Reconstruction of the First Web Space in Symbrachydactyly Using the Reverse Radial Forearm Flap

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Purpose: To present a new approach for the reconstruction of severe first web contractures using a distally based reverse radial forearm flap in symbrachydactyly patients.

Methods: This study included 6 hands in 5 patients. Subjective evaluation included appearance, parent satisfaction (and patient satisfaction when appropriate), and ability to perform daily activities such as thumb-index grasp and pinch at follow-up evaluations. We measured the angle between the first and second rays using a goniometer at maximum radial abduction, and pinch and grasp strengths were evaluated as an objective assessment.

Results: The average follow-up period was 2 years. All parents and patients were happy with the aesthetic appearance. They were completely satisfied in their daily living activities. The average first web angle measurement was 56°. An average of 39° of improvement of web measurement was achieved. For the unilateral 4 patients, the average pinch strength measurement was 80% of the normal contralateral hand and the grip strength was 75% of the normal contralateral hand.

Conclusions: The reverse radial forearm flap was found to be a safe and simple method in the reconstruction of severe first web contractures in symbrachydactyly patients. This method provided good coverage of appropriate thickness and skin quality, and supple soft tissue that filled the first web space. (J Hand Surg 2007;32A:162–167. Copyright © 2007 by the American Society for Surgery of the Hand.)

Type of study/level of evidence: Therapeutic IV.

Key words: Symbrachydactyly, first web space, radial forearm flap.

Symbrachydactyly is described as syndactylous fingers combined with short fingers. The common feature of this congenital anomaly is the unilateral finger reduction that occurs mainly in the central finger rays, extending to the small finger and thumb, accompanying complete or incomplete cutaneous syndactyly. In severe forms, 1, 2, or all central finger rays may be absent, forming a gap; or the fingers may be gradually reduced, leaving only bud-like fingers.[1–6] The thumb is affected least frequently with an adduction contracture. Because adequate breadth of the first web space is critical for normal hand function, satisfactory pinch action, grip, and prehension often are severely limited in adduction contractures seen in patients with symbrachydactyly.[5,7,8] Most investigators agree that z-plasty techniques are appropriate for mild contractures; however, there is no clear consensus regarding the appropriate management of severe contractures of the first web. Alternative treatments such as skin grafts, digit removal or transposition, and some local flaps, such as local transpositional flaps, prepared from dorsum or palmar side of the hand have been reported in the literature for severe first web contractures in symbrachydactyly. These flaps were either applied solely or together with Snow-Littler procedures.[2,7,9–12]

Our experiences in inadequate primary corrections or recurrent contractures in severe first web contractures and syndactylies between the thumb and index finger in symbrachydactyly patients led us to use a reverse radial forearm flap (RRFF) to reconstruct the first web space in patients with symbrachydactyly.

Materials and Methods

This study included 6 hands in 5 patients (3 girls, 2 boys; 2 right, 2 left hands, 1 bilateral). The average

Figure 1. An 18-month-old child with symbrachydactyly.

age of the patients at the time of the first surgery was 2 years (range, 1–3 y). Two patients presented with unilateral finger reduction accompanying incomplete cutaneous syndactyly (Fig. 1), 2 with absent double central finger rays associated with thumb index syndactyly (Fig. 2), and 1 bilateral involvement. There were 3 first web syndactylies and 3 severe first web contractures. One previous surgery in 3 hands and double surgeries in 2 hands were noted, with various releasing techniques before the final reconstruction. In 1 patient the reconstruction of the first web with the RRFF was performed primarily.

Surgical Technique

Because an essential prerequisite for using this flap is to show adequate collateral flow to the hand after interruption of flow through the radial artery, the Allen's test was performed in all patients before the surgery. With this test, we could assess the blood supply to the hand via the ulnar artery, which was normal in all patients.

Under general anesthesia and pneumatic tourniquet, a linear palmar incision that passes through the first web to the dorsum of the thumb is made to release the web space. Specific incisions may be used to release the syndactyly in the first web, keeping in mind the potential anatomic abnormalities of the web such as tight extensions of the palmar aponeurosis, rigid fascia of the adductor pollicis and the first dorsal interosseous muscles, direction of the princeps pollicis artery, tight fascial bands between the metacarpals, and limited mobility of the thumb carpometacarpal joint. Maximal web release is achieved as abnormal tight structures are isolated and incised. In patients with an absent third ray, the index finger with its metacarpal may be transferred to the remnant of the middle metacarpal, similar to a Snow-Littler procedure,[12] if more deepening and widening of the first web is needed.

A tailored skin flap large enough to cover the defect then is outlined on the radiovolar surface of the midforearm, marking the radial artery as its axis. The dissection encompasses the deep fascia, ensuring that the radial artery and fascial plexus are included in the flap, as in a fasciocutaneous flap. The fascia is incised circumferentially larger than the skin incision. The superficial radial nerve and branches of the lateral antecubital nerve are preserved. The radial artery and its venae commitantes are ligated and transected at the proximal end of the flap, and the flap is elevated on its distal pedicle, leaving behind the exposed muscles and tendons covered with paratenon. At this point, the tourniquet is released to assess the viability of the flap and the hand. The radial artery was not reconstructed in any patient.

The flap then is transposed onto the first web. If the index ray is relocated to widen the first web as in the Snow-Littler procedure, thus creating a larger dorsal defect, the flap is transposed from the dorsal side (Fig. 3). But if a first web defect is more prominent palmarly than dorsally, thus creating a larger palmar defect, the flap is transposed from the palmar side (Fig. 4). The donor defect is closed either primarily (3 hands) or with a small full-thickness skin graft taken from the groin region (3 hands) (Figs. 3, 4).

Subjective evaluation included appearance, parent satisfaction, patient satisfaction if the patient is old enough, and the ability to perform daily activities such as thumb-index grasp and pinch at follow-up

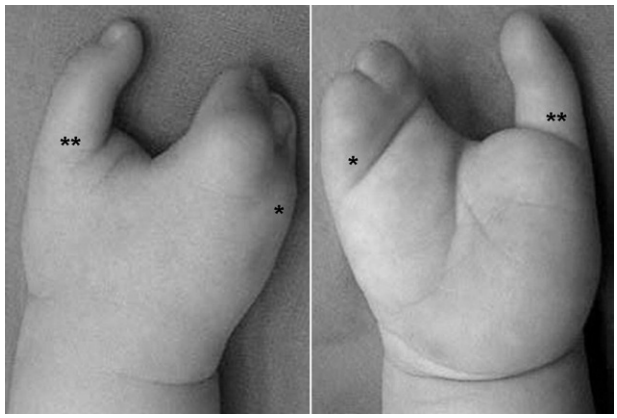

Figure 2. Dorsal and volar photographs of a 1-year-old patient with symbrachydactyly. A thumb (*) index syndactyly with a large gap is visible in the central finger rays associated with an almost-normal appearance of the small finger (**).