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Over 20-year follow-up of Miura reconstruction of cleft hand

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Abstract Several techniques have been described for cleft hand closure and web space reconstruction in patients with central deficiency; however, long-term documentation of results is rare. We present a 23-year follow-up of a patient who underwent the Miura procedure for a Manske type IIb cleft hand exhibiting long-term aesthetic and functional success. In addition, early skin flap necrosis and late web space contracture, which have been seen after the Snow-Littler procedure, did not occur in this case.

Introduction

Cleft hand deformities are characterized by a deficiency of the central ray with narrowing or syndactyly of the adjacent border digits creating a cleft in the center of the hand. Central deficiency of the hand was first described by Jan Jacob Hartsinek in 1770 and since then numerous attempts have been made to classify and explain the pathogenesis of this condition [1, 4]. The initial hypothesis proposed for cleft hand formation was a necrosis of mesenchymal tissues leading to a failure of formation [7]. Animal models have since demonstrated that a central deficiency in the apical ectodermal ridge leads to cleft hand formation [10].

Classification of cleft hand has been difficult because the central deficiency can vary from a mild soft tissue cleft with intact bony architecture to complete absence of digits. Although many classification systems have been proposed [5, 9, 14, 17, 12], the Manske and Halikis classification provides guidelines for treatment [6]. Manske and Halikis theorized that the primary functional limiting factor in children with cleft hand was the loss of thumb-index finger web space and, therefore, proposed a system based on this finding.

Adrian Flatt commented that a cleft hand is "a functional triumph and a social disaster" [2]. Early reports on surgical treatment suggested that the primary indication for surgery was for aesthetic rather than functional improvement [1]. However, a recent study evaluating postoperative function following the Snow-Littler procedure demonstrates functional improvement in Manske type IIb and III patients [11].

Multiple techniques have been described to address the web space contracture and the cleft associated with central deficiency (Snow-Littler [13], Miura [8], Ueba [15], and Upton [16]) but long-term follow-up is limited [8, 13, 15, 16]. We present a 23-year follow-up of a patient who underwent the Miura procedure for Manske type IIb (severely narrowed thumb index web space) cleft hand.

Case report

A 3-month-old female presented to the senior author (NFJ) with central deficiency of the right hand. Clinical exam revealed a V-shaped cleft between the index and ring fingers with constriction of the thumb-index finger web space and complete simple syndactyly of the ring and small fingers (Figs. 1a, b and 2). The child had no structural anomalies of the contralateral hand or the feet. She had no history of heart or

Type of study/level of evidence: Therapeutic IV

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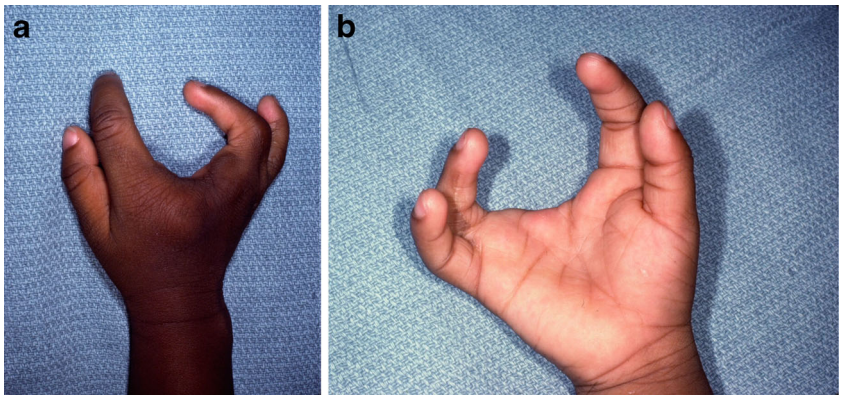

Fig. 1 **a** Dorsal and **b** palmar right hand with Manske IIb cleft hand

other systemic genetic conditions and no family history of hand deformity. She initially underwent release of the ring-small finger syndactyly at age 3 months and closure of the cleft with reconstruction of the web space using the Miura technique at age 14 months.

