Surgical Treatment of Pediatric Trigger Thumb with Metacarpophalangeal Hyperextension Laxity

Zhongyu Li · Ethan R. Wiesler · Beth P. Smith ·
L. Andrew Koman

Received: 7 October 2008 / Accepted: 17 August 2009 / Published online: 1 September 2009
© American Association for Hand Surgery 2009

Abstract Between 1994 and 2004, seven patients (nine thumbs) at our institution were treated for trigger thumb with hyperextensible metacarpophalangeal (MP; $>60^\circ$) anomaly with surgical release of the A1 pulley and proximal advancement of the MP volar plate. There were four girls and three boys (three right, two left, and two bilateral thumbs) with a mean age at surgery of 46 months (range, 26 to 82 months). The mean follow-up was 64 months (range, 1 to 8 years). At the time of the last follow-up, all patients had returned to full activities without functional limitations or pain and were satisfied with the outcome of the surgery. There was no recurrence of triggering or MP hyperextension deformity. The results from this study demonstrate that the trigger thumb in children with concomitant MP hyperextension laxity can be treated safely with predictable results by releasing the A1 pulley and advancing the volar plate.

Keywords Trigger thumb · A-1 pulley · Volar plate · Hyperextension · Pediatric

Introduction

Trigger thumb is an uncommon condition in children and can be treated successfully with the release of the A1 pulley alone when conservative treatments fail [2, 4, 8, 15]. Complications after pediatric trigger thumb release are rare and seldom reported. However, interphalangeal (IP) joint

motion loss and metacarpophalangeal (MP) joint hyperextension deformity may occur after A1 pulley release. A recent long-term follow-up study revealed a 17.6% of incidence of thumb MP joint hyperextension after A1 pulley release for trigger thumb in children [14]. Although the authors did not present their preoperative MP range of motion, pre-existing MP volar plate laxity could contribute to the MP hyperextension deformity observed postoperatively. In our experience, there is a small percentage of children with trigger thumb who have concomitant flexible thumb MP joint hyperextension laxity. Those children are treated routinely with MP volar plate advancement while releasing the A1 pulley if the MP joint can be passively hyperextended more than 60° preoperatively. The purpose of this retrospective study is to review and report our results of surgical treatment of this abnormality in pediatric patients.

Materials and Methods

There were more than 100 children treated at our institution for pediatric trigger thumbs between 1994 and 2004. Among them, there were seven children (nine thumbs) who were treated for a trigger thumb with MP hyperextension deformity (MP hyperextension more than 60°) identified through a medical chart review. All seven children were treated surgically and underwent division of the A1 pulley, advancement of the MP volar plate and temporary pinning of the MP joint. There were four females and three males (three right, two left, and two bilateral thumbs). Information regarding the patient's birth history, family history, age of presentation of the trigger thumb, age at surgery, surgical details, radiographic information, and clinical follow-up notes were reviewed. A telephone

Z. Li (✉) · E. R. Wiesler · B. P. Smith · L. A. Koman
Department of Orthopaedic Surgery, Wake Forest University
Baptist Medical Center,
Medical Center Blvd,
Winston-Salem, NC 27157, USA
e-mail: zli@wfubmc.edu

fellow-up also was conducted. The study protocol was approved by the Institutional Research Board.

The mean age at surgery was 46 months (range, 26 to 82 months). All but two patients were noticed to have the hyper-extendible thumb MP since birth. Among those two patients, one “bent” his thumb backward when he was 5 years old with subsequent development of symptomatic

Figure 1 A child with trigger thumb symptoms presented with a thumb IP flexion (a) deformity with the MP joint passively extensible to 90° (b, c) (reprinted with permission from [12]).

Figure 2 No skeletal abnormalities were noticed on the radiological studies (a), stress view often reveals the hyperextensibility of the MP joint (b) (reprinted with permission from [12]).

triggering symptoms 1 year later. In another patient, the deformity was noticed after he slammed his hand in the door of a coffee table. The mean age at first presentation was 36 months (range, 9 to 77 months). All patients initially were referred by their primary care physicians for assessment of their trigger thumb symptoms. A painless, palpable nodule at the MP level was noticed on physical examination in all thumbs. All thumb IP joints were flexed and were unable to be extended to neutral. The MP joint could be passively hyperextended to 60–90° (Figs. 1, 2). No other congenital deformities or associated syndromes were identified. No skeletal abnormalities were noticed on the radiological studies; however, stress views, if obtained, confirmed significant hyperextension of the MP joint (Fig. 2). There were no extensor tendon or flexor tendon anomalies found during the surgery.

