9

Management of Miscellaneous Conditions in the Paralysed Hand

• M. VIRMOND
H. DA ROSA PEREIRA

INTRODUCTION

Hand surgery in nerve injury aims to restore function and cosmesis. Undoubtedly, tendon transfers and nerve decompression are the most common and needed operations in a surgical program aiming to physically rehabilitate neuropathic hands. However, surgeons dealing with leprosy patients will be faced with a variety of conditions: from a preserved hand with just mobile clawed ulnar fingers to a grossly deformed and destroyed hand (Fig. 9-1). The first condition is easily resolved with a simple tendon transfer. The latter could lead surgeons to a feeling of frustration and hopelessness in the sense that nothing can be done for such conditions. The aim of this chapter is to present some suggestions for selected techniques devised to correct and/or ameliorate some of these deformities not covered elsewhere in the textbook.

The leading philosophy is that, in many instances, something can be done to improve the function of a badly deformed hand. Sometimes, a minor arthrodesis may result in a dramatic improvement in the daily life activities of a patient. However, it is most important before the operation, to carefully examine the hand, select an adequate intervention and fully discuss with the patient the possible results and operate only if the patient understands and agrees with the procedure.

FIGURE 9-1 A grossly deformed hand. Unattended acute reactions may lead to severe deformations in the hand due to myositis, arthritis, joint contractures and scarring of skin wounds after necrotizing erythema nodosum.

The cosmetic appearance of the hand should not be neglected. Some surgeons consider these aspects as non-priority. However, one should remember that this decision should be given to the patient and not to the surgeon. It is intriguing to realize that some patients with longstanding ulnar paralysis are, by far, more concerned with wasting of the first web than with clawed fingers. They can often overcome the functional disadvantage with a variety of tricks but hardly can conceal a depressed web other than keeping the hand in the pocket. This attitude may lead to socially embarrassing situations.

Contractures

Collateral ligaments, volar plate and joint capsules are structures to provide a stable link that allows efficient transmission of muscular force across the joints. These structures are maintained in their optimal flexibility and length by a normal joint. Muscle weakness or palsy interferes greatly with this intricate mechanism and the final result can be soft tissues and joint con-

tractures. Longstanding muscle palsy is common in leprosy and thus joint contractures are also frequent if preventive measures are not timely. The sensory loss may lead to wounds that may become infected, compromising deep structures and resulting in tendon, bone and joint involvement. There may be loss of insertion of the tendons, bone sequestra and joint destruction.

The end result may be shortened fingers with contracted joints that interfere with normal function of the hand. A careful analysis of each hand may lead to the indication of surgical techniques that can improve the function. It is important to note that these cases are of longstanding contractures and not recent conditions as we commonly see after trauma. For this reason, possibilities for surgical correction are very limited. In many cases the surgical techniques are restricted to release skin contractures and arthrodesis in order to simply improve the position of the finger and thereby improve hand function.

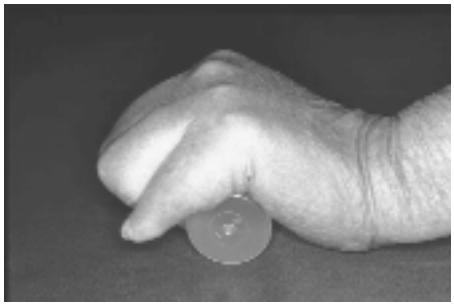


FIGURE 9-2 The contracted distal phalan made grasping of objects difficult. A DIP arthrodesis has improved function of the hand.

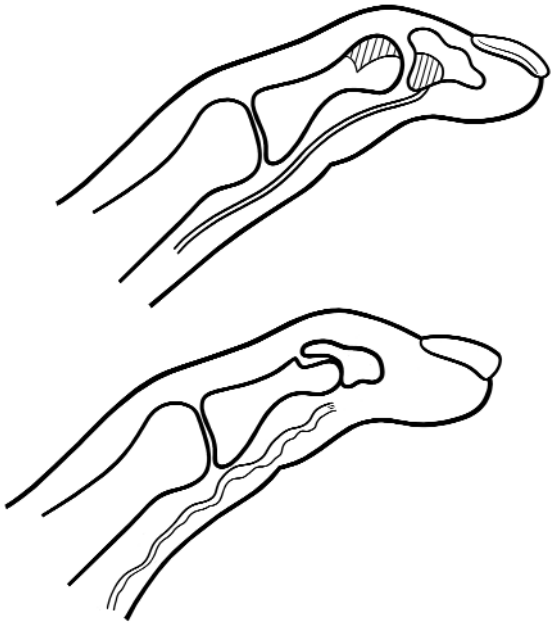


FIGURE 9-3 DIP arthrodesis with reshaping of the distal bone, which increased the surface contact between the remaining distal phalanx and the medial phalanx.

Distal interphalangeal joint contractures

To the clawed fingers contractures of the distal interphalangeal joint (DIP) may cause additional difficulty for pinch and grasp. Arthrodesis of the DIP joint can improve the overall function of the hand (Fig. 9-2). Frequently in leprosy the amount of bone at the distal phalanx is not enough to allow adequate fusion. Therefore it is useful to shape the bone ends to increase the bony surface (Fig. 9-3).

Operative technique: After a wrist or finger anesthetic block, incise deeply and longitudinally in the dorsal aspect of the distal finger including the terminal slip of the extensor tendon. Preserve as much as possible the dorsal venous drainage. Expose the capsule and collateral ligaments and release these structures carefully with a #15 blade.

Fully expose both the articular facets and remove the cartilaginous tissue with a thin osteotome and shape the proximal end of the distal phalanx and the distal portion of the middle phalanx in order to obtain an angle of 15° to 20°. Carefully remove debris between the facets and firmly fix both phalanxes with two Kirschner wires keeping the bones compressed as the wires are inserted (Fig. 9-4).

Proceed with hemostasis and close the

wound with separate sutures of nylon 6/0. Immobilize with a plaster cast, which should be removed after 4 weeks.

