

# Postoperative Growth in Radial Polydactyly: A Clinical Study

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**Purpose** This study was designed to evaluate thumb growth after surgical management of a duplicate thumb and investigate its developmental pattern.

**Methods** We compared the thumbs and index fingers of 486 normal children (aged 1–18 y) (group A) with 15 children showing radial polydactyly (group B). All duplicate thumbs were treated with excision of the radial thumb and reconstruction of the ulnar thumb. Radiographs of groups A and B were used to compute the thumb-to-index finger length ratio and width ratio, and the thumb-to-index finger phalanx length ratio and phalanx width ratio.

**Results** In group A, the length ratio, width ratio, phalanx length ratio, and phalanx width ratio did not change with age, and remained constant in males and females. In group B, after an average follow-up period of 41.0 months, the original findings were also similar to the final ratios. In group B, only the phalanx width ratio was obviously smaller than normal.

**Conclusions** A permanent developmental stability exists between the thumb and the index finger, even in patients with radial polydactyly. The development of the retained digit is not influenced by the ablation of the extra digit. (*J Hand Surg Am.* 2016;41(9):e273–e278. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)

**Type of study/level of evidence** Therapeutic IV.

**Key words** Catch-up growth, digit ratio, radial polydactyly, thumb.



**R**ADIAL POLYDACTYLY IS A COMMON congenital anomaly of the hand.<sup>1–4</sup> Several studies have reported its etiology and treatment, especially surgical techniques, which aim to improve thumb function and appearance. However, even after surgical reconstruction the treated thumb is still smaller than the normal. Postoperative thumb growth in patients

with radial polydactyly has been rarely reported.<sup>5,6</sup> To determine the growth pattern of the reconstructed thumb, we reviewed 486 normal children aged 1 to 18 years and 15 patients with radial polydactyly. The purpose of this study was to analyze thumb development in normal children and in patients with surgically treated radial polydactyly.

## MATERIALS AND METHODS

### Clinical materials

The study was conducted in accordance with the Declaration of Helsinki and approved by our Research Ethics Committee. This study included 2 groups. In group A, there were 486 normal children, 236 males and 250 females aged 1 to 18 years, visiting our hospital between April 2006 and February 2013 for physical examination and a “healthy child” assessment. All the children underwent radiological investigation of their hands, after parental request, for purposes of

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**TABLE 1. Participant Distribution by Age**

Age(y)	Number of Healthy Children	
	Male	Female
1	10	11
2	11	12
3	12	14
4	11	12
5	13	18
6	15	14
7	15	16
8	11	15
9	15	13
10	14	14
11	14	13
12	12	14
13	17	14
14	15	12
15	13	18
16	13	11
17	15	15
18	10	14
Total	236	250

establishing bone age. Generally, the radiographs were performed in an anteroposterior position of the left hand and were used to evaluate the development of the thumb in this study. None of the authors in this study had any direct contact with the parents or physicians performing physical examination of the children, before this x-ray examination. All the subjects were healthy with no history of disease affecting the hands. The results were considered as the control data. The total number of subjects by age is shown in Table 1.

In group B, there were 15 patients with radial polydactyly, including 11 males and 4 females. The right thumb was involved in 9 patients and the left in 6 patients. The median age at operation was 13 months (range, 4–55 months). The average follow-up period was 41.0 months (range, 12–81 months). There were 6 thumbs of Wassel type<sup>7</sup> IV, 1 of type V, 1 of type VI, 4 of type VII, and 3 of floating type. Cases with Wassel type I, II, and III deformities were excluded. All the thumbs were treated with excision of the radial thumb followed by soft tissue and bony reconstruction of the ulnar thumb. The reconstruction included, when applicable, repair of capsular structures of the metacarpophalangeal and carpometacarpal joint, relocation of the abductor pollicis brevis tendon, metacarpal osteotomy, and widening of the first web space with the

skin of the radial thumb. All the procedures were performed by a single surgeon. We typically preferred not to augment the reconstructed thumb with any additional tissues from the excised digit. In this group, standard anteroposterior x-rays of the affected hands were also obtained to measure the length and width of the thumb and index finger. This was done to allow calculation of the length and width ratios of thumb-to-index finger as an evaluation of thumb size. Radiographs obtained before surgery in 4 patients and approximately 1 month after surgery in 11 patients were used to obtain baseline measurements. At the final follow-up, the results of the last radiological examination were used to make post-treatment measurements.

### Measurement methods

All the measurements were obtained using a picture archiving and communication system.<sup>8</sup> The measurements were rounded to the nearest 0.01 mm using the system's measurement tool. We measured and calculated the thumb-to-index finger length ratio (LR) and width ratio (WR), the thumb-to-index finger phalanx length ratio (PLR), and the phalanx width ratio (PWR) at baseline and final follow-up.

The measurements were performed in the thumb and index finger in the following way: the length of the phalanx was measured from the distal phalanx tip to the middle of the proximal phalanx base. The finger length was measured from the distal pulp tip to the middle of the proximal phalanx base. If there was an ossification center, the phalanx and finger lengths extended to the ossification center base. The width of the phalanx was measured at the midpoint of the proximal phalanx and the finger width was measured at the same position (Fig. 1). All the measurements were performed by a single observer, who was blinded to the purpose of measurement and data analysis.

Even though the thumb was not in an anteroposterior position in these images, all the thumbs showed in the oblique projection, and this was used to evaluate the thumb size.

### Statistical analysis

The relative sizes of the thumb and index finger were presented as mean percentage  $\pm$  SD. In group A, Pearson correlation coefficient analysis was used to assess the relationship between age and thumb-to-index finger ratios. The differences of thumb ratios between the males and females were evaluated in group A using an independent-sample *t*-test. In group B, a paired-samples *t*-test was used to evaluate the differences between the original thumb ratio and the final thumb ratio. A one-sample *t*-test was performed

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