Surgical Techniques

A zigzag volar incision was performed centered at the thumb MP joint. Both digital neurovascular bundles were

Figure 3 Through a volar incision, the A-1 pulley was identified and incised sharply (**a**). The volar plate was elevated in a U fashion open proximally, the periosteum was denuded from the distal metacarpal, a 3-0 Prolene suture was placed through the volar plate and then

through drill holes placed through the metacarpal (**b**). The volar plate was then advanced and sutured with a pullout button (**c**) (reprinted with permission from [12]).

identified and retracted. The A-1 pulley was identified and incised sharply (Fig. 3a). The intrinsic muscles then were dissected from the volar plate, and the metacarpal shaft was exposed extraperiosteally. A longitudinal incision was made to determine the edge of the joint, the volar plate was elevated in a U fashion, and opened proximally. The periosteum was elevated off from the distal metacarpal. A 3-0 Prolene suture was placed through the volar plate and then through drill holes placed through the metacarpal (Fig. 3b). The thumb was flexed 10–20° and pinned with a K-wire in this position. The volar plate then was advanced and sutured with a pullout button (Fig. 3c). The wound was closed in anatomic layers, and a cast was applied. K-wires were removed in the office after 3.5 to 4 weeks. Patients then were placed in short-arm thumb spica casts for an additional 2 weeks. The pullout button was removed 6 weeks postoperatively. The patient then was placed in a night splint for another 3 months (Fig. 4).

Results

The length of the mean clinic follow-up was 5 years (range, 12–89 months). Five patients were contacted by telephone with a mean follow-up of 7 years (range, 6.5–8 years). There were no surgical complications. All patients returned to full school and daily living activities without functional limitations or pain. All thumb MP joints were stable with less than 20° of passive hyperextension. The range of motion of MP and IP was symmetric to the contralateral side. There were no pin-site infections. There was no recurrence of thumb triggering or MP hyperextension deformity. No additional operative procedures were performed on the affected digits in this patient cohort.

Figure 4 Clinical pictures showing the resolution of thumb deformity after surgery (**a**, **b**).

Discussion

Trigger thumb in children is uncommon; however, the exact incidence remains unknown. The reported success rates of conservative treatments such as observation, stretching and/or splinting vary in the literature [2, 4, 13]. The majority of children with trigger thumb may eventually require a surgical release. Surgical treatment by dividing the A-1 pulley is simple and effective for this pediatric condition [8, 15]. Although it has been seldom studied, the reported incidence of recurrence of trigger thumb after surgical release is low and complications are rare. However, incision of the A1 pulley and the oblique pulley may result in a significant decrease in IP joint motion and a significant increase in MP motion and therefore should be avoided [3].

Children with trigger thumb may present with compensatory MP hyperextension due to limited IP motion. Mild compensatory MP hyperextension often resolves after A1 pulley release. However, excessive MP hyperextension with volar plate laxity should be addressed because of the concern of persistent postoperative MP hyperextension deformity after trigger release. A MP volar plate advancement procedure may be considered at the same time the A1 pulley is released if the thumb MP joint can be passively hyperextended more than 60°. Although 60° is arbitrary, MP hyperextension deformity may deteriorate after A1 pulley release if the patient has excessive passive MP extension preoperatively based on the senior author's personal experience.

Although the cause and relationship between trigger thumb symptoms and excessive MP laxity is unknown, the majority of patients' caregivers reported that MP joint laxity was evidence soon after birth in this patient cohort. Two patients had a history of thumb hyperextension injury and that might have contributed to the development of the trigger thumb. Trigger thumb after MP hyperextension injury also has been reported in adults [1]. Wood [17] described “retroflexible thumb”, an uncommon congenital deformity characterized by a flexed thumb IP joint and a hyperextended MP joint. Certain diseases can occur in association with this deformity, specifically trisomy D-1 and partial trisomy D1 [9, 15, 16]. Surgical lengthening of the extensor pollicis brevis (EPB) with advancement of the volar plate often is necessary. Kobayashi et al. [11] reported two cases of thumb “duck-neck deformity” with congenital extensor tendon anomaly. One of the patients that had deficient extensor pollicis longus (EPL) and extensor pollicis brevis (EPB) required an extensor indicis proprius transfer. The other patient had a deficient EPL but their thick and taut EPB required an EPB lengthening. However, there were no associated syndromes or tendon anomalies among patients in this study.

