Results of Surgical Release in Pediatric Trigger Thumb

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Objective: *To observe and evaluate the treatment outcome of pediatric trigger thumb in patients who had undergone surgical release of the annular ligament with the oblique pulley partially released in patients who did not achieve full IP joint extension.*
Material and Method: *From 2003 to 2010, 21 surgically operated thumbs in 17 patients were reviewed. Bowstringing, range of motion (ROM) of thumb interphalangeal joint, Notta's node resolution and assessment of patient/parent satisfaction were used as outcome parameters. The pulley pathology system was observed intra-operatively. The annular ligament was completely released, and in patients who were not fully corrected, a further procedure in which 50% of the oblique pulley was released was undertaken.*
Results: *One thumb had recurrent triggering after 60 months of follow-up. No infection, neurovascular injury, excessive scarring, or bowstringing were detected. Notta's node was fully resolved in all operated thumbs. Mean follow-up was 64 months. Improved IP joint motion without flexion contracture was observed in all patients. The procedure was well tolerated by patients and both the patients and parents of patients expressed satisfaction with the results of the procedure.*
Conclusion: *Surgical release is recommended for children aged more than one year that are afflicted with trigger thumb. This procedure delivers satisfactory results with minimal complications. To achieve full FPL excursion, some patients need to release 50% of the oblique pulley after the first procedure.*

Keywords: *Trigger thumb, A-1 pulley, Notta's node, Oblique pulley, Annular ligament*

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Congenital trigger thumb is an uncommon condition that is found mostly in neonates and young children. The name, however, may be deceptive according to some authors who suggest that this deformity develops some months after birth; for this reason, the word "acquired" may be more appropriate than the word "congenital"[1]. The flexed fixed deformity of the affected thumb causes difficulty with passive extension and this can cause painful triggering or snapping. Triggering, clicking, or snapping is observed by flexion or extension of the interphalangeal joint. Pathological findings of this condition are fusiform hypertrophy of the flexor pollicis longus (FPL) tendon producing a nodularity of the FPL tendon (termed "Notta's node"), palmar to the metacarpo-phalangeal (MP) joint, and flexion deformity at the thumb interphalangeal (IP) joint[2,3]. By the age of 12 months, spontaneous improvement in 30% of cases was reported by Dinham and Meggitt[8]. They also reported that 12% of patients developed symptoms of trigger digits between 6 and 30 months of age. Management recommendations included: (1) observation for spontaneous resolution up to the age of 12 months; (2) for those diagnosed between the ages of 6 and 12 months, observation for 6 months could be offered; (3) surgical release was suggested for children diagnosed after the age of 3 years, as the chance of spontaneous resolution was minimal and there was a potential for residual contracture.

The use of oblique pulley preservation to prevent bowstringing has been a standard practice[4,5]. The incision of the proximal annular ligament alone was not able to provide a complete correction of the deformity. Two cases in Dinham and Meggitt's study of failure in the incision of the proximal annular ligament alone required a second operation because of inadequate release and wound infection[8]. The recurrence rate, which is caused by inadequate release, has been reported in several studies: 1.4% in Tan et al[6]; 4% in Dunsmuir and Sherlock in which 8/200 operated thumbs were fully successful after reoperation[14], and 7.4% in Marriott's report, the largest series of recurrences (7/94 thumbs)[19]. From these reports, we can assume that complete release of annular

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ligament alone would not be sufficient for achieving full FPL excursion and IP joint extension in some pediatric trigger thumbs.

The authors propose a combined surgical procedure, comprising the complete release of the annular ligament and the partial release of the oblique pulley in the pediatric-locked, trigger thumb patient who does not achieve full IP joint extension.

