

CORRECTION OF DEFORMITIES FOLLOWING DEEP BURNS ON EXTENSOR SURFACE OF THE HAND

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SUMMARY

Postburn contractures on the extensor aspect of hand produce crippling deformities. The deformities produced vary from extension contractures with or without associated web contractures, scar syndactyly, non-healing ulcers, disrupted extensor mechanism, contractures of musculotendinous units and capsular ligaments. Stiffness and/or subluxations of joints further complicates the problems. Release of contracture, skin grafting, judicious splintage and physiotherapy has been the sheet-anchor of treatment. With this regime it has been possible to restore near normal function in majority of the cases at our centre.

Extension contractures may be mild and limited to fingers, webs, metacarpophalangeal joints, or may be more severe and associated with dense adherent scars, non-healing indolent ulcers, disrupted extensor apparatus and stiff, ankylosed or subluxated joints. There may be associated abnormalities in the nails of the fingers.

Principles of Treatment

1. Excision of scar and release of contracture.
2. Resurfacing the resultant raw area with split skin graft.
3. Prevention of skin graft contraction and recurrence of deformity.
4. Active physiotherapy to prevent stiffness and encourage mobilisation of joints and restoration of function.

Time of Treatment

Early surgical treatment is recommended to restore normal position of fingers and function of the hand and prevent development of secondary deformities of soft tissues i.e. musculotendinous units, bones and joints (Fig. 1 and 2). However in infancy and early childhood treatment may be deferred until the age of 5 years

when the child becomes more co-operative and understands the use of splints in the post-operative period (Fig. 3 and 5).

Operative Technique

It comprises excision of scars including non-healing ulcers by dissecting through a plane superficial to the extensor tendons (Fig. 5 and 6). If the scar is adherent it may be prudent to leave a slice of adherent scar rather than excise it exposing the tendons, which would not accept a skin graft and thereby pose difficult problems. Multiple incisions may be given to release web contractures (Fig. 7) to achieve full correction and restore the transverse arch and full flexion of fingers at M.P. joints (Fig. 8 and 9). First web has to be fully released to permit full abduction and flexion of the thumb. It may necessitate multiple incisions over the fascia covering the first dorsal interosseous muscle. In infants and younger children when fingers are fused (scar syndactyly), limit your procedure to excision of scar on the dorsal aspect of fingers and hand avoiding separation of fingers except the thumb, so that initial release produces a mitten hand (Fig. 10 and 11). This is especially indicated where full correction of the deformity cannot