Proximal interphalangeal joint contractures

Contractures of the PIP joint are the most com-

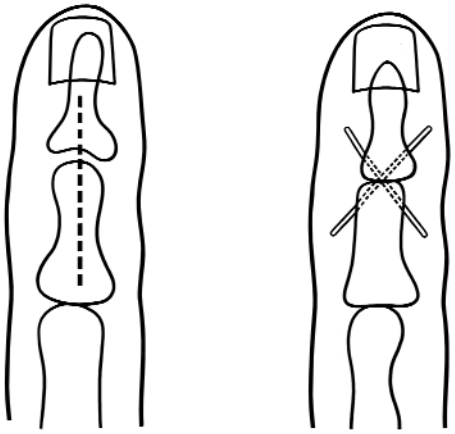


FIGURE 9-4 DIP arthrodesis. If the distal phalanx has enough bone, a conventional two K-wire arthrodesis can be done. Bone parts should be kept under compression while inserting the wires.

mon in hands of patients affected by leprosy. Contractures following recent paralysis should be treated with adequate physical therapy and/or surgical release of ligaments and volar plate by conventional techniques.[19] It is also advisable to consider the use of distractors, which has the advantage of allowing progressive and slow lengthening of soft tissues and collateral vessels.[14] However, this section will describe only treatment for longstanding contractures in which most of the conventional techniques are not successful. The surgical technique is similar as that for DIP arthrodesis (Fig. 9-5a,b). Besides these standard techniques, others can be advocated depending on the experience of the surgeon.[1,12,16] How-ever, its is important to stress that, due to the accompanying severe contracture of skin, the amount of bone to be removed to allow good positioning may severely shorten the finger. In order to avoid this problem it is advisable prior to arthrodesis to

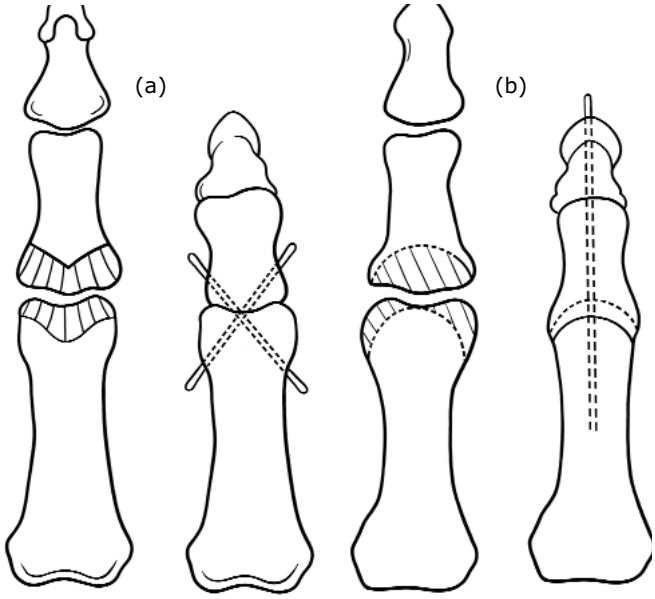


FIGURE 9-5a,b PIP arthrodesis. (A) Chevron-type technique. (B) Cup and cone type arthrodesis allows adequate bone-to-bone contact and, most of all, makes the final adjustment of the phalanx position before the fixation with K-wire easier.

release soft tissue contrac-tures. A good technique for this purpose is the one proposed by Fritschi described below (Fig. 9-6, 9-7 and 9-8).

Operative technique

With a marking pencil outline a "Y" in each side of the joint which legs should join at the volar aspect of the joint. Incise along the drawing and make sure to keep the knife superficial – do not incise deeply, that is, beyond the dermis.

With fine scissors, undermine distally and proximally to the volar incision in order to draw areolar tissue to your surgical wound to cover the flexor tendon sheet, which will be exposed along with the progressive release of the joint and skin contracture.

Through the "V" portion of the "Y" incision, release the collateral ligament on both sides and the volar synovial pouch if it is obliterated. As the release proceeds, notice that the

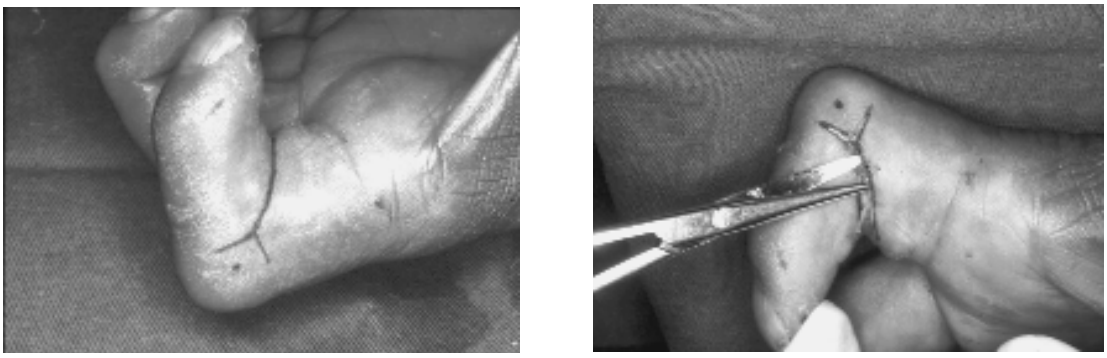


FIGURE 9-6 Fritschi's Y technique for skin and joint contracture. **a.** The "Y" is marked in the skin. The dot is intended as the fulcrum of the PIP joint. **b.** A careful superficial undermining is made both distally and proximally releasing contracted tissue and drawing areolar tissue to the open surgical wound.

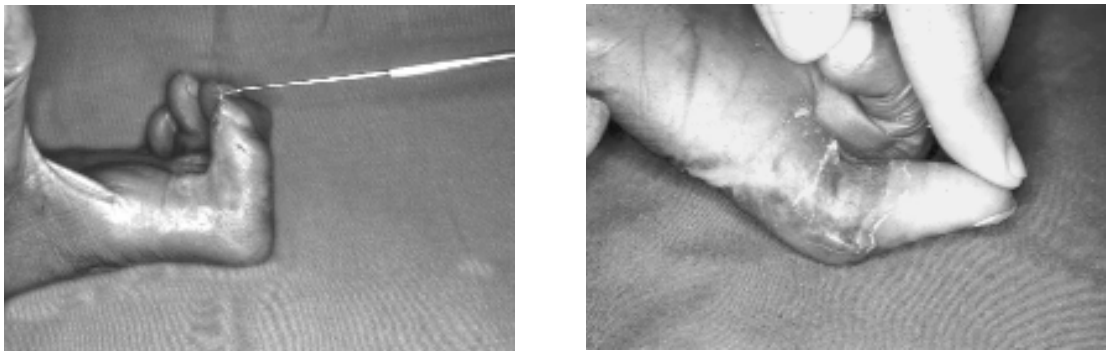


FIGURE 9-7 Fritschi's Y technique for skin and joint contracture. **a.** Pre-operative view with passive extension. **b.** Passive opening of the finger after surgery.

