Outcome of index finger pollicisation

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Abstract

Background Pollicisation of the index finger for absence or severe hypoplasia of the thumb has been reported as a good procedure to recreate a new ‘thumb’ with good cosmesis and acceptable function. The purpose of this study is to evaluate the outcome of our series from different viewpoints.

Methods Seventeen patients with 24 involved hands were willing to come back for evaluation. The mean age at operation was 12 months. In 8 hands there was also a radial club hand. Buck Gramcko’s technique was used with slight modifications. The mean follow-up time was 53 months (ranging from 6 to 142). The outcome was determined in a variety of ways: the functional assessment, cosmesis (objectivated with measurement of thumb length, girth and nail size) and a subjective evaluation of function and aspect done with a patient/parent questionnaire and a visual analogue score.

Results The mean functional score was: one excellent, eleven good, five fair and five poor results. The mean length was 96% the width was 93%, the nail width was 85%. There was no significant different outcome in the syndrome related thumbs versus the isolated cases, unilateral versus bilateral cases. A significant worse outcome was seen for function and subjective evaluation in the radial club hand associated thumbs and for the functional score for the more severe Blauth group.

Conclusion The general outcome for non radial club hand associated thumb reconstructions was satisfying. There was good correlation between the different scoring systems.

Keywords thumb aplasia · congenital · pollicisation, reconstruction · pediatric

Introduction

Pollicisation of the index finger for absence or severe hypoplasia of the thumb has been reported as a good procedure to recreate a new ‘thumb’ with good cosmesis and acceptable function. The original technique of Buck Gramcko [1–2] has been modified along the years [3–5] but still is the base for all procedures. Except for the original author, most series are limited and the evaluation techniques were different. The purpose of this study is to add our series and to evaluate them from different viewpoints. Function, cosmesis, subjective evaluation, patient’s and surgeon’s satisfaction were investigated and correlated with each other.

Material and methods

Patients

From 1998 to 2007 a pollicisation was performed for 28 hands in 20 patients. Seventeen patients with 24 involved hands were willing to come back for evaluation: one patient (bilateral) lived abroad and preferred not to come, the two others were too much involved with the care for their generalized problem that they did not want to expose their child to too many exams.

There were 10 boys and 7 girls, the mean age at operation was 12 months (range 5 to 54 months). There was a bilateral hand involvement in 7, the left was involved 4 times, the right 6 times.

In 8 hands there was also a radial club hand. The thumb hypoplasia was part of a generalized syndrome in 10 cases: Holt-Oram in 4, VACTERL in 3, Fanconi in 2 patients and one non specified MR/MCA syndrome. Other non syndrome related anomalies were present in 2 children: one CHD, one cleft hand. A contra lateral involvement but at a lesser degree was seen in 2 other children.

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Operative technique

All operations were done by the same surgeon. Except from one patient they all were operated before the age of 15 months. The surgical technique is the one described by Buck Gramcko, with some minor modifications [1, 2, 6]. The skin incision used are the ones described in the textbook by Scheker and Cendales [4]. Resection of the metacarpal, dissection of different structures (veins, arteries, nerves, tendons and intrinsic muscles) are done according to the description in Buck Gramcko's technique. The metacarpal head is rotated and fixed to the carpal bone (mostly the trapezoid) with a bone anchor [3]. The intrinsic muscles are reinserted to balance the thumb. The extensor tendon is slightly shortened. The A1 pulley is incised. The skin is closed and a bulky dressing was applied in all for 3 weeks. Later on mobilisation was encouraged but physiotherapy was not prescribed.

Evaluation

The patients were called back and evaluated by an independent examiner. The mean follow-up time was 53

months (ranging from 6 to 142). The outcome was determined in a variety of ways: the functional assessment was done as proposed by Percival et al. (Table 1) [7]. The cosmesis was objectivated with measurement of thumb length, girth and nail size according to Goldfarb et al. [8]. The subjective evaluation of function and aspect was done with a patient/parent questionnaire (Table 2). The patient's (or his caregiver's) satisfaction was expressed with a visual analogue score (VAS). The surgeon's estimation was also measured with a VAS.

