THE CORRECTION OF SIMPLE SYNDACTYLY

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Syndactyly is by no means a rare condition; it occurs in 1 in every 2,000 - 2,500 births.[1] The syndactyly may be simple or complicated. Commonly only the skin is involved, but there may be associated digital anomalies such as ectrodactylia (partial absence of a digit), brachydactylia (abnormal shortness of the fingers), and polydactylia (more than the normal number of fingers or toes). Rudimentary extra parts may be present. Associated with the fusion of the skin may be synostosis and synonychia (fusion of the finger nails). In 50% of cases both hands are involved and in 35% the toes are involved as well. In complicated cases the skin involvement is often a minor problem in relation to the bizarre skeletal deformities found.

In the aetiology of this condition there is no doubt that heredity plays a role — in as many as 80% of cases according to some authorities and as few as 20% according to others. The part played by environmental factors is less certain and, as with the deformities of cleft lip and palate, experimental syndactyly has been produced in mice by irradiation during the early period of pregnancy or by anoxia in the 2nd - 7th week of gestation.

Certain problems face the surgeon in a case of simple syndactyly, the most important of which is the shortage of available skin. No proposed procedure can overlook the fact that the skin area between the fingers of the average child aged 2 years is equivalent to 7·5 sq. cm. We must, therefore, provide skin cover; few, if any, cases of

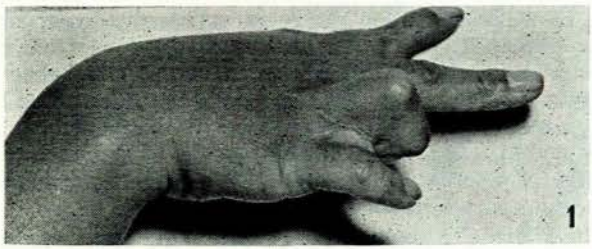

Fig. 1. Bilateral syndactyly. Method of repair unknown. Illustrates the palmer contraction of the fingers and the phenomenon of 'creep' of the web.

syndactyly can be corrected without skin grafting of the exposed surfaces. The next problem is that of contracture, for a simple splitting of the web with insertion of a skin graft almost inevitably leads to linear contracture on the palmar surface of the graft, with resulting flexion deformity of the fingers (Fig. 1).

Where adjacent skin-grafted surfaces (such as two fingers that have been divided) meet at one point, in this case the web, there is a tendency for this web to creep distally and impair the normal abduction of the fingers from each other. The only method of correcting this is to use some form of bridle flap across the apex of the web to prevent this distal creep.

Finally, we should aim for as normal an appearance as possible; so full-thickness skin grafts should always be used.

Previous Approaches to the Problem

At first the struggle was to prevent reunion between the divided fingers. Some foreign material was kept between the fingers and with our present-day knowledge on the fibrosis of exposed surfaces with slow epithelization from the edges it can be seen that this was doomed to failure.

Rudtdorffer[2] (1810) used a seton to get an epithelial lining at the web and then separated the fingers. This helped to prevent creeping of the web, but it did not counteract the contraction of the surfaces that were left to heal by fibrosis and epithelization.

Since then attempts to solve the problem have centred around operations designed to cover the exposed surfaces—Didot[3] (1849) and Faniel[4] (1911) with flaps, and Kanavel[5] (1932) with a skin graft; and around attempts to form a commissure with triangular and rectangular flaps—Zeller[6] (1810), Diffenbach[7] (1834), and Norton[8] (1881). Norton proposed interlocking of two triangular flaps at the web, but when this is done the web is found to be vertical and has not got the normal dorsal to palmar slope.

More recently, Cronin[9,10] pointed out that all contractures arose from the straight incision on the flexor surface and that the dorsal incision did not cause any trouble. It is a basic principle that a broken- or staggered-line closure of the skin will not contract in the way a straight-line closure will. It therefore seemed logical to him that if this straight line on the palmar surface could be broken up with a series of Z-plasties at the time of the operation these contractures could be avoided. If, at the same time, a large dorsal flap were used to form the commissure or web, then one could avoid the creeping phenomenon seen where only a skin graft lines the exposed surfaces.

A combination of these two procedures, with full-thickness grafts to the sites that remained uncovered, would seem to form the ideal operation, the ideal being a procedure that will give the child a completely normal function and a cosmetic appearance that, in time, will be barely distinguishable from normal.

Time to Operate

Below the age of 18 months the fingers are very small, soft and flexible. At this age the child keeps his fingers flexed most of the time and movement is much more

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limited than in rather older children. The hands are pudgy and there appears to be more subcutaneous fat. Therefore, it would seem that the ideal time to correct the deformity of syndactyly would lie between the ages of 18 months and 3 years.

