



# Index Pollicization: A Report of 3 Cases and Literature Review

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## Abstract

Thumb hypoplasia is one of the common congenital hand deformities. It varies from slight hypoplasia to absent thumb. Thumb contributes about 50% of hand function, so severe hypoplasia or absence of thumb causes severe dysfunction. The modified Blauth classification is used to grade hypoplasia. Index pollicization is the best treatment option for type III B, IV, and V. Pollicization has been used over 40 years for treatment of thumb hypoplasia since first described by Buck-Gramcko in 1971. In this paper, we present 3 case reports of severe hypoplastic thumb treated with index pollicization.

**Keywords:** Index pollicization; Thumb Hypoplasia; Congenital Hand Deformity

## Introduction

Thumb hypoplasia accounts for about 15% of congenital hand deformities and is a condition of congenital under development of the thumb [1]. Thumb hypoplasia can range from slight hypoplasia to complete absence [2]. The modified Blauth classification is used to grade hypoplasia and also to guide treatment [3]. Severe hypoplasia or absence of thumb causes severe dysfunction of affected hand; due to over 50% of hand function is contributed by the thumb [4].

During examination of patient with thumb hypoplasia, syndromes or genetic disorders such as VACTERL (vertebral anomalies, anal atresia, cardiac anomalies, tracheo-esophageal fistula, renal agenesis and limb dysplasia), Holt-Oram syndrome, Fanconi anemia, CHARGE syndrome (coloboma, heart defect, atresia choanae, retarded growth and development, genital abnormalities and ear abnormalities) should be evaluated due to association with thumb hypoplasia.

In this report, we present clinical and functional outcomes of 3 patients operated due to severe thumb hypoplasia.

## Material and Methods

Between June 2009 and April 2016, three patients were operated due to thumb hypoplasia. Patients age at the time of surgery, affected side, sex, thumb hypoplasia classification and past medical history collected (Table 1) (Figure 1a, 2a,b, 3a,b). All of three surgeries performed under general anesthesia by same experienced hand surgeon (K.E.). A pneumatic pediatric tourniquet is placed on upper arm.

The modified Buck-Gramcko technique was used. After surgery, long arm splint was applied. Patients were discharged from hospital 2 days after surgery without any complication. Patients were followed with 2 weeks intervals until 8 weeks and monthly until 6 months. Kirschner wires and splint were removed at 4 weeks after surgery and patients enrolled a rehabilitation program.

## Results

Patients follow-up duration, pinch strengths compared with nonoperated side, opposition, length discrepancy between operated and nonoperated upper extremity were recorded (Table 2) and plain radiographs were taken (Figure 1b, 2d, 3d).

**Table 1:** Demographics of patients.

	Age (months)	Sex	Affected Side	Grade of Hypoplasia*	Concomitant Disease/Syndrome
Patient 1	12	Male	Right	Type III B	Scoliosis
Patient 2	30	Male	Right	Type IV	None
Patient 3	50	Male	Left	Type IV	VACTERL

\*According to Modified Blauth classification

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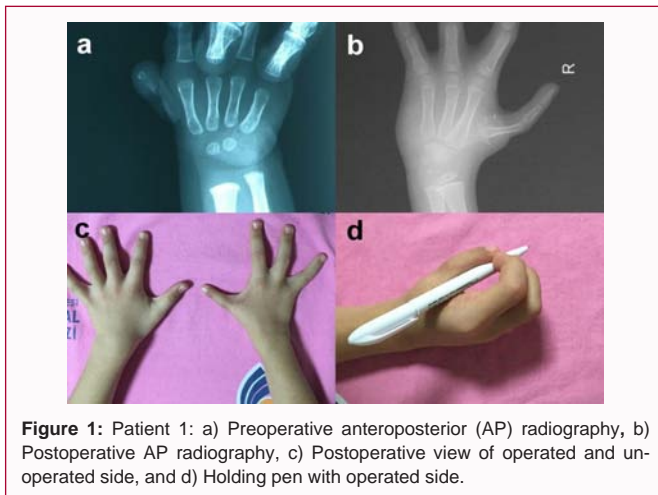
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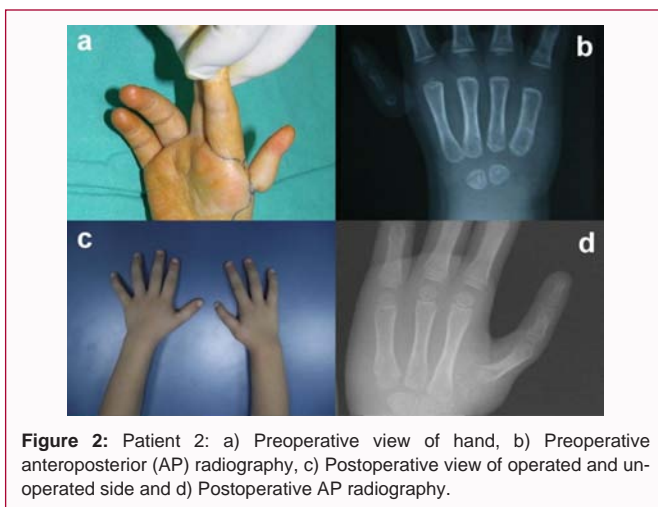
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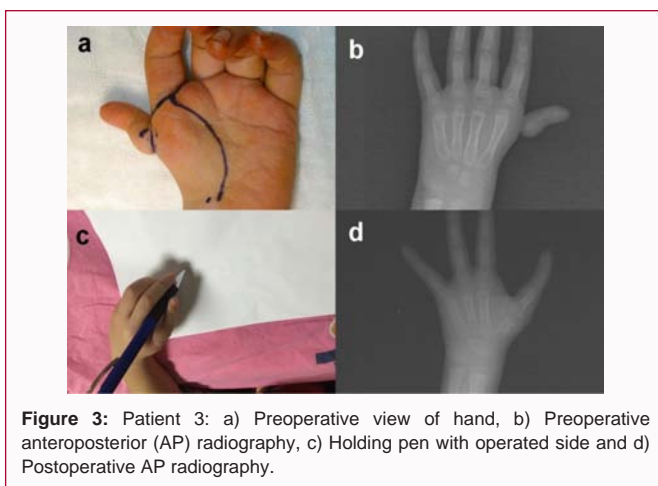
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**Figure 1:** Patient 1: a) Preoperative anteroposterior (AP) radiography, b) Postoperative AP radiography, c) Postoperative view of operated and unoperated side, and d) Holding pen with operated side.