Different surgical techniques including volar capsulodesis using the EPB [10], volar plate advancement [5, 7, 18], and palmaris longus tenodesis [6] have been reported to correct the thumb MP hyperextension deformity. Our method is similar to the technique described by Filler et al. [7]. Based on our experience, the volar plate advancement method using a pullout button provides the most anatomical and technically straight forward procedure to address the problem. The volar approach allows isolation of digital nerves, appropriate access to the joint and minimal scar. In this retrospective study, all thumbs were treated with a release of the A1 pulley, proximal advancement of the MP volar plate using a pullout button, and pinning of the MP joint in 10–20° of flexion for 3.5 to 4 weeks. Successful deformity correction was achieved in all patients.

In contrast to a simple trigger thumb release, the volar plate advancement requires a larger surgical incision, more extensive dissection, and prolonged immobilization. Although loss of thumb range of motion due to tendon adhesion is a major concern, no patient from this study developed tendon adhesion requiring a tenolysis procedure. Our study is also limited by its retrospective nature and small sample size. The other weakness of this study is that we did not compare the results of A1 pulley release alone with the combined A1 pulley release and volar plate advancement in this patient population. However, the results from this study demonstrate that the trigger thumb in children with concomitant excessive MP hyperextension laxity can be safely treated with predictable results using A1 pulley release and volar plate advancement.

References

1. Ametewee K. Trigger thumb in adults after hyperextension injury. *Hand*. 1983;15:103.
2. Baek GH, Kim JH, Chung MS, Kang SB, Lee YH, Gong HS. The natural history of pediatric trigger thumb. *J Bone Joint Surg Am*. 2008;90:980–5.
3. Doyle JR, Blythe WF. Anatomy of the flexor tendon sheath and pulleys of the thumb. *J Hand Surg [Am]*. 1977;2:149–51.
4. Dunsmuir RA, Sherlock DA. The outcome of treatment of trigger thumb in children. *J Bone Joint Surg Br*. 2000;82B:736–8.
5. Eaton RG, Floyd W. Thumb metacarpophalangeal capsulodesis: an adjunct procedure to basal joint arthroplasty for collapse deformity of the first ray. *J Hand Surg [Am]*. 1988;13:449–51.
6. Eiken O. Palmaris longus-tenodesis for hyperextension of the thumb metacarpophalangeal joint. *Scand J Plast Reconstr Surg*. 1981;15:149–52.
7. Filler BC, Stark HH, Boyes JH. Capsulodesis of the metacarpophalangeal joint of the thumb in children with cerebral palsy. *J Bone Joint Surg Am*. 1976;58:667–70.
8. Herdem M, Bayram H, Toğrul E, Sarpel Y. Clinical analysis of the trigger thumb of childhood. *Turk J Pediatr*. 2003;45:237–9.

9. Johnson CF. Abnormal thumbs and physical diagnosis: anomalies of the thumbs as signs of congenital disorders in organ systems. *Clin Pediatr*. 1970;9:131–42.
10. Kessler I. A simplified technique to correct hyperextension deformity of the metacarpophalangeal joint of the thumb. *J Bone Joint Surg Am*. 1979;61:903–5.
11. Kobayashi A, Ohmiya K, Iwakuma T, Mitsuyasu M. Unusual congenital anomalies of the thumb extensors: report of two cases. *Hand*. 1976;8:17–21.
12. Koman [ed]: Wake Forest University School of Medicine Orthopaedics Manual 2005, Winston-Salem: Orthopaedic Press
13. Lee ZL, Chang CH, Yang WY, Hung SS, Shih CH. Extension splint for trigger thumb in children. *J Pediatr Orthop*. 2006;26:785–7.
14. McAdams TR, Moneim MS, Omer GE Jr. Long-term follow-up of surgical release of the A(1) pulley in childhood trigger thumb. *J Pediatr Orthop*. 2002;22:41–3.
15. Slakey JB, Hennrikus WL. Acquired thumb flexion contracture in children: congenital trigger thumb. *J Bone Joint Surg Br*. 1996;78:481–3.
16. Smith DW. The no. 18 trisomy and D1 trisomy syndromes. *Pediatr Clin North Am*. 1963;10:389–407.
17. Wood VE. The retroflexible thumb. In: Green DP, editor. *Operative hand surgery*. 3rd ed. New York: Churchill Livingstone; 1993. p. 408–11.
18. Zancolli E. *Structural and dynamic bases of hand surgery*. 2nd ed. Philadelphia: Lippincott; 1979. p. 212–3.