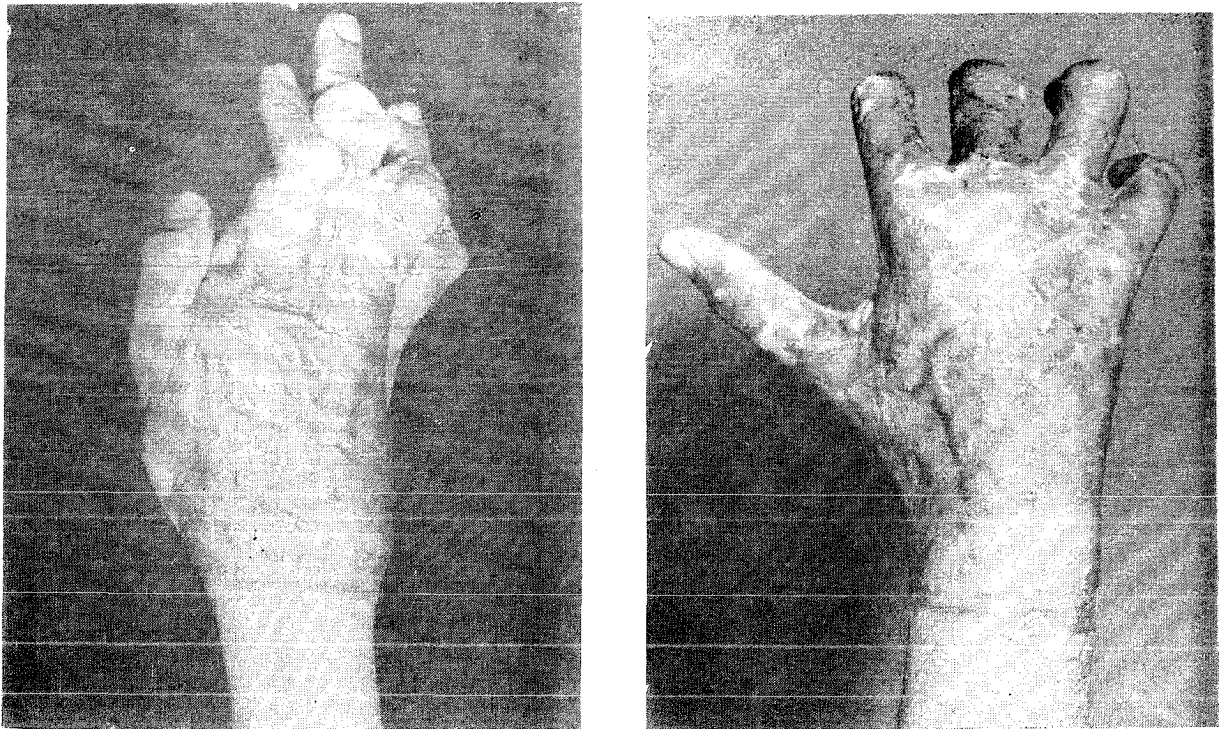


Fig. 1-2. Pre-operative and post-operative follow-up photographs of a patient with a contracting hypertrophic scar on dorsum producing extension contracture of the hand, including finger webs, scar syndactyly and damaged middle slip of extensor apparatus.

be achieved because of associated secondary contracture of collateral and capsular ligaments, musculotendinous units and joint subluxation.

The individual fingers are separated after skin grafts have settled and deformity has been fully corrected by the use of splints (Fig. 13). The whole dissection is carried out under a tourniquet which is deflated after release of contracture to secure any major bleeders and is then reapplied to suture the split skin graft over the resultant raw area. The first dressing is changed on the 6th post-operative day and after ensuring complete take of the graft a well moulded Plaster of Paris splint is applied and retained in place by a mild pressure dressing. This is maintained for three weeks by which time the skin graft consolidates and then is followed by wearing of specially designed static (Fig. 12) and dynamic splints in succes-

sion as required to prevent skin graft contraction and recurrence of the deformity. Splints are worn for 8 to 9 months.

Management of Secondary Deformities

1. *Contracture of musculotendinous units and capsular ligaments:* These are corrected by the judicious use of static and dynamic splint after the skin grafts have consolidated. The static splint comprises a thin aluminium sheet or plastic which is cut and moulded to conform to the flexor aspect of the fore-arm, wrist and hand, with the wrist in dorsiflexion and bent at the level of proximal palmar crease to facilitate flexion of fingers at all joints. A 1 cm thick foam rubber is applied on the graft on the dorsum and tied in place by an elastic crepe bandage to exert moderate pressure on the skin graft and fingers. The fingers are pressed down against the splint.