Operative technique

A linear skin incision was made along the cleft from the radial base of the ring finger to the ulnar base of the index finger and continued proximally with a curved incision around the base of the index finger (Fig. 3). The long finger metacarpal was excised at the metaphyseal flare as well as the transversely positioned proximal phalanx (Fig. 4). A transverse osteotomy was then created at the base of the index metacarpal which was translocated ulnarly and fixed to the middle finger metacarpal base with K-wire fixation (Fig. 5). Great care was taken to maintain the rotational alignment of the transposed index finger with the adjacent ring and small fingers during fixation with the K-wires. All incisions were closed primarily without tension.

Postoperatively, the hand was immobilized in a splint allowing immediate proximal interphalangeal (PIP) and distal interphalangeal (DIP) joint motion for 3 weeks. The index finger was then buddy-taped to the ring finger. All the incisions and flaps healed primarily without any evidence of skin necrosis. Bony union was present by 6 weeks following surgery. At 3 months, the child was able to oppose to the small finger (Figs. 6 and 7) and was able to perform activities of daily living appropriate for her age. At this time, her parents were very satisfied with the surgical reconstruction.

At 23-year follow-up, the patient was assessed subjectively for the ability to perform activities of daily living, satisfaction with results, and appearance. The patient is currently working full time in sales. She is able to perform all activities of daily living without limitations and is very satisfied with the appearance and result (Figs. 8, 9, and 10). Physical examination demonstrated that the index finger was axially aligned with the ring finger. She had flexion at the MCP, PIP, and DIP joints of the index finger so that she was able to touch the distal palmar crease. There was no malrotation of the index finger. She was able to oppose the thumb to the tips of all three fingers. She had a slight flexion contracture of 15° at the PIP

Fig. 2 PA radiograph of the right hand demonstrating the central cleft with a long finger metacarpal and a transversely oriented proximal phalanx

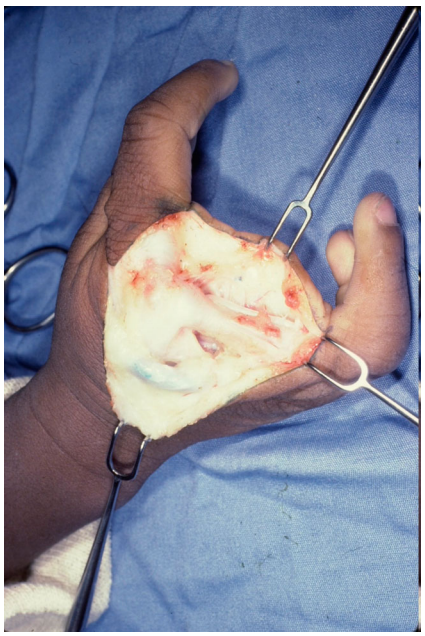

Fig. 3 Skin incision from the radial base of the ring finger to the ulnar base of the index finger and then continued proximally around the base of the index finger

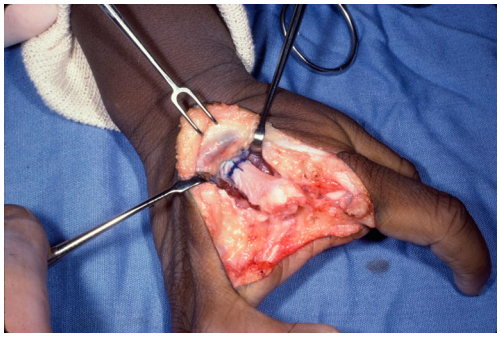

Fig. 4 Osteotomy of the long finger metacarpal as well as excision of the transversely positioned proximal phalanx

joint of the ring finger but could flex to 85°. Secondary web space reconstruction has never been necessary.