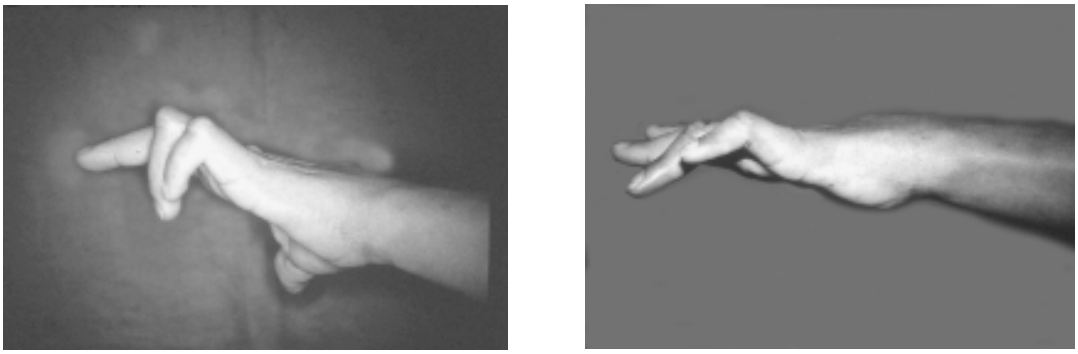


FIGURE 9-8 Fritschi's Y technique for skin and joint contracture. **a.** Pre-operative view – active extension. **b.** Postoperative view – active extension.

surgical wound becomes wider. This is actually the gain in the passive range of movement of the PIP and it also shows the amount of skin necessary to cover the gap.

Harvest the needed amount of full-thickness skin graft and apply the graft over the surgical wound at the volar aspect of the joint. Before suturing the skin graft, insert at least one Kirschner wire to effectively immobilize the joint while, in the post-operative period, the skin graft takes and retracts.

Full-thickness skin grafts are preferable to repair the surgical gap due to the smaller degree of contraction in the post-operative period and because the quality of skin is better than in split-skin grafts. For all skin grafting techniques in this chapter it is recommended to harvest the donor skin from the antecubital space. In this space it is possible to harvest a reasonably amount of good quality hairless skin yet allowing easy closure of the transverse defect. If there is need for a larger piece of skin, it must be harvested at the groin.

According to the severity of the contracture the surgical wound may prove to be inadequate for a skin graft. This happens when, after release, the joint becomes exposed and the amount of areolar tissue is not enough to provide a recipient bed for the graft. In this case a flap may be used. A cross finger flap is a satisfactory choice to cover the remaining defect (Fig. 9-9) and it is easy and safe to perform. The inconvenience is that the fingers must be kept immobilized for 2 weeks and there is need for a second operation to release the pedicle.

FIGURE 9-9 Fritschi's Y technique for skin and joint contracture. A cross-finger flap can be used to improve coverage of the surgical wound.

Metacarpophalangeal joint contractures

Flexion contracture of the MP joints is seldom seen in leprosy. However, extension contractures may occur as a result of a severe and inadequately treated "reactional" hand. This is a challenging condition to the surgeon. The dorsal skin may become shiny, immobile and fragile with poor blood supply. The capsule is contracted as well as the extensor hood, which may additionally be laterally dislocated. The joint itself may be affected e.g. exostosis and compromise of the cartilaginous facets. Extension contractures of MP joints are highly dysfunctional since they prevent adequate grasping or pinching. If possible, release of skin and joint contracture should be undertaken to allow the distal joints to perform basic tasks of daily life activities.

Operative technique

Place a transverse incision at least 3 cm proximal to the knuckle of the MP joints. It is of utmost importance to preserve dorsal veins at this stage. Undermine carefully the distal border of the incision to expose the MP joint area. If necessary, complete the incision with an extended "V" in both radial and ulnar sides (Fig. 9-10).

Expose and incise the two collateral ligaments and release the volar plate pouch with a small curved elevator. If exostoses are present, remove them with a fine nibbler.

At this stage, sufficient flexion should be obtained (50°-60°). Immobilize the affected joints with a longitudinal Kirschner wire taking care to maintain the finger properly aligned on its longitudinal axis.

Apply a full-thickness graft to repair the widened dorsal surgical wound. Immobilize the hand with a volar plaster cast including a

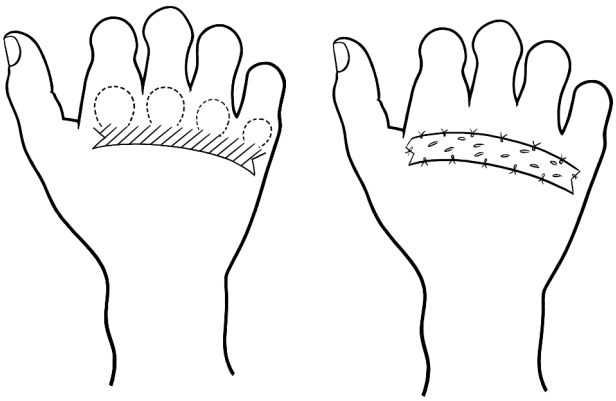


FIGURE 9-10 Technique for dorsal release. A skin graft is applied to cover the defect.

padded dressing in the dorsum to ensure mild compression over the skin graft.

Soft tissue contractures

Soft tissue contractures can be severely limiting to the function of the hand in leprosy. These contractures can be treated by physical therapy. For finger contractures the choice treatment includes exercises, splinting and serial cylinder casting. The latter is particularly efficient to restore adequate range of movement (ROM), but requires a carefull follow-up and complete patient compliance. However, in some longstanding contractures, surgical interven-tion is necessary.

Release of soft tissue contractures in the fingers can be treated by skin graft or pedicle flap and the various techniques have been previously discussed in this chapter. Skin contractures in others sites of the hand need a careful analysis and the surgical technique should be decided on each specific situation. Again, skin grafts are, in most cases, the preferable option after release of the contracture. Z-plasty is a goodprecious technique that should be considered whenever applicable (Fig.9-11a and b).