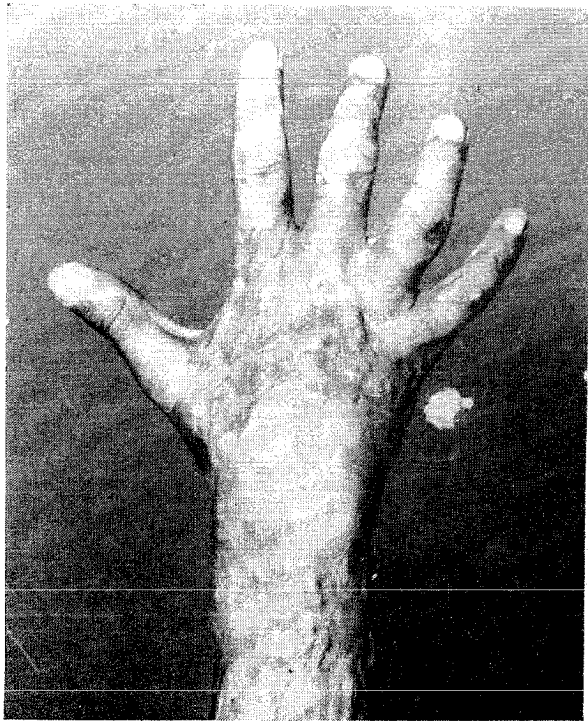
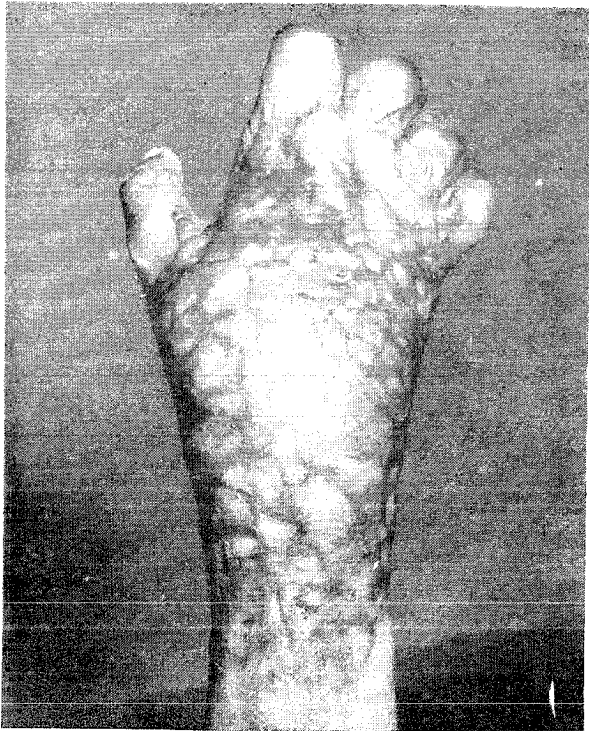


Fig. 3-4. Pre- and post-operative follow-up photographs of a child with a diffuse contracting hypertrophic scar on dorsum of hand producing extension contracture and involvement of 1st to 4th web.

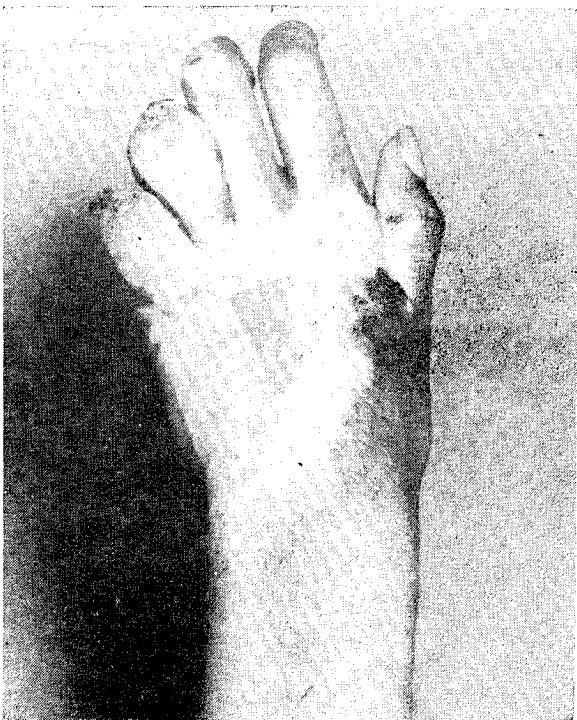


Fig. 5-6. Pre-operative photographs with extensive scarring on the dorsum of hand.



Fig. 7. Post-operative after excision of scar tissue and contracture release of 1st web space.