Discussion

Surgical closure of a central deficiency with restoration of the thumb-index finger web space can provide aesthetic as well as functional benefits to children with cleft hand [11]. The Snow-Littler procedure [13] has been the most common surgical technique to close the cleft and widen the thumb-index finger web space. There are only two reports of the results of the Snow-Littler procedure in the literature. They demonstrate good pinch strength and appearance, but ischemia and compromised healing of the skin flaps have been a problem [8, 11]. A second limitation to the Snow-Littler procedure is its difficulty. Meticulous technique and design are required to allow the cleft space flap to be properly transposed and inset without tension that may result in ischemia and subsequent flap loss. In contrast, the Miura technique [8] is a simpler design and surgical technique with less risk of flap necrosis while producing similar functional and cosmetic results.

Short-term results of the Snow-Littler procedure as well as the Miura technique demonstrate functional improvement in Manske type IIb and III patients as well as aesthetic improvement; however, there are very few long-term results or photographic documentations [8, 11]. Rider et al. evaluated 12 hands in 11 patients with a minimum of 4-year follow-up after undergoing the Snow-Littler procedure. They reported pinch strength from 50 to 90 % of the contralateral hand with 100 %

Fig. 7 Three-month follow-up showing opposition to the small finger

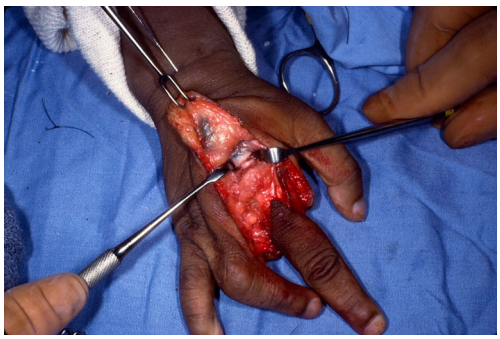

Fig. 5 Index metacarpal translocated and fixed to the long finger metacarpal base

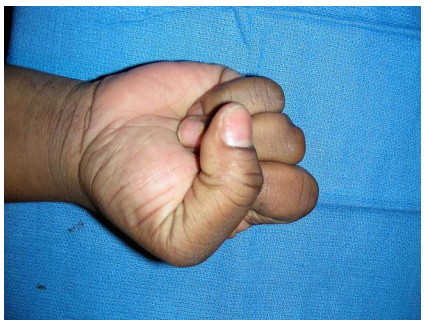

Fig. 8 A 23-year follow-up with full digital flexion without any malrotation of the index finger

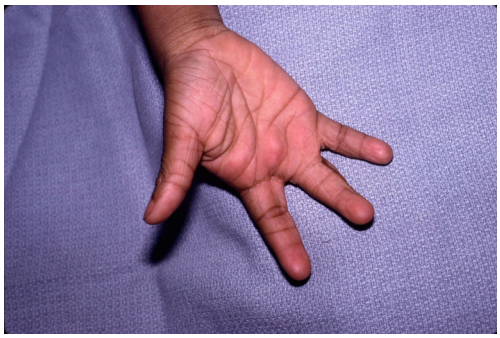

Fig. 6 Three-month follow-up showing excellent alignment of the index finger with the ring finger and a satisfactory thumb-index finger web