Intrinsic plus deformity (Swan-neck)

In this deformity there is hyper-extension of the PIP and some degree of flexion in the termi-

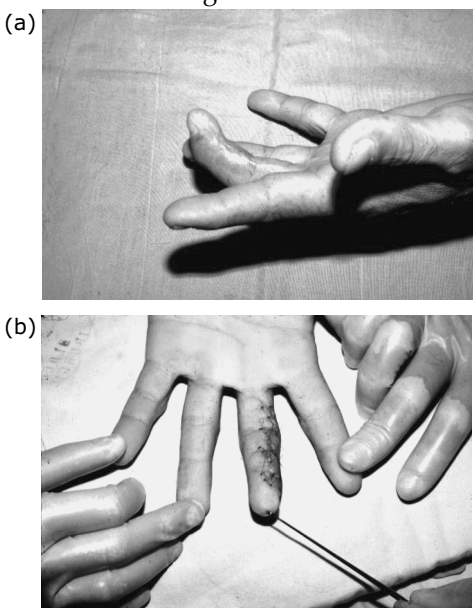


FIGURE 9-11 Z-plasty for skin contracture release. **a.** pre-operative view. **b.** a multiple Z was done along the axis of the scarred tissue.

nal joint (Fig. 9-12).[13,15] Most frequently, the One cause for intrinsic plus deformity in leprosy is contracture of the intrinsic muscles due to myositis as a result of reactions. The degree of severity depends on the time elapsed without adequate treatment and the severity of the reaction. Sometimes it is possible to see "acute" swan neck during an acute reactional state due to spasm of the intrinsic muscles (lumbrical and interosseous).[5] On the other hand, following a severe reaction without proper treatment or with delayed attention (drugs, splinting and physical therapy), the fine structures of the dorsal expansion become contracted and fibrotic, the skin contracts and the joint develops stiffness. Contracture of the oblique retinacular ligament is also a common feature of longstanding intrinsic plus deformity. Another common cause for "intrinsic plus" deformity is the removal of the flexor sublimis for tendon

FIGURE 9-12 Swan-neck deformity. Note the hyperextension of the PIP and flexion of the DIP joint.

transfer in the hand (sublimis-minus).[2,13] A third cause is following intrinsic replacement surgery in an excessively mobile hand. An alternative in these hands is to employ the Lasso technique of Zancolli[19], which corrects the clawed fingers without direct attachment of tendon slips in the extensor apparatus, thereby greatly reducing the risk of swan-neck deformity.

In mild deformities where flexion of the PIP joint can be actively achieved and there is no gross contracture, there should be no need for surgical correction. If necessary, a simple dermadesis (Fig. 9-13) may be sufficient to reverse the deformity though the correction proves to be not longstanding in my experience.

Correction of Swan-neck deformity

The traditional technique for correction of "intrinsic plus" was described by Littler.[10] He suggests excision of a triangle of the oblique fibers in the dorsal expansion at the level of the middle or proximal third of the proximal phalanx. This technique is indicated in those cases in which the flexion of the PIP is restrained (Fig. 9-14). Another possibility is an incision of the lateral band at the proximal third leaving the band attached to the distal end. The band is then rerouted volarly to the ligament of Cleland and sutured to the flexor tendon sheath. In this way, the tension on the band

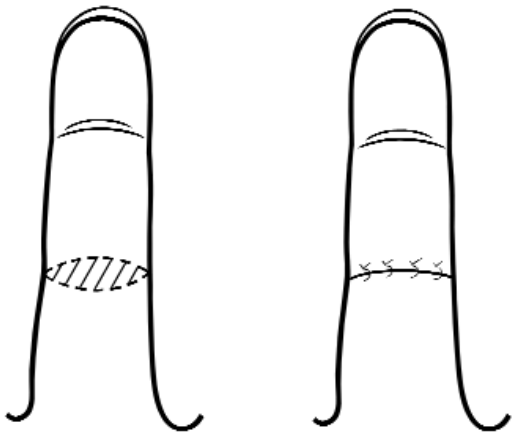


FIGURE 9-13 Dermadesis at PIP joint. An elliptic skin resection is made. The incision should be placed in order that the final suture lies in the natural PIP volar crease.

allows extension of the DIP and prevents hyperextension of the PIP (Fig. 9-15).

Fritschi[3,8] recommended a longitudinal incision along the expansion, which divides the oblique fibers and continues distally dividing the lateral band (Fig. 9-16). After release of the hyperextension of the PIP, the lateral band is reattached to the oblique fiber in the new position.

Tenodesis of the flexor sublimis is an alternative that may give good results.[7] A slip of the flexor sublimis is cut in the proximal end of the proximal phalanx. The slip is passed through a small opening made in the distal portion of the A2 pulley and sutured to itself (Fig. 9-17). This method prevents the hyperextension of the PIP.

In severe cases of intrinsic-plus deformity it may be necessary to release skin contracture with Z-plasty and reconstruction with flaps. The dorsal expansion should be released as well as the lateral band. Finally, the PIP is arthrodesed in slight flexion. This is almost a salvage procedure that should be fully discussed with the patient before operation.

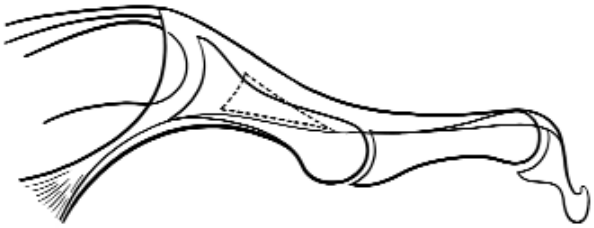


FIGURE 9-14 Littler's technique for Swan-neck correction. Using a triangular resection, the lateral band and oblique fibers of the dorsal aponeurosis are removed at the level of the middle or proximal third of the proximal phalanx.