Material and Method

From 2003 to 2010, 17 patients with 21 trigger thumbs were evaluated. The patients were referred by general practitioners and pediatricians and they were seen by orthopaedic specialists who made and confirmed the clinical diagnosis. Patients were classified as stage I: A Notta's nodule is present, but no triggering is observed in the IP joint; Stage II: Triggering is observed during active extension of the IP joint; Stage III: Active extension of the IP joint is not possible and triggering is observed during passive extension of the IP joint; Stage IV: Passive extension of the IP joint is not possible[15,16]. Children with pediatric trigger thumbs who were treated by surgery and who could be contacted for follow-up were included in the present study; the pre-operative evaluation for patients who had symptoms for less than 6 months with no prior therapy; the passive stretching exercises by the parents, supervised by the author. The authors recommended surgical treatment if the patient had failed to improve with stretching therapy after 6 months, if the symptoms presented for 6 months or longer, or if the patients was aged more than 12 months. Patient data included gender, affected side thumb, age at onset, age at surgery, stage of trigger thumb, postoperative splint, partial oblique pulley release, recurrent triggering and follow up duration (Table 1).

Surgical procedure

The surgical procedure was performed with tourniquet control under general anesthesia. A transverse incision was made at the flexion crease of the thumb MP joint; the Notta's node was usually near this area. The ulnar and radial digital nerves were protected. The annular ligament was longitudinally incised and the IP joint of the thumb was then passively extended in order to ensure an adequate release. If full

Table 1. Data of 17 patients

Patient	Thumb	Affected side	Age at onset (month)	Age at surgery (months)	Stage of trigger thumb	Postopera-tivesplint	Partial oblique pulley release	Recurrent triggering	F/U (months)
1	1	R	9	33	IV	+	+	-	6
2	2	R	Birth	25	III	-	-	-	2
3	3	R	23	27	IV	+	-	-	36
4	4	R	36	94	III	+	-	-	57
5	5	R	Birth	36	IV	+	+	-	57
	6	L	28	36	IV	+	+	-	57
6	7	L	12	15	III	+	-	-	27
7	8	R	2	21	III	+	-	-	30
8	9	R	12	20	III	-	-	-	80
9	10	L	Birth	17	III	-	+	-	66
10	11	R	Birth	38	II	+	-	-	59
	12	L	Birth	38	II	+	-	-	59
11	13	L	12	22	IV	+	-	-	90
12	14	R	28	31	IV	+	+	-	85
13	15	L	18	21	II	-	-	-	66
14	16	L	Birth	12	III	+	+	-	112
15	17	R	118	122	III	+	-	-	86
	18	L	118	122	III	+	-	-	86
16	19	R	21	24	III	+	-	+	115
17	20	R	18	19	III	+	-	-	115
	21	L	27	28	III	+	-	-	115

correction of the deformity was not achieved, then an oblique pulley partial release was undertaken until the IP joint was in a fully extended position. No nodule excision was performed.

An extensor-type splint was used for immobilization at nighttime in all cases for 30 days, but some patients did not use the splint due to non-compliant parents. Active and passive exercise was started at 1 week after surgery.

Hand function and parent/patient satisfaction were evaluated at follow-up. No gradation was used for rating, only a report of satisfied or unsatisfied. Hand function assessment was based on any reported difficulty of hand use. The recurrence of flexion deformity and thumb IP range of motion were recorded. The superficial displacement of the tendon and overlying skin was observed to be bowstringing. Notta's node persistence was also observed.