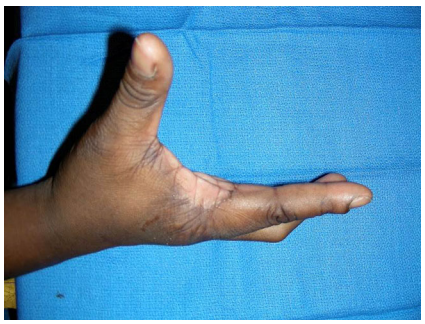

Fig. 9 Maintenance of the thumb-index finger web space at 23-year follow-up

Fig. 10 Twenty-three-year follow-up X-ray

parent satisfaction. Two of the 12 flaps developed ischemia but none progressed to major necrosis. Four patients (36 %) required secondary web space revision [11]. Glicenstein et al. reported 22 hands in 20 patients who underwent surgical treatment of cleft hand using either the Barsky, Snow-Littler, or Miura techniques. They treated seven patients with simple and complex cleft hands without syndactyly using the Miura technique with a minimum follow-up of 1 year. All seven patients were reported to have had "excellent global function and good thumb-index finger pinch." The aesthetic results of the Miura technique were assessed as good in three cases, acceptable in two cases, and not reported in two cases. Of the eight patients that were treated by the Snow-Littler technique, 38 % had flap necrosis (three out of eight) and only 25 % (two out of eight) had satisfactory thumb abduction at final follow-up [3]. The longest duration follow-up in their series was a 7-year follow-up of a Snow-Littler procedure [3]. No long-term outcomes or photographs of the Miura technique could be found in the literature.

In our case, the long-term result of the Miura technique demonstrates excellent patient satisfaction in both function and appearance. In addition, the surgical result was reliable enough to allow the patient to work in a position where her hand was in constant view of customers. The subjective and objective long-term results without the risk of early flap necrosis or late web space contracture suggest that the Miura technique is a reliable option for cleft hand closure and web space reconstruction.

Conflict of Interest John D. Beck declares that he has no conflict of interest.

Benjamin Chang declares that he has no conflict of interest.

Neil F. Jones declares that he has no conflict of interest.

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). Informed consent was obtained from all patients for being included in the study.

Statement of Informed Consent This report was a retrospective review and identifying information, including patient name initials, were omitted from pictures and subsequently informed consent was not required for the purpose of publication.

References

1. Barsky AJ. Cleft hand: classification, incidence and treatment. J Bone Joint Surg Am. 1964;46:1707–20.
2. Flatt AE. The care of congenital hand anomalies. St. Louis: CV Mosby; 1977. p. 265–85.
3. Glicenstein J, Guero S, Haddad R. Fentes medianes de la main. Ann Chir Main Memb Super. 1995;14:253–63.
4. Hartsinck JJ. Beschryving van Guiana, of de wilde Kust in Zuid-America, vol. 2. 1st ed. Amsterdam: Gerrit Tielenburg; 1770. p. 811–2.
5. Jones NF, Kaplan J. A new documentation system for congenital absent digits. Hand. 2012;7(4):391–9.
6. Manske PR, Halikis MN. Surgical classification of central deficiency according to the thumb web. J Hand Surg [Am]. 1995;20:687–97.
7. Miura T. Congenital hand anomalies, and their association with other congenital abnormalities. Hand. 1981;13(3):267–70.
8. Miura T, Komada T. Simple method for reconstruction of the cleft hand with an adducted thumb. Plast Reconstr Surg. 1979;64:65–7.
9. Nutt JN, Flatt AE. Congenital central hand deficit. J Hand Surg. 1981;6:48–60.
10. Ogino T. Teratogenic relationship between polydactyly, syndactyly and cleft hand. J Hand Surg (Br). 1990;15:201–9.
11. Rider MA, Grindel SI, Tonkin MA, Wood VE. An experience of the Snow-Littler procedure. J Hand Surg (Br). 2000;25(4):376–81.
12. Sandzen SC. Classification and functional management of congenital central defect of the hand. Hand Clin. 1985;1:483–98.
13. Snow JW, Littler JW. Surgical treatment of the cleft hand. In: Transactions of the fourth international congress of plastic surgery and reconstructive surgery. International congress series No. 174, Excerpta Medica, Amsterdam, 1967:888–893.
14. Tada K, Yonenobu K, Swanson AB. Congenital central ray deficiency in the hand—a survey of 59 cases and subclassification. J Hand Surg. 1981;6:434–41.
15. Ueba Y. Plastic surgery for the cleft hand. J Hand Surg [Am]. 1981;6:557–60.
16. Upton J. The surgical approach to the cleft hand. In: Saffar P, Amadio PC, Foucher G, editors. Current practice in hand surgery. London, Martin Dunitz 1997. p. 421–428.
17. Watari S, Tsuge K. A classification of cleft hands, based on clinical findings. Theory of developmental mechanism. Plast Reconstr Surg. 1979;64:381–9.