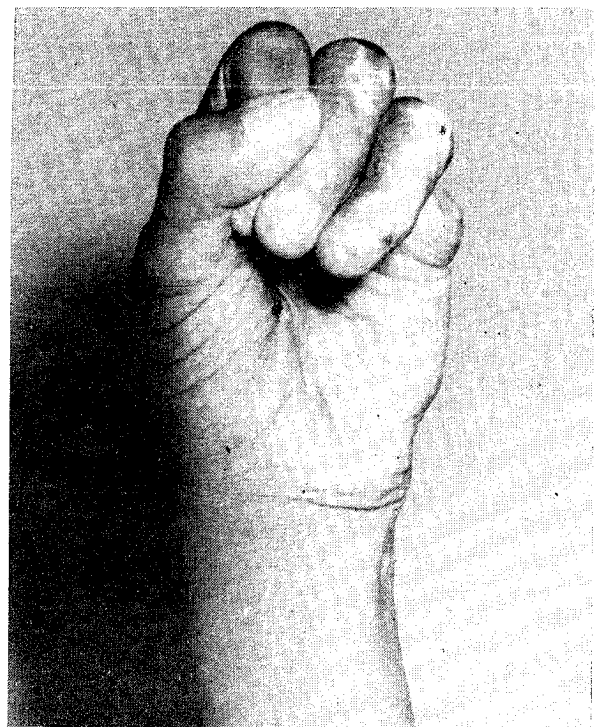
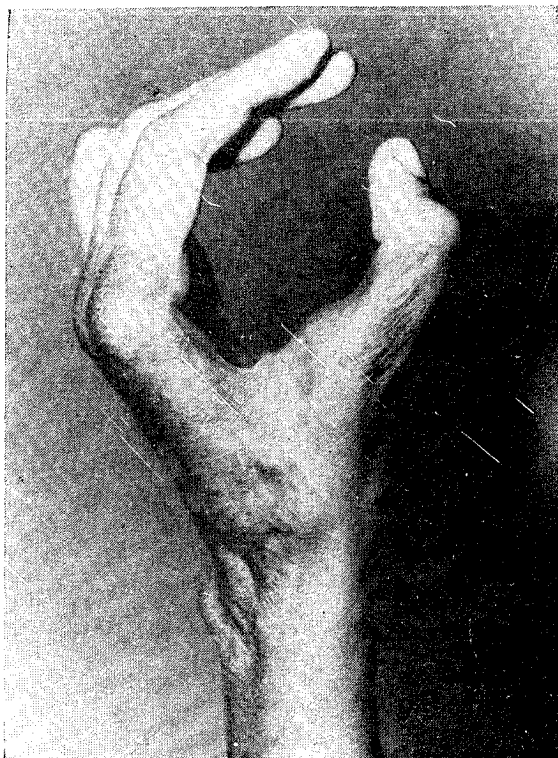


Fig. 8-9. Post-operative functional result.



Fig. 10. Pre-operative photograph of a child with gross extension contracture of hand, with web contractures, scar syndactyly involving all fingers and subluxation of fingers at metacarpophalangeal joints.



Fig. 11. After release of contracture, partial correction of deformity and production of a mitten hand.

Continued pressure on the graft and consequent downward tension on the fingers stretches the contracted musculotendinous units gradually. This is continued with the pressure being adjusted from time to time until full correction i.e. flexion at M.P. joint and I.P. joints is achieved. The first web requires special attention and is corrected by applying continuous compression over the graft in this area with a foam rubber of adequate size with abduction of the thumb and maintained by a moderately tight crepe bandage. After achieving full correction by static splints, a dynamic splint is applied to maintain corrected position, permit active and passive movements.

Capsulotomy of collateral ligaments which are often contracted in such cases has not much role. Capsulotomy alone does not permit flexion at M. P. joints because of resistance offered by

the contracture of strong extensors. Judicious use of static splints however stretches these ligaments gradually to normal dimensions precluding the need of capsulotomy.

2. *Subluxation of metacarpophalangeal joints:* This is not an uncommon accompaniment of severe degree of extension contractures of prolonged duration and is associated with contracture of musculotendinous units. In such cases full correction of the deformity is seldom obtained at primary operation. By the use of static splints tailor made to achieve gradual stretching of accompanying contracture of musculotendinous units and capsular ligaments, the subluxation is gradually reduced and fingers are brought into flexion. Having achieved flexion static splint has to be maintained for a further period of few weeks until the tendency of M.P. joints to subluxate disappears. After that the patient wears dyna-



Fig. 12. After use of static splints and external compression to correct secondary deformities i.e. musculotendinous contractures capsular ligament contractures and incompletely reduced subluxation at M.P. joints.