OPERATIVE TECHNIQUE

The hands and the abdomen are prepared with 'phisohex' solution the day before operation and wrapped in sterile towels. At operation the hands and abdomen are again cleaned with phisohex, and the nails of the fingers trimmed and the space under the finger-nails painted with a weak solution of iodine.

The vessels of the arm are emptied with an Esmarch's bandage and a pressure-cuff tourniquet is applied to the upper arm.

The lines of incision are marked on the fingers with a Bonney's-blue solution (Figs. 2 and 3); we find it makes the procedure easier if, after marking the Zs on the dorsum of the web, a very fine needle is dipped in Bonney's blue and passed through the web in the centre of the triangle to assure accurate imbrication of the flaps. A large

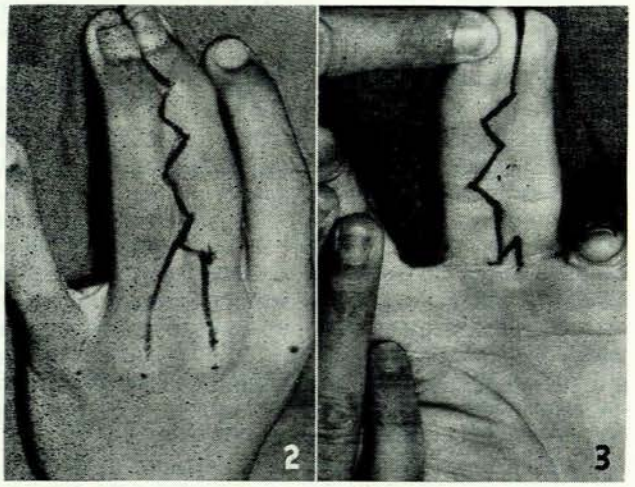

Fig. 2. Dorsal aspect of the hand, showing pre-operative markings. Notice the large dorsal flap.

Fig. 3. Palmar aspect of the hand, showing pre-operative markings.

dorsal flap is outlined, extending two-thirds of the distance between the metacarpo-phalangeal joints and the proximal interphalangeal joints. From this point the zig-zag line is made, *keeping to the radial finger on both palmar and dorsal surfaces.* These interlocking flaps will cover the radial aspect of one of the divided fingers with skin that carries normal sensation. This is important because the thumb comes into contact with the radial surface of each finger in normal actions and the ulnar surface of the fingers play little part in the sensory appreciation of objects.

These flaps are then raised and the division is started from the tips of the fingers (Fig. 4). Many of these cases of syndactyly show bony union of the terminal phalanges, which one may have to divide with a fine pair of bone cutters before proceeding with the dissection proper.

Experience with these cases shows that a clear plane of dissection can be found between the fingers which is only interrupted by a few inter-linking veins. These are caught at the time of dissection and tied with 6/0 catgut.

The dissection is carried to the bifurcation of the neurovascular bundles, but it is certainly not necessary to divide the deep transverse ligament as described by some authors.

The hand is now wrapped in a damp abdominal swab and the tourniquet is released. Bleeding vessels are not caught at this stage, for much of the bleeding is due to reactive hyperaemia and there is always the danger of damaging the neurovascular bundles with indiscriminate bites of an artery forceps.

The area of full-thickness graft required is estimated and this is marked on the abdominal wall in a transverse direction on the left side below the level of the umbilicus. The area is infiltrated with 1 : 300,000 adrenaline solution, and 7 minutes are allowed to elapse before starting dissec-

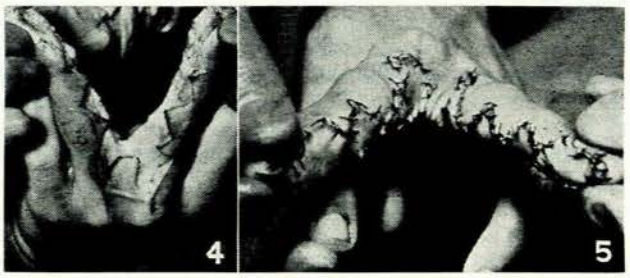

Fig. 4. Dissection completed (same case as in Figs. 2 and 3).
Fig. 5. At completion of operation (same case as in Fig. 4). Notice: (1) The normal appearance of the web. (2) The interlocking Zs of normal skin on the radial aspect of the ring finger. (3) The full-thickness graft on the ulnar aspect of the middle finger. (4) The full-thickness graft at the end of both fingers. There was a synostosis of the terminal phalanges present in this case.

tion. This ensures a bloodless field. During this time the hand, wrapped in a wet abdominal swab, has been held up by the assistant and the period of reactive hyperaemia has passed. The layer of fat is now dissected from the under surface of the full-thickness graft and the piece of skin is divided into as many fragments as necessary to fill the exposed surfaces of the fingers. The interlocking Zs on the radial side of the ulnar finger are next sutured with 6/0 black silk, and then the full-thickness grafts are sutured into position also with 6/0 black silk (Fig. 5).