**Figure 2:** Patient 2: a) Preoperative view of hand, b) Preoperative anteroposterior (AP) radiography, c) Postoperative view of operated and unoperated side and d) Postoperative AP radiography.



**Figure 3:** Patient 3: a) Preoperative view of hand, b) Preoperative anteroposterior (AP) radiography, c) Holding pen with operated side and d) Postoperative AP radiography.

There were no complications such as venous congestion, skin necrosis, infection, scar contracture in follow-up period.

All patients were able to use their operated hand to such as picking up a pencil, coloring, writing (Figure 1c,d, 2c, 3c). But parents of patients reported nonoperated hand of all three patients is dominant in daily activities. Parents of 3 kids reported their satisfaction with results of surgery.

**Discussion**

Due to contribution to hand function, severe hypoplasia or

**Table 2:** Results of patients.

	Follow-up duration (months)	Pinch strength (kg) operated/ nonoperated	Opposition	Length discrepancy (cm)
Patient 1	79	1/5, 3	8/10	1
Patient 2	70	1/5, 1	8/10	1, 5
Patient 3	11	0, 8/1, 3	10/10	None

agenesis/agnosia of thumb seriously impairs the hand function. Currently index pollicization is the most powerful technique for restore function of thumb, but it is a replica [4]. Although evaluation in techniques since first described by Buck-Gramcko [5], it is not possible reproduce all functions of thumb by pollicization due to unique and specialized components of thumb [6].

Pollicization is good option for type III B, IV, and V according to the modified Blauth classification [7]. Type I usually does not require treatment [3]. Type II and III A requires thumb reconstruction which is consist of stabilization of MCP, release of first web space and opponensplasty due physical findings [8,9].

Trist et al. [10] reported stability of new thumb after index pollicization. They evaluated thumb carpometacarpal (TMC) joint stability. They had union in 39 of 46 thumbs. There was stability in 37 thumbs. Pinch strength and ROM were reduced in TMC joint unstabil group, but not statistically significant. Grip strength was statistically higher in TMC stabil group.

After index pollicization, brain adapts it self and shows changes in sensorimotor cortex homuonculus in part of hand region. Manduch et al. [11] showed expansion in brain region that control the thumb in functional MRI after thumb reconstruction.

In our series, we do not have any complication but in literature, some complications have been reported. Perioperative complications such as skin necrosis, venous congestion, infection; postoperative complications such as scar contractures, redundant skin, cold intolerance could be seen after pollicization [12]. Goldfarb et al. [12] reported lost of pollicized digit due to venous congestion in their series of 78 patients.

There are other options for thumb hypoplasia such as toe to thumb transfer. Toe transfer is more complex procedure than pollicization. Toe transfer procedure requires vascular anastomoses and nerve coaptations. Also donor site may be require skin grafts [13]. Range of motion and growth of transferred toe is unpredictable [13,14]. Vilkki and Foucher et al. [15,16] reported 20 and 25 degree of extension deficit, respectively.

There are limitations in our study. Our study has small size of sample. We do not have preoperative photo of patient 1.

As conclusion, we believe index pollicization with modified Buck-Gramcko technique is a good treatment option for congenitally severe hypoplasia and absent thumb currently. Despite good functional outcomes pollicized digit is not a normal thumb and has functional deficiencies due to anatomical limitations.

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