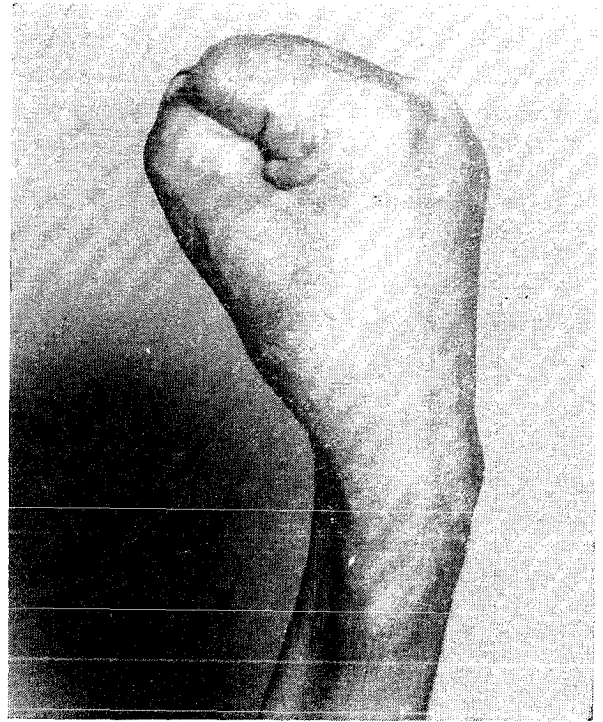


Fig. 13. On follow-up 5 years later after separation of fingers and restoration of full function.

mic splints (Fig. 14, 15, 16 and 17).

3. *Stiff and ankylosed finger joints:* The small joints of fingers especially P.I.P. and D.I.P. joints become stiff and ankylosed following disruption of extensor mechanism on the dorsum of fingers, exposure of the joints and ensuing sepsis. This is always associated with scars on the dorsum. The joints may become stiff in extension or in varying degrees of flexion. During the primary operation after the dorsal scar is excised the finger joints are manipulated and brought to their functional position i.e. 50° - 60° flexion at P.I.P. and 15° flexion at D.I.P. joints, and the raw area is grafted. If the joints have a tendency to revert to their original position, the corrected position is maintained or further correction is done by static splints after grafts have consolidated. Useful function can generally be restored if M.P. joints are mobile. In stiff joints energetic physiotherapy

restores some degree of movement of active flexion which may be advantageous in improving function. If however there is complete ankylosis of finger joints both P.I.P and D.I.P. and operative manipulation is not helpful then arthrodesis of joints in functional position is done after skin grafts have settled.

4. *Disruption of extensor apparatus:* This is not uncommon in deep burns on extensor surface. Middle slip of the extensor mechanism is commonly disrupted over the P.I.P joint producing Boutonniere deformity. As this is often associated with adherent scar on the dorsum and stiff joint, no attempt at reconstruction of the middle slip is done as it does not succeed. The scar on the extensor surface of finger is excised and resultant raw area is skin grafted, and the P.I.P. joint is maintained in functional position using static splints. This may decrease the disability. If the deformity is gross i.e.



Fig. 14. Pre-operative photograph of a patient with scar on the dorsum of the hand with loss of palmar arch and extension contracture, web contracture 2nd to 4th, scar syndactyly involving 3rd, 4th and 5th finger, damaged extensor mechanism, ankylosed M.P., P.I.P. and D.I.P. joints and almost a frozen hand.

there is acute flexion of P.I.P. joint and it interferes with normal function then wait till the skin graft becomes soft and pliable and then arthrodesis the P.I.P. joint in functional position.

Disruption of collateral bands of extensor apparatus over the middle phalynx is relatively uncommon, but when it does occur it produces minimal functional disability because D.I.P. joint is seldom acutely flexed because of contracting scar on dorsal aspect. If however it is fixed in extension it should be manipulated into functional position at the time of operation. No attempt is made to reconstitute the extensor mechanism as the results are not satisfactory. If however the D.I.P. joint is ankylosed in abnormal position arthrodesis in functional position is recommended.



Fig. 15. Illustrating use of dynamic splint to mobilize joints.