Table 1. Percival's assessment method

Tip pinch	
Strength (bulb manometer; %)	
< 25	0
25 to 75	1
> 75	2
Accuracy (pin and coin)	
Unable	0
Difficulty	1
Ease	2
Pulp pinch	
Strength (bulb manometer; %)	
< 75	0
> 75	1
Accuracy (key)	
Unable	0
Able	1
Opposition	
Middle	1
Ring	1
Little	1
Grasp	
Tennis-ball	1
Table-tennis ball	1
Strength > 75%	1
Mobility	
CMCJ	1
MPJ	1
IPJ	1
Sensation (two-point; mm)	
< 5	3
5 to 10	2
> 10	1
Cosmesis	
Tip to within 0.5 mm PIPJ index	1
Position	
45 to 80° abduction	1
90 to 160° rotation	1
Appearance	1
Scores	
> 20	Excellent
16 to 19	Good
12 to 15	Fair
< 12	Poor

Fig 1 Measurements for objectivation the appearance.

Fig 2 Example of excellent outcome.

Statistics

A T-test was used to differentiate between the different subgroups. The different outcomes were correlated with a Pearson correlation coefficient, significance was $P < 0.05$.

Results

The mean functional score for the whole group was 14.7; one excellent, eleven good, five fair and five poor results (Table 1). One patient with bilateral thumb aplasia was excluded due to her age and the short follow-up (6 months). The subjective evaluation was 65 (range 29 to 85). The VAS for the surgeon ranged from 7 to 9 (mean 7.8) for the parents it ranged from 3 to 10 (mean 7.6). The mean length was 96% (SD 29.6) (range 43 to 145), the width was 93% (SD 15.4) (range 67 to 114), the nail width was 85% (SD 9.9) (range 70 to 100).

There was no significant different outcome in the syndrome related thumbs versus the isolated cases, unilateral versus bilateral cases. Since all patients were operated relatively at a young age, the age of operation did not made a significant outcome.

A significant outcome was seen for function and subjective evaluation in the radial clubhand associated thumbs and for the functional score for the more severe Blauth group (Table 3). Patient/parent's estimation and surgeons subjective score, length, width and nail width were not significantly different in the different subgroups.

There is a significant correlation between the Percival score, the subjective questionnaire and the global evaluation of the surgeon and the patient/parent, but not with the objective description of the pollicised index (Table 4).

Table 2. Questionnaire for subjective evaluation

General satisfaction
Recommend operation
Do stranger notice
Limitations in ADL's
Eating normal
Aesthetic aspect satisfying
Button shirt or coat
Writing
Different shape of hand satisfying
Normal sensitivity
Hair combing
Ashamed of the hand
Satisfied about function
Thumb looks normal
Picking up things
Enough force
Use this hand preferentially

Discussion

Pollicisation means creating – making – a thumb. Severe hypoplasia or absence of the thumb has important effect of the overall function of the hand and the impairment resulting from it, is great, also in children. Since Buck Gramcko's publication [2], the surgeon's attitude to this problem has changed dramatically. Despite some modification the basic principles remain unchanged:

- Transposing the index finger on its neurovascular pedicle(s).
- Skeletal readjustment.
- Muscular stabilisation and rebalancing.
- Skin incision allowing to correct visualisation and creating a wide first web.

All these are necessary to create a functional and cosmetic acceptable thumb. Assessment of this function and the aspect are difficult, specially in younger children. The objective measurements are not always correlated to the patient's/parents' satisfaction.

We have chosen to highlight different aspects of the new thumb: function–cosmetic–satisfaction. In an ideal situation these should all be parallel to each other, but the reality however is different.

