An On-Top-Plasty Reconstruction for Complicated Radial Polydactyly

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Abstract

Background: The clinical presentation of radial polydactyly can vary greatly. Careful planning and appreciation of the anatomic subtleties provides alternative surgical options to improve patient outcomes. **Methods:** We present a case of a well-formed accessory web space thumb and a hypoplastic primary thumb. **Results:** Rather than excising the accessory digit, we performed a spare-part, on-top-plasty reconstruction to replace the diminutive distal phalanx of the primary thumb. **Conclusions:** This novel case applied the principle of spare-part surgery to reconstruct a more aesthetic and functional reconstructed digit.

Keywords: congenital hand differences, hand surgery, on-top-plasty, thumb duplication

Introduction

Radial polydactyly occurs in between 1 in 1000 and 1 in 10 000 births and is the most common anomaly involving the thumb.² These duplications are often unilateral and sporadic, but may also have syndromic associations. Although relatively common, the clinical presentation of thumb duplications can vary. The method of surgical correction should be individualized with careful consideration of both bony and soft tissue differences, and classification system algorithms may aid in this process.^{6,8} In cases of an accessory thumb, reconstruction is usually simplified to resection of the supernumerary, smaller digit with stabilization of the larger digit.⁷ However, instances of variably hypoplastic anatomy between the 2 digits or congenital joint contracture warrant creativity to establish the most aesthetic and functional outcome. In these cases, injudicious resection of the accessory digit may preclude the use of these tissues to augment the reconstructed digit. Combining the 2 thumbs may result in better appearance, position, and length by using tissues that normally would be discarded. We present a spare-part, on-top-plasty procedure utilizing the distal accessory digit to augment thumb reconstruction.

Case Report

A 20-month-old male with history of Diamond-Blackfan anemia presented with a left accessory thumb in the first web space and a congenital interphalangeal joint contracture of the primary (radial) thumb. Physical examination demonstrated a dominant radial thumb of inadequate length

accompanied by a shorter accessory digit in the first web space. The primary thumb had a fixed flexion deformity at the interphalangeal joint, with marked distal atrophy and a diminutive nail. The accessory digit in the web space was well formed and had a more normal distal appearance and is sensate (Figure 1). The accessory digit moved freely with no bony or tendinous attachments to the adjacent thumb metacarpal. Radiographs confirmed the presence of a floating accessory thumb in the first web space (Figure 2).

Given the anatomy, neither the radial thumb nor the accessory digit alone could provide a satisfactory reconstructed digit. We sought to create a functional and esthetically pleasing thumb by taking advantage of the metacarpophalangeal joint of the radial thumb and the normal appearance of the web space accessory digit as an elegant on-top-plasty reconstruction. On-top-plasty was performed using a dorsal artery pedicled transfer of the web space accessory thumb to transfer to the proximal radial digit to create a single thumb of appropriate length, position, and appearance (Figure 3). Thumb innervation was preserved on the volar skin, and the osteotomy site was pinned for 6 weeks. The tourniquet time was 51 minutes, and total operative time was 104 minutes. At 8-month

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Figure 1. Twenty-month-old male with left accessory thumb in the web space and a small, immobile primary digit. Figure depicts the radial (a), volar (b), and dorsal (c) views of the hand.

Figure 2. Plain radiographs demonstrating preaxial polydactyly with a dominant radial digit and an accessory ulnar digit in the first web space, with 2 views of the hand demonstrating the bony anatomy.

follow-up, the thumb was well perfused with excellent position and favorable aesthetic result (Figure 4). The child was actively using the hand and thumb in play. He was able to oppose his thumb to all 4 digits with good overall thumb range of motion despite a stiff interphalangeal joint.

Discussion

Reconstruction of congenital hand anomalies is often difficult because ideal appearance does not always yield ideal function. Furthermore, the final outcome of a reconstruction is critical for normal childhood psychosocial development.⁵ In cases of an accessory or duplicated thumb, the type of duplication and the anatomy of the paired digits dictate the possible operative interventions.⁶ In the presented case, on-top-plasty seemed ideal because the radial thumb had a fixed flexion deformity and a dysplastic pulp and nail while the distal phalanx of the accessory digit appeared more like the contralateral thumb, with bulkier pulp, nail size, and better bone stock on radiograph. More extensive revisions of the radial digit interphalangeal joint might have improved its function, but the distal phalanx would have remained a poor match to his contralateral hand.