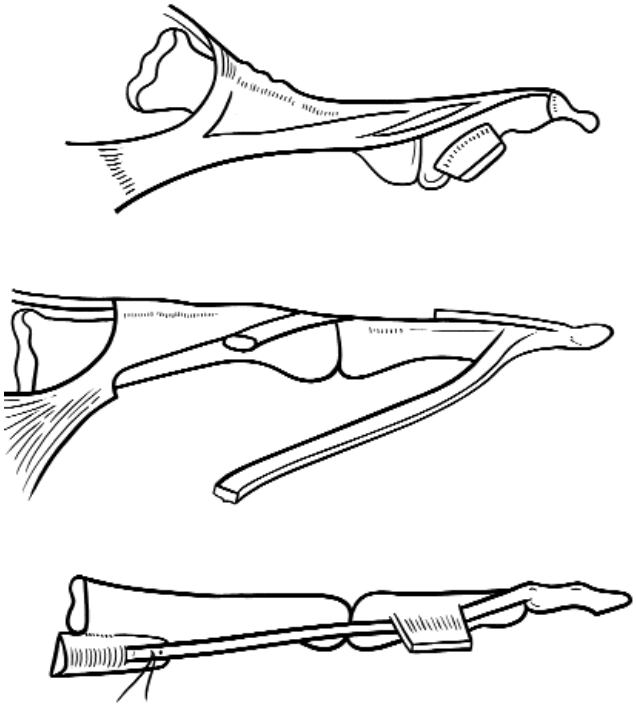


FIGURE 9-15 Swan-neck correction by rerouting of the lateral band. The lateral band is detached at the proximal end and reattached to the flexor sheath after having been threaded volarly through Cleland's ligament, which prevents its dorsal excursion. The new route of the lateral band avoids hyperextension of the PIP joint while still allowing extension of the DIP.

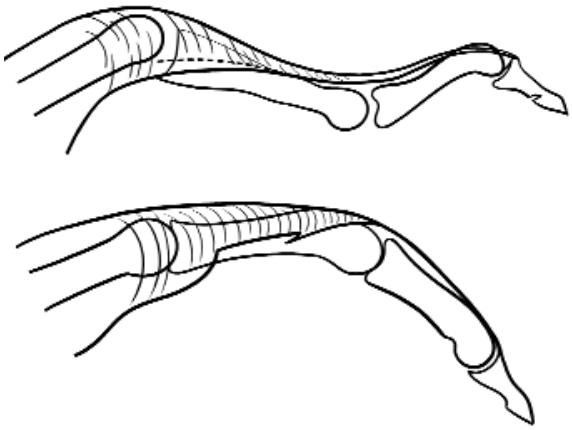


FIGURE 9-16 Swan-neck correction. Fritschi's modification of Littler's operation. The lateral band is sectioned. The PIP joint is flexed at 60º and the lateral band is re-sutured to the cut oblique fibers in the new position.

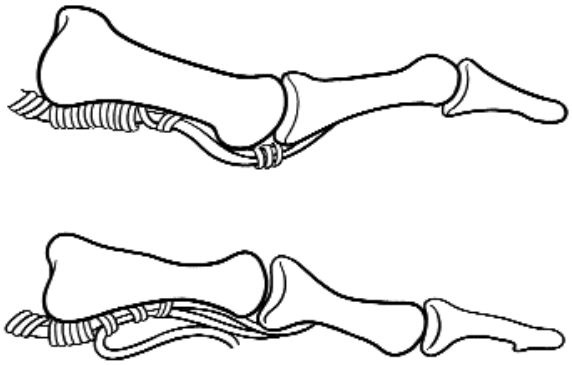


FIGURE 9-17 Tenodesis for correction of Swan-neck deformity. A slip of the flexor sublimus is cut proximally to its insertion at the base of the medial phalanx. The slip is threaded through a small opening made in the distal part of A2 pulley and sutured to itself after flexing the PIP joint. During flexion of the fingers the slip becomes loose but as the finger attempts to extend, the slip becomes tight and prevents hyperextension of the joint beyond the adjusted angle of the PIP joint.

Boutonniere deformity

The extensor apparatus of the finger is a fine complex of bands, slips and ligaments that contributes to a smooth and coordinated movement of extension and flexion of the finger. Damage to any of its portions may induce severe imbalance in both movements.

Disruption of the integrity of the extensor apparatus at the level of the middle joint may result in a boutonniere (button-hole) deformity.

Actually division of the central slip of the extensor tendon alone is not enough for a boutonniere deformity to occur. Also required is some involvement of the retinacular component of the dorsal apparatus.[3] This concept should be borne in mind to understand the pathogenesis of the deformity in leprosy.

The most common cause of boutonniere in ulnar palsy is the chronic abnormal position of the various structures of the extensor apparatus as a result of longstanding clawed fingers. The lateral bands migrate volarly resulting in contracture of the oblique retinacular ligament of Landsmeer. Sometimes this is referred to as "hooding deformity". It is important to note that clawed fingers greatly expose the often insensitive skin of the knuckles of the finger to repetitive trauma which may lead to wounds that may become infected and destroy the tendon apparatus on the dorsum of the middle joint. In other instances, the granulomatous component of a reaction can also compromise these fine structures. As a result, the boutonniere (hooding) deformity in leprosy is basically characterized by volar displacement of the lateral bands and contracture of the oblique retinacular ligament. The final picture is flexion of the PIP joint with mild extension of the DIP joint (Fig. 9-18).

To assess contracture of the oblique retinacular ligament the PIP is passively extended and then the distal phalanx is flexed. In the presence of a boutonniere deformity there will be marked resistance to flexion of the DIP. With the PIP flexed it will be easier to flex the DIP joint (Fig. 9-19). Before considering surgically correcting a recent boutonniere, the patient should be asked to actively flex the DIP while extending the PIP with the other hand.

Surgical treatment of boutonniere in leprosy depends on the severity of the case. Different from fresh or traumatic boutonniere[9] the deformity in leprosy is commonly chronic with intense residual fibrosis and disorganization of the fine extensor apparatus structures – therefore, results are often unrewarding.

Central Slip Advancement

In mild cases with rupture of the central slip an advancement of this structure can be performed.

Operative technique

After a wrist, or even a finger block, make an incision on the dorsal aspect of the middle and proximal phalanx, fully exposing the region of the PIP.

Identify and remove the fibrotic callus on the central slip over the PIP. Sometimes it is dif-

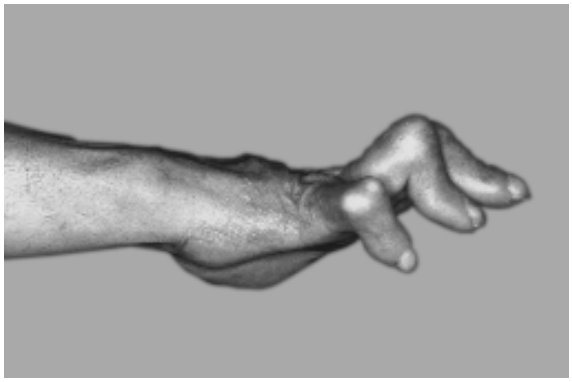


FIGURE 9-18 Severe Boutonniere deformity.

