suzuki T, Takahashi K. Fractional Fowler tenotomy for chronic mallet finger: a cadaveric biomechanical study. *J Hand Surg Am.* 2012;37:2263–2268.
14. Kanaya K, Wada T, Yamashita T. The Thompson procedure for chronic mallet finger deformity. *J Hand Surg Am.* 2013;38:1295–1300.
15. Lin JD, Strauch RJ. Closed soft tissue extensor mechanism injuries (mallet, boutonniere, and sagittal band). *J Hand Surg Am.* 2014;39:1005–1011.
16. Lin JS, Samora JB. Surgical and Nonsurgical Management of Mallet Finger: A Systematic Review. *J Hand Surg Am.* 2018;43:146–163.
17. Liu Z, Ma K, Huang D. Treatment of mallet finger deformity with a modified palmaris longus tendon graft through a bone tunnel. *Int J Burns Trauma.* 2018;8:34–39.
18. Makhlof VM, Deek NA. Surgical treatment of chronic mallet finger. *Ann Plast Surg.* 2011;66:670–672.
19. Mazzocca AD, Chowaniec D, Cote MP, Fierra J, Apostolakis J, Nowak M, Arciero RA, Beitzel K. Biomechanical evaluation of classic solid and novel all-soft suture anchors for glenoid labral repair. *Arthroscopy.* 2012;28:642–648.
20. Nagra NS, Zargar N, Smith RD, Carr AJ. Mechanical properties of all-suture anchors for rotator cuff repair. *Bone Joint Res.* 2017;6:82–89.
21. Nakamura K, Nanjo B. Reassessment of surgery for mallet finger. *Plast Reconstr Surg.* 1994;93:141–149.
22. Schweitzer TP, Rayan GM. The terminal tendon of the digital extensor mechanism: Part II, kinematic study. *J Hand Surg Am.* 2004;29:903–908.
23. Smit JM, Beets MR, Zeebregts CJ, Rood A, Welters CF. Treatment options for mallet finger: a review. *Plast Reconstr Surg.* 2010;126:1624–1629.
24. Sorene ED, Goodwin DR. Tenodesis for established mallet finger deformity. *Scand J Plast Reconstr Surg Hand Surg.* 2004;38:43–45.
25. Suzuki T, Iwamoto T, Sato K. Surgical Treatment for Chronic Tendon Mallet Injury. *J Hand Surg Am.* 2018;43:780.e1–780.e5.
26. Szalay G, Schleicher I, Schiefer UR, Alt V, Schnettler R. Operative treatment of osseous pull out of the extensor tendon using a hook plate. *Oper Orthop Traumatol.* 2011;23:151–157.
27. Thompson JS, Littler JW, Upton J. The spiral oblique retinacular ligament (SORL). *J Hand Surg Am.* 1978;3:482–487.
28. Tolkien Z, Potter S, Burr N, Gardiner MD, Blazeby JM, Jain A, Henderson J. Conservative management of mallet injuries: a national survey of current practice in the UK. *J Plast Reconstr Aesthet Surg.* 2017;70:901–907.
29. Ulkür E, Açikel C, Ergun O, Celiköz B. Repair of chronic mallet finger deformity using Mitek micro arc bone anchor. *Ann Plast Surg.* 2005;54:393–396.
30. Valdes K, Naughton N, Algar L. Conservative treatment of mallet finger: a systematic review. *J Hand Ther.* 2015;28:237–245.
31. Wehbe MA, Schneider LH. Mallet fractures. *J Bone Joint Surg Am.* 1984;66:658–669.

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