Results

Excellent results with full functional restoration have been achieved in almost all cases of extension contractures even when they were associated with contractures of web, scar syndactyly, contractures of musculotendinous units and capsular ligaments, and subluxation of M.P. joints. Single stage correction is preferred over multistaged procedures, except in those with secondary contractures of deeper soft tissues, scar syndactyly and subluxation of joints. This not only facilitates application and maintenance of splints, but also restores function early. The splints properly applied hold the key to success and need to be tailor made to suit individual requirements. They may have to be changed frequently as correction proceeds. They are worn continuously for 8-9

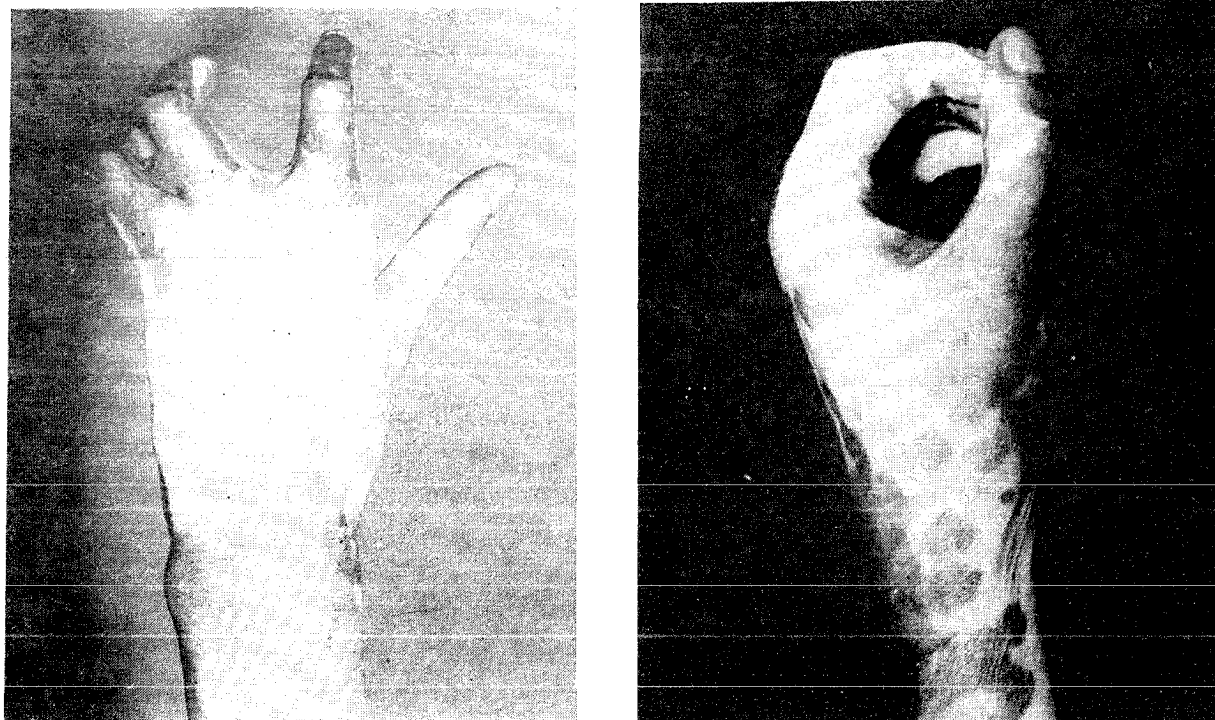


Fig. 16-17. Follow-up result showing restoration of useful function.

months to prevent recurrences. With the judicious use of splints it has been possible to achieve almost full function even in long standing gross deformities which were considered beyond salvage. Full function however cannot be restored in cases where extensor apparatus has been disrupted and finger joints have become ankylosed. However even in these cases adequate restoration of function can be achieved so that patient can perform essential day to day functions.

Intermediate thickness split skin grafts on the dorsum of the hand behave very well and

after they are settled in 8-9 months they become indistinguishable from adjacent normal skin in texture. They stand well to normal stresses that obtain on dorsum of hand. We have never used nor felt the necessity of using full thickness skin flaps in any case. The only exception being cases where damage to tendons on the dorsum of the hand has occurred and there is need for subsequent reconstruction. These latter cases however, are uncommon, and the damage is generally so extensive that useful function can seldom be obtained.

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