FIGURE 9-19 Restrained flexion of the DIP joint is a characteristic of advanced Boutonniere. The test should be made before any attempt for physical therapy or surgery treatment.

ficult to recognize the difference between the tendon (central slip) and the fibrotic tissue. The former has a shine pearl aspect and the latter is light gray and transparent.

While removing the fibrotic callus, leave a cuff of tissue attachment to the base of the middle phalanx, which will help later inthe reattachment of the advanced central slip to the dorsum of the medial phalanx.

In order to advance the extensor tendon, make two lateral and parallel incisions in the central slip towards the MP joint. While incising, be careful not to harm the underlying tissues to prevent adhesion of the tendon to the bone phalanx.

Suture the lengthened central slip to the attachment in the base of the middle phalanx. If no attachment is present, fix the central slip to the periosteum of the middle phalanx. The finger should assume slightly the shape of a swan neck. Tenotomy of the distal tendon to release retinacular contracture is advocated by some authors and contraindicated by others.

A Kirschner wire may be inserted in the PIP to guarantee adequate immobilization of the joint. Immobilize the hand for 4 weeks and then start gentle physical therapy.

Dorsal Fixation of Lateral Bands

In cases with a marked relaxation of the extensor structures but still with no fixed contractures, it is possible to reconstruct the extensor apparatus.

Operative technique

Incise the skin in the dorsal aspect of the middle and proximal phalanx exposing the tendinous structures, including the displaced lateral bands.

If the central slip is loose it may be required to excise a few millimeters of the slip and reattach it distally in order to shorten the central slip.

The displaced lateral bands should be freed of attachments, including its connections with the oblique retinacular ligament. Thus, the bands are brought to their original physio-logical position and sutured to the central slip with 2 fine 6-0 nylon sutures (Fig. 9-20). If necessary, the triangular ligament should also be reconstructed.

Immobilize the PIP joint with a Kirschner wire for 4 weeks.

In severe long-standing boutonniere deformities with marked contractures and joint stiffness a PIP arthrodesis of the most con-tracted fingers can be performed using one of the standard techniques described elsewhere in this chapter.

A mild anterior displacement of the lateral bands without severe contracture of the oblique retinacular ligament is a common finding in hands with clawed finger. This displacement results in a poor extension of the distal phalanx after intrinsic replacement. It is important while correcting clawed finger by any of the flexor to extensor tendon transfer techniques to restore the lateral bands to their orig-

FIGURE 9-20 Mild Boutonniere. The central callus should be removed. The freed central slip is advanced and sutured in the base of the middle phalanx.

inal position while performing the insertion of the transfered slip into the lateral bands.

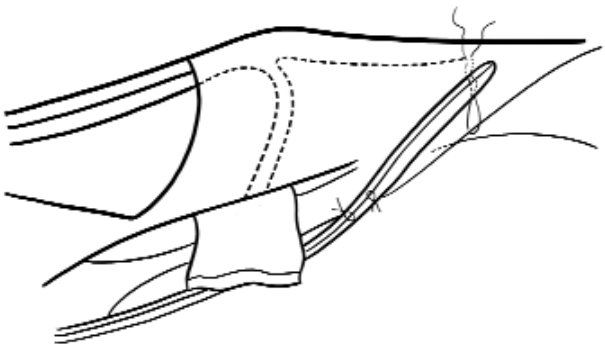
Fritschi[8] has devised a simple procedure that aims to correct this problem (Fig. 9-21a) and consists in an additional step to the Stiles-Bunnel sublimis transfer, which can apply to any of the techniques involving insertion into the lateral bands. While suturing the tendon slip in each finger, one should pass the suturing needle through the central slip and then in the free border of the lateral band and finally in the tendon transfer slip (Fig. 9-21b). When the suture is concluded the lateral band will be brought dorsally to its original position allowing adequate extension of the finger. This is a simple procedure that should be kept in mind when performing intrinsic replacement for correcting clawed fingers with a mild hooding deformity.

Extensor Tendon Guttering

Guttering is the ulnarward subluxation of the extensor tendon of the fingers (Fig. 9-22). The extensor tendons lay in the gutter between the knuckles of two adjacent fingers. This is a common finding in hands with rheumatoid arthritis. In the normal hand fingers show more lateral mobility towards the ulnar than the radial side. The index finger normally tends to be ulnarly deviated at rest. Although common in rheumatoid arthritis, guttering deformity in leprosy is seldom seen and also difficult to explain. It can occur due to spasm of the intrinsic muscles and thus there may be a connection with intrinsic-plus deformity. However, hypermobility of joints, looseness of the dorsal apparatus and flexion contracture of MP joints also seem to play an important role in the pathogenesis of this deformity.

As in rheumatoid arthritis, there are three degrees of ulnar deviation. When mild the patient can actively reduce the deformity. When more severe the deformity can only be passively reduced. Lastly, the guttering is not passively reducible.

FIGURE 9-22 "Guttering" deformity of the fingers with marked ulnar deviation.



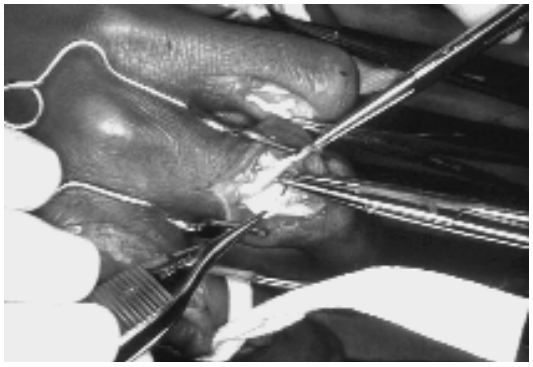


FIGURE 9-21 Lateral band dorsal fixation: Fritschi's technique. In selected cases this procedure should be carried out during a Bunnell's flexor to extensor tendon transfer for claw hand correction. **a.** Drawing of the basic procedure proposed by Fritschi. **b.** The intra-operative photograph shows the lateral band being taken by the needle that has been previously passed through the central slip of the extensor tendon (dorsal). While fixing the suture the lateral band is moved dorsally.