Multiple classification systems exist to describe thumb duplications, including the Wassel and Platt classification.¹⁰ Operations to correct thumb duplication are generally based on the level of duplication and the bony anatomy. For example, the smaller or more unstable of the digits may be removed and, if possible, the maintained digit can then be improved upon.^{7,9} Creative combinations have also been described, such as the Bilhaut-Cloquet procedure in which the duplicated thumbs are split and combined along the midline axis. This reconstructive method maintains the radial and ulnar collateral ligaments by performing a wedge resection with fusion of the lateral aspects from each thumb. Given the wide spectrum of deformities, however, these predefined techniques may not always consider special circumstances in the anatomy.

The “on-top-plasty” technique has previously been described as an alternative for reconstruction of the thumb

Figure 3. The ulnar thumb is elevated as a pedicle flap with a 1-cm dorsal skin bridge (asterisk).

Note. The radial digit is amputated at the midshaft of the proximal phalanx (arrow) to allow for bony fusion and preservation of the metacarpophalangeal joint (a). Two views of the viable digit after inset are shown (b and c).

Figure 4. Eight-month postoperative follow-up. Lateral (a) and palmar (b) views show that the digit is viable and stable. The child is able to use the hand in play and activities (c).

in both congenital and traumatic situations. This term was coined to describe the method of digit transposition using a distal portion of one digit to transfer to a neighboring digit to restore useful length and appearance.⁴ This maneuver was first described utilizing a neurovascular pedicle, but microsurgical techniques have also been successfully implemented.¹ Kelleher et al described a case series of on-top-plasty reconstructions for traumatically amputated fingers with good success.⁴ By applying the principles of pedicled on-top-plasty, these digits can restore pincer grasp by lengthening the digit and potentially improving the appearance of the hand. Kelleher et al also described a case of congenital bilateral thumb absence whereby they successfully performed on-top-plasty pollicization with the distal index finger transferred

to the thumb proximal phalanx.⁴ Interposition segment or joint transfers can also be an option if presented with thumb hypoplasia in the desired reconstructed digit. Foucher et al have reported interpositional toe joint transfers to improve length and stability in children with congenital hand differences who otherwise did not qualify for index finger pollicization.³

Conclusions

Creative use of spare parts in cases of congenital hand anomalies may enhance outcomes in situations when the anatomy does not indicate a standard surgical procedure. In the presented scenario, neither digit alone would have provided this patient with a normal appearing or functioning

thumb. Use of an on-top-plasty provided an elegant alternative which resulted in more appropriate final length, alignment, and appearance.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008 (5).

Statement of Informed Consent

Informed consent was obtained from all individual participants included in the study

Declaration of Conflicting Interests

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References

1. Cavadas PC. Microvascular free on-top plasty in multidigital amputations. *J Plast Reconstr Aesthet Surg*. 2007;60:720-723.
2. Dijkman RR, van Nieuwenhoven CA, Hovius SE, et al. Clinical presentation, surgical treatment, and outcome in radial polydactyly. *Handchir Mikrochir Plast Chir*. 2016;48:10-17.
3. Foucher G, Medina J, Navarro R. Microsurgical reconstruction of the hypoplastic thumb, type IIIB. *J Reconstr Microsurg*. 2001;17:9-15.
4. Kelleher JC, Sullivan JG, Baibak GJ, et al. "On-top plasty" for amputated fingers. *Plast Reconstr Surg*. 1968;42:242-248.
5. Kelley BP, Franzblau LE, Chung KC, et al. Hand function and appearance following reconstruction for congenital hand differences: a qualitative analysis of children and parents. *Plast Reconstr Surg*. 2016;138:73e-81e.
6. Ogino O, Tsuchida H, Kashiwa H, et al. Thumb polydactyly. *Tech Hand Up Extrem Surg*. 1999;3:278-285.
7. Ogino T, Ishii S, Takahata S, et al. Long-term results of surgical treatment of thumb polydactyly. *J Hand Surg Am*. 1996;21:478-486.
8. Tonkin MA. Thumb duplication: concepts and techniques. *Clin Orthop Surg*. 2012;4:1-17.
9. Wall LB, Goldfarb CA. Reconstruction for type IV radial polydactyly. *J Hand Surg Am*. 2015;40:1873-1876.
10. Wassel HD. The results of surgery for polydactyly of the thumb. A review. *Clin Orthop Relat Res*. 1969;64:175-193.