The reported series are few, mostly small and the outcome parameters are very different from each other, making comparative studies very difficult. Egloff and Verdan [9] studied 14 cases concentrated on sensibility, skin quality, mobility and possibility of opposition and concluded that the procedure gave satisfactory results. Manske and Carroll [5] reported one of the first series. Forty pollicisations in 33 patients. The procedures were done at a relatively old age (5.5 y on average). Appearance improved, the thumb was used to grasp larger objects and could maintain smaller objects. A long term outcome evaluation was done by the same author in 1992 [10]. From his group of 28 hands, he concluded that the mobility was 50% of the normal value, the gripping force was 21%, the pinch force was between 22 and 26% and handling objects was 22% slower. The use of the thumb was normal or modified in 84% of 14 defined activities. Larger objects were easier than smaller objects to handle. Age of operation was not influencing the outcome. Radial club hands did poorer than the other hands. Roper and Turnbull [11] reviewed 9 cases, found good sensibility and a 63% of power grip and 56% of pinch grip. In 1991 Percival et al. [7] established a method of assessment based on tip pinch, opposition, grasp, mobility, sensibility and aspect, all expressed in a numerical score. The same group [12] used this score for evaluation of their series of 30 pollicisations, 73% were graded good or excellent. In our series this is only 54%. They found better results in Blauth groups III and IV compared to Blauth group V. This could be confirmed by our survey. Kozin et al. [13] had similar results in their 14 operated hands in 10

Table 3. Summary data according to the radial club hand (RCH) associated thumb anomaly or according to Blauth's classification

Rad club	N	Percifal	N	Quest	Vas Surg	Vas Fam	Length
No RCH	14	16.1 (3.36)	16	69.25 (11.4)	8 (0.89)	7.5 (1.89)	94.1 (24.43)
RCH	8	12.4 (3.74)	8	56.5 (16.0)	7.6 (1.06)	7.75 (2.25)	97.5 (38.5)
P Value		0.027*		0.034*	0.4	0.8	0.8
Blauth < 5	10	16.7 (2.3)	10	67 (8.9)	8 (0.91)	8.1 (1.03)	103 (15.5)
Blauth 5	12	12.5 (3.8)	14	63 (17.5)	7.7 (1.00)	7 (2.65)	85.7 (38.5)
P Value		0.005*		0.5	0.5	0.2	0.2

Table 4. Correlation between different outcome measurements (* = significant $P < 0.01$)

Questionnaire	0.87*			
Vas Surg	0.72*	0.81*		
Vas P&P	0.76*	0.72*	0.75*	
Length	0.1	0.19	0.15	0.14
	Percival	Questionnaire	Vas Surg	Vas P&P

patients: 67% of gripping force, 60% key pinch force and 70% efficiency in manual dexterity. Knabl et al. [14] used a complex evaluation method to examine 6 patients with a pollicisation and found sensibility, strength and skill varying between 11 and 50%. Foucher et al. [3] were also disappointed of the reduced power of 27 pollicisations: 55% of normal pinch grip, despite the good sensibility, the growth and the high patient/parent satisfaction. They found that the new thumb was used in power grip but not for fine pinch. The surgeon's assessment was 6.5/10. In our series the surgeon's appreciation was higher 7.8. Based on these findings they modified the technique of skin incision, fixation of the metacarpal head and balancing the muscles. Staines et al. [15] confirmed in their series of 10 children with 12 operated thumbs, the reduced gripping force. They also used a questionnaire and functional tests to further evaluate the results. Parents satisfaction was high, handling small objects was difficult, the functional dexterity test was slower in operated hands, but the Jebsen hand function test was not different. Goldfarb et al. [8] reported an objectivation of the aesthetic outcome of the pollicised index fingers. They found in their series of 26 patients with 31 pollicisations an increased length (90% versus the normal 71% of normal controls) (in our series 96%). The VAS for the parent/patient was 7.3 (in our series 7.6) but markedly less for the surgeon 6.0 (our series 7.8).

Goldfarb et al. [16] and our group [17] studied the normal length of children's thumb. Goldfarb et al. [8] demonstrated that most pollicised index fingers were too long, but this was the length recommended by Buck Gramcko [6]. To aim at the level of the PIP of the middle finger seems not appropriate and a more shortening of the

index finger should perhaps be purchased, if this does not compromise function as suggested by Goldfarb et al. [8].

This series confirms most of findings of previous studies: the aspect and function is judged usually satisfactory, the length is too long, radial club hands and thumb aplasia have poorer outcome. We found a good correlation between different outcome evaluations, meaning that function and subjective evaluation are parallel, but that excessive length seems not to be that important.

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