Guttering Repair

For mild guttering Boyes recommends a flap of the dorsal expansion aponeurosis at the ulnar side of the extensor tendon that is sutured to the same aponeurosis in the radial side.[4] This flap acts as a pulley that brings the extensor tendon back to its original position on the crest of the knuckle of the affected finger. This same procedure is advocated by Fritschi with a minor modification consisting of placing an individual longitudinal incision for each affected finger to prevent damage to the dorsal veins.[8] Milford proposes a different approach that is easy to perform and results are not disappointing for mild guttering (Fig. 9-23).[12]

Operative technique

Expose each affected extensor tendon through a single incision on the ulnar side of the MP joint of each finger and not a single transverse incision. After incision, expose the extensor tendon and the extensor hood at the knuckle. Make a short and longitudinal incision at the radial side of the extensor hood and a relaxing incision in the ulnar side of the hood. Place the extensor tendon in its normal position on the crest of the knuckle and suture the radial incision with fine separate sutures of nylon 6/0. If necessary, overlap the edges of the radial side incision to better position the central tendon. The incision on the ulnar side should not be sutured.

Suture the skin incisions and apply a mild compressive dressing. The hand should be immobilized in a plaster cast with mild extension of the metacarpophalangeal joints.

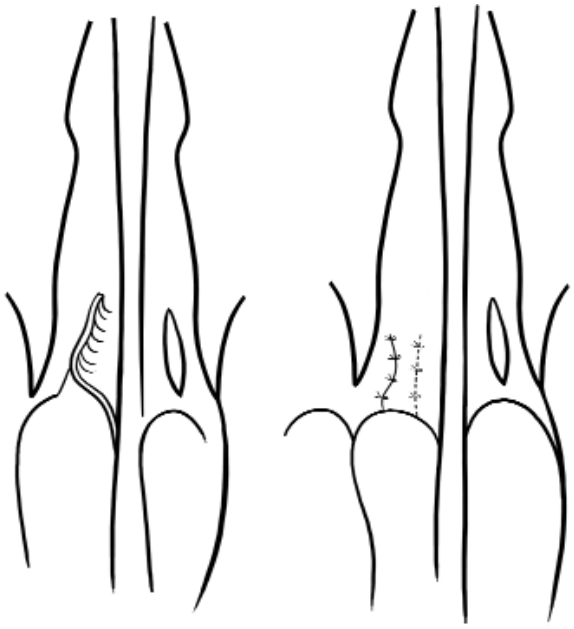


FIGURE 9-23 Technique for correction of mild guttering. (Left) An incision is made on the radial side of the hood and a small relaxing incision in the ulnar side. (Right) The relaxing incision permits repositioning of the extensor tendon. The radial side incision is then closed after its edges are overlapped.

Correction of muscular wasting in the first web

Atrophy of the first dorsal interosseous and adductor pollicis muscles is common following ulnar nerve paralysis resulting in a shallow aspect of the first web. In many countries this deformity is considered as one of the most stigmatizing signs of leprosy (Fig. 9-24).

Many techniques have been described to restore the bulky contour of the first web space to correct the cosmetic problem. Dermal grafts, silicon rubber and fat graft have been used with results ranging from good to disappointing. These techniques have their own advanta-

FIGURE 9-24 Wasting of the first web is quite noticeable and recognized as a sign of leprosy.

ges and disadvantages. Dermal grafts are problematic due to complications such as dermal cysts and the need for a reasonable amount of dermis to adequately fill the web space. Fat grafts are likely to lose up to one half of their original bulk. Recently, it has been suggested to use fat graft harvested by liposuction that is injected in the web pocket. There are no reported data on its results although the idea seems interesting. The use of carvable silicon rubber implants has been recommended and results are promising although the consistency of the implant is harder than the normal muscle.[6] The encapsulated silicone gel implants are more appropriate for procedures such as testicular implants.[18]

Silicone Implant Insertion

A special encapsulated silicone gel implant for the first web was designed by Dr. Adenaur M. Goes (unpublished data) from Brazil. The implant is commercially available in four sizes at an affordable price (Fig. 9-25).

Operative technique

Select the implant according to the size of the hand. Manufacturers provide a set of 4 samples

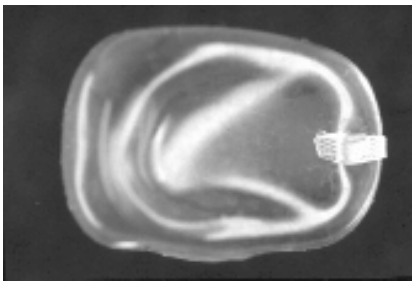


FIGURE 9-25 Encapsulated silicone gel implant.

for this purpose (7, 9, 11 and 13), #13 being the largest one. Implant # 9 is the most suitable for the average hand (manufacturer: SILIMED Inc. Rua Figueiredo Rocha 374. Rio de Janeiro Brazil.

Use local anesthesia. It is advisable to infiltrate the superficial branch of the radial nerve distal to the wrist. The procedure does not require use of a tourniquet and, a bloodless field is not necessary nor desirable, since perfect hemostasis is mandatory before closing the incision.

Incise along the first web no longer than 4 cm following the interdigital line and close to the index finger (Fig 9-26).

Create a pocket through this incision by blunt dissection between the paralyzed fibers of the adductor pollicis and first dorsal interosseous muscles. The size of the pocket should be enough to receive the implant (Fig. 9-26 b). Proceed carefully while dissecting to prevent damage to vessel, particularly in the deep portion of the pocket and obtain hemostasis.

Rinse the implant and the pocket with saline. Introduce the implant deeply into the pocket. If necessary, introduce a guiding suture

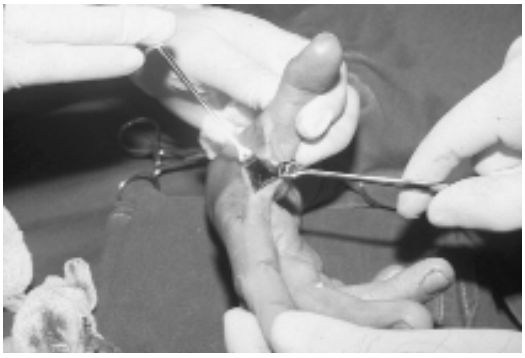


FIGURE 9-26 Silicone gel implant. A short incision is made in the first web along the line separating the dorsal and palmar skin. After careful tissue dissection between the fibres of the first dorsal interosseous and the adductor pollicis, the pocket is ready to receive the implant.