Results

There were 21 trigger thumbs in 17 patients, trigger thumb was the only abnormality of the hand, without any other underlying disease. In all, 5 were boys and 12 were girls. The mean age was 23 months (range: birth-118 months) at onset and 38 months (range: 12-122 months) at surgery. There were six cases of trigger thumb noted at birth. In five thumbs (52%), the condition was noted in the first year of life, eight thumbs (38%) between 13 and 36 months, and two thumbs (9%) beyond 36 months. Most of trigger thumbs were stage III (57%); with stage IV (29%), and stage II (14%). Four patients had bilateral involvement. The predominantly affected side was the right (57%). Seventeen thumbs (81%) were immobilized at nighttime with a postoperative splint for 30 days (Tables 1). Six thumbs had to undergo partial oblique pulley release. Surgical treatment was performed between 12 months to 24 months of age in 9 cases and between 25 months to 48 months of age in 7 cases. One patient was operated upon at the age of 122 months. The mean follow-up period was 64 months. The only case of recurrence occurred at 60 months after surgery and the clinical review was positive after the follow-up surgery. No wound infection, neurovascular injury, excessive pain, or thickening of scar was observed in any patient. Bowstringing and MP joint hyperextension were not found. As compared to the normal side, the operated thumbs had full, active IP joint extension. Satisfaction regarding the procedure was reported by both patients and parents. Indeed, both groups reported the normal function of both hands. All patients reported resolution of Notta's node. However, one patient reported asymmetrical thumb size.

Intraoperative finding

Although the anatomy could not be precisely ascertained, the surgical findings overall revealed that the thumb pulley system was similar to that previously reported by Doyle and Blythe[7]. The A1 pulley was almost indistinct from the remaining proximal tendon sheath and was stretching at the point of the MP joint. The entrapped Notta's node was identified beneath the membranes. The stenosis of the oblique pulley appeared to have the fibers thickening at the distal part. The annular ligament was fully released and the motion of the thumb FPL was tested. If full extension were not achieved, the partial release of the proximal oblique pulley was performed.

Discussion

Pediatric trigger thumb is an unclear origin and not commonly found in children. Previous studies note an incidence rate of 2.2%[5] and 0.0005% (1/2000 live birth)[4]. In the present series, there were 6 cases diagnosed at birth and 5 cases had developed this condition within 1 year of birth. The incidence of trigger thumb, which develops within the first year of life, encourages us to believe that this condition is not congenital, but acquired. Although the incidence tends to the acquired side, there were no conclusion to the questioning the original presentation of the pediatric trigger thumb whether it was at birth or developed as the child grew. Mulpruek et al[17] reported that spontaneous recovery occurred in 10 out of 42 patients within 3 months of the initial visit. Fortunately, this condition can spontaneously improve, as reported by Mulpruek et al[17]. Their data showed 10 of 42 patients spontaneously recovering within the 3rd month of visit. Unlike De Smet et al[18] data, which showed no spontaneous recovery in any patient and all had to undergo the surgical release procedure. Clearly, there might be some joint contracture in delaying treatment by surgery[9,10]. Surgical complications, such as inadequate release, digital nerve injury, secondary adhesion, and bowstring of the flexor tendon should be communicated to the patient and/or the parents[11-13].

At our institute, the surgical treatment was only advised when the patient had persistent trigger thumb after the first year of age. From our intra-operative observations, we learned that the stenosis could be located distally from the A1 pulley. The

treatment advised in the previous literature was to excise the A1 pulley and protect the oblique pulley to avoid having the bowstring effect[3,4,14,15]. In these/this series, no bowstringing of the FPL was found after the proximal 50% release of the oblique pulley. There were questions about the role of the annular ligament, the question about the pathophysiologic of the pediatric trigger thumb was raised by Loveren and van der Biezen due to the discovery of 69% (11/16 thumb) having a stenosis site, found distally to the A1 pulley. This caused some extension incision instances the normal incision at the thickening contracted annular ligament. They suggested that both the annular ligament and oblique pulley were involved[16]. Despite of lack of competence to distinguish pulley, the authors found stenosis at the distal part of the first annular pulley. The authors believe that the oblique pulley played the primary pathological role in this distal stenosis, by entrapping the Notta's node at the proximal border of the stenosis oblique pulley rather than the annular pulley, which was thin and membranous. Some patients may end up with bowstringing of the FPL tendon due to a misunderstanding regarding the oblique pulley to the annular pulley with a release of the entire oblique pulley. In spite of extended release involving 50% of the oblique pulley in the present series, the authors observed no bowstringing. All patient thumb motion reached the same degree of hyperextension as a normal thumb and none had flexion deformity or compromise of hand function. All 9 patients had their surgeries after the age of 2 years or older. No MP joint hyperextension was noted. The authors concluded that there was no relationship between the difference of age at the time of surgery and thumb motion. McAdams et al reported 23% of patients with loss of IP motion and 17.6% with MP hyperextension without any correlation with time of surgery[11]. The residual flexion contracture in 3 of 6 operated patients after the age of 4 was reported by Dinham and Meggitt. They suggested that the operation should be performed under the age of 4[8]. Our patients achieved a satisfactory outcome emanating from the surgical treatment. All patient Notta's nodes were postoperatively resolved, so the authors suggest that it is not necessary to excise the nodule. By understanding more about the pulley in a child from newborn to school age, the authors can appreciate in advance the innovative treatment with only stenosis release as the selected target.