The child's hand is then cleaned with saline solution and the fingers covered with neomycin ointment. The sutured fingers are dressed with a 1-inch gauze plug soaked in acriflavin emulsion applied lightly around the fingers. Cottonwool soaked in acriflavin emulsion is then used to separate the fingers and to form a large pad in the palm of the hand. The hand is now wrapped in cottonwool and immobilized with a crepe bandage, which must not be applied too firmly; each succeeding turn of the bandage increases the pressure, which may produce a dangerous constrictive effect on the hand and fingers.

The hand, forearm and upper-arm are immobilized with a light plaster-of-paris splint to prevent the child tearing the underlying dressings. It is advisable to immobilize the

arm with the elbow bent to a right-angle and to take the plaster-of-paris splint above the elbow; these children usually manage to extricate themselves from a below-elbow splint with consummate ease. The dressings are left untouched for 10 - 14 days, and then the plaster-of-paris splint is removed under general anaesthesia and the sutures are removed from the fingers.

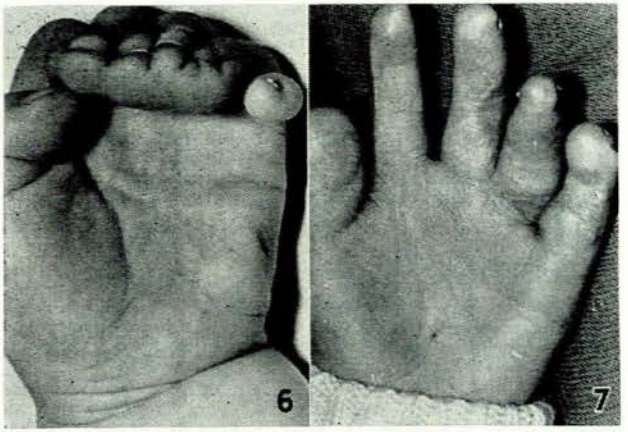

Fig. 6. Pre-operative picture of a severe case of simple syndactyly with polydactylia, synostosis and synonychia.
Fig. 7. Postoperative view of same case.

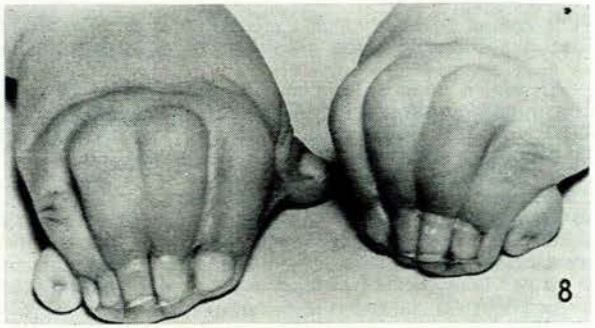

Fig. 8. Pre-operative view of dorsal aspect of the hands.

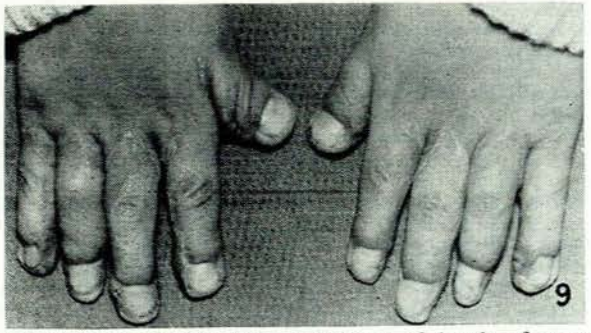

Fig. 9. Postoperative view of dorsum of hands of same patient as in Fig 8.

The original dressings, with gauze plug, cottonwool, and plaster of paris, are repeated and left in position for another 14 days. This second splint can be removed without anaesthesia, but the child may be sedated if necessary. No further dressings are then necessary.

If the operation has been successful, no splinting and no physiotherapy are necessary, for contraction of the zig-zag scars is not possible and the normal exploring hands of a child will provide all the movement necessary for the fingers (Figs. 6, 7, 8 and 9).

Where more than two fingers are involved in the webbing it is wise to avoid exposing both sides of one finger. It is advisable to arrange the operations so that only one side of any one finger is exposed at one time. No complications of this type have been experienced in the author's series, but two cases have been seen where a finger, exposed on both sides by the dissection, has suffered damage to its vascular supply and been lost.

CONCLUSIONS

In syndactyly, as in so many congenital deformities, the era of casual surgery has gone. The affected child is entitled to a perfect, functional and cosmetic result, and in the author's opinion one of the safest methods of achieving this is by applying the technique described by Cronin[9] in 1943.

A child's tissues heal rapidly and respond well to practised and gentle surgery exercised with skill and patience. A child deserves no less.

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