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Potential conflicts of interest

None.

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ผลการผ่าตัดรักษาภาวะนิ้วหัวแม่มือล็อคในเด็ก

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วัตถุประสงค์: *เพื่อศึกษาผลของการผ่าตัดรักษาภาวะนิ้วหัวแม่มือล็อคในเด็กโดยการผ่าตัดเอ็น annular ร่วมกับผ่าตัดเอ็น oblique pulley ในผู้ป่วยบางรายที่ไม่สามารถเหยียดนิ้วได้สุดโดยการผ่าตัดเอ็นเดียว*

วัสดุและวิธีการ: *การวิจัยโดยเก็บข้อมูลผู้ป่วยตั้งแต่ปี พ.ศ. 2546 ถึง พ.ศ. 2553 พบว่ามีผู้ป่วยภาวะนิ้วหัวแม่มือล็อคในเด็กทั้งหมด 17 ราย จำนวนนิ้วหัวแม่มือที่ได้รับการผ่าตัด 21 นิ้ว มีการเก็บรวบรวมข้อมูลต่าง ๆ ของผู้ป่วย ได้แก่ นิ้วหัวแม่มือข้างที่เป็นโรค อายุที่เริ่มเป็น อายุขณะที่ผ่าตัด ระยะของโรค และผลการผ่าตัดรักษา ภายหลังการผ่าตัดมีการประเมินการหย่อนของเอ็น การยุบลงของ Notta's node การเคลื่อนไหวของนิ้ว และความพึงพอใจของผู้ป่วยและญาติโดยการผ่าตัดรักษาจะทำการผ่าตัดเอ็น annular ร่วมกับผ่าตัดเอ็น oblique pulley ไม่เกินร้อยละ 50 ในผู้ป่วยบางรายที่ไม่สามารถเหยียดนิ้วได้สุดโดยการผ่าตัดเอ็นเดียว*

ผลการศึกษา: *พบว่ามี 1 รายที่มีการกลับเป็นซ้ำของอาการนิ้วล็อค ไม่พบว่ามีการติดเชื้อ การบาดเจ็บต่อเส้นเลือด เส้นประสาท ไม่มีแผลเป็นขนาดใหญ่ ไม่พบการหย่อนของเอ็นมีการยุบลงของ Notta's node ในผู้ป่วยทุกรายผู้ป่วยและญาติทั้งหมดพึงพอใจในผลการรักษา*

สรุป: *การผ่าตัดรักษาภาวะนิ้วล็อคในเด็กควรทำเมื่ออายุมากกว่าหนึ่งปี ผลของการผ่าตัดรักษาภาวะนิ้วหัวแม่มือล็อคในเด็กอยู่ในเกณฑ์ดี มีผลข้างเคียงน้อย การผ่าตัดเอ็น annular ร่วมกับผ่าตัดเอ็น oblique pulley ไม่เกินร้อยละ 50 มีความจำเป็นในผู้ป่วยบางรายที่ไม่สามารถเหยียดนิ้วได้สุดโดยการผ่าตัดเอ็นเดียว*