(nylon 3-0) from proximal to distal, pass the suture through the loop included in the implant and back to the proximal dorsal skin. This is seldom necessary.

Close the fascia with 2 to 3 sutures of nylon 6/0 and then suture the skin with 3 or 4 separated fine nylon stitches.

Apply a bulky padded dressing or a plaster cast to immobilize the first web for 2 weeks. Allow free movement after that period.

The main advantages of the encapsulated gel implant are the muscle-like consistency and readiness of the implant. There is no need for shaping. In a 12 month follow-up in a group of 14 cases results are good and no complications have been reported.[6] Patient's satisfaction is high (Fig. 9-27 a,b and Fig. 9-28).

Conclusion

The techniques described in this chapter should serve as a complement to the other chapters on hand surgery in this book to give the reconstructive surgeon a broad range of skills to re-enable the paralyzed hand. With the dramatic reduction of prevalence of leprosy worldwide as a result of MDT implementation, the number of disabled patients appears to be reducing. Many of the procedures described in this chapter apply to patients with nerve injury who present late with established secondary deformities. In developing countries these types of patients will continue to be seen, especially among patients affected by leprosy. As such these surgical skills will be needed for years to come. Fortunately, most of the procedures discussed in this chapter are related to a very limited number of patients. Patients in need for these secondary techniques are those that could not have an early diagnosis, an adequate treatment, a careful follow-up and effective health education. Certainly we must be striving to prevent patients from developing such late severe disabilities. However when these patients present, surgeons should be prepared to cope with theses situations in order to assist patients in improving the functional condition of their hands, aiming to restore dignity and self-respect to their life. It is to this purpose that this chapter has been included, to assist even those with severely disabled hands to regain some of the independence they had lost through their hand deformity.

FIGURE 9-28 Silicone gel implant. The left hand has not been operated. Compare with the right hand in which the implant was included.

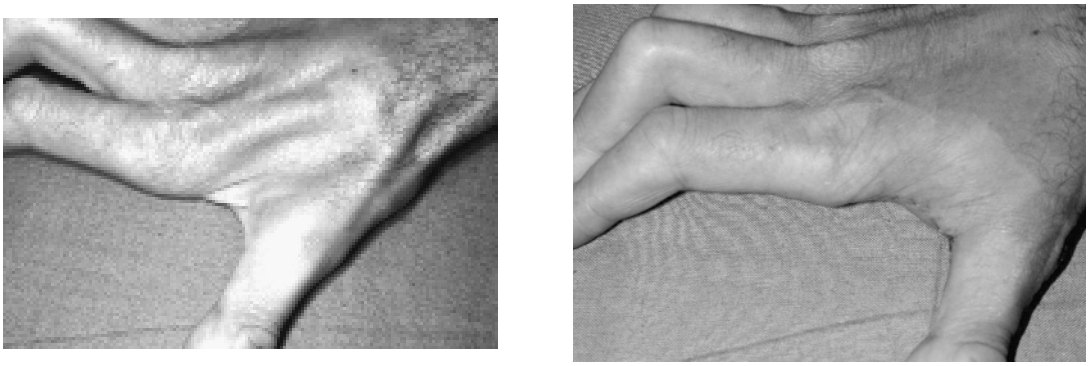


FIGURE 9.27 Silicone gel implant. **a.** preoperative view. **b.** postoperative view.

BIBLIOGRAPHIC REFERENCES

1. Ayres JR, Goldstrohm GL, Miller GJ, Dell PC: Proximal interphalangeal joint arthrodesis with the Herbert screw. J Hand Surg; 13A: 600-603, 1988
2. Beine A: Prevention of post-operative "sublimis-minus" deformity by modified surgical procedure at the donor finger. Ind J Lepr 69: 33-41, 1997
3 Boyer MI, Gelberman RH: Operative correction of swan-neck and boutonniere deformities in the rheumatoid hand. J Am Acad Orthop Surg 7:92-100, 1999
4. Bunnell S: Surgery of the Hand, 5th ed. J.B. Lippincott, Philadelphia, 1970
5. Carayon A, Bourrel P, Languillon J: Contracture of the instrinsic muscles. Pp. 139-147. In: Surgery in Leprosy. Paris, Masson et Cie. Éditeurs, 1964
6. Duerksen F, Virmond M: Carvable silicon rubber implant for atrophy of the first web in the hand . Lepr Rev 61: 267-272, 1990
7. Duerksen F, Virmond M: Cirurgia reparadora e reabilitação em Hanseníase. TALM ILEP, Bauru, 1997
8. Fritschi EP: Reconstructive Surgery in Leprosy. John Wright & Sons Ltd., Bristol, 1971
9 Le Bellc Y, Loy S, Touam C, Alnot JY, Masmejean E: Traitement chirurgical de la déformation en boutonnière des doigts longs. Etude d'une série rétrospective de 47 patients. Chir Main 20:362-7, 2001
10. Littler JW: Restoration of the oblique retinacular ligament for correcting hyperextension deformity of the proximal interphalangeal joints. Pp. 39-42. In La Main rheumatoide. Groupe d'Etude de la Main Expansion Scientifique Français, Paris, 1968
11. McGlinn JT, Smith RA, Bougumill GP: Arthrodesis of small joints of the hand: A rapid and effective technique. J Hand Surg 13A: 595-599, 1988
12. Milford L: The Hand. Pp. 331-333. In Edmonson AS, Crewshaw AH (eds): Campbell's Operative Orthopaedics, 6th ed. C.V. Mosby Co. St. Louis, 1980
13. Palande DD: Surgical correction of intrinsic minus fingers. Ind J Lepr 58:537-542, 1986.
14. Salafia A, Chauahn G: Joshi external stabilizing system (JESS) in proximal interphalangeal joint (PIP) contractures in leprosy. Ind J Lepr 69: 331-339, 1997
15. Smrcka V, Dylevski I: Treatment of congenital swan neck deformity with dynamic tenodesis of proximal interphalangeal joint. J Hand Surg 26B:165-7, 2001
16. Stern PJ, Gates NR, Jones TB: Tension band arthrodesis of small joints in the hand. J Hand Surg 18 A: 194-197, 1993
17. Watson HK, Turkeltaub SH: Stiff Joints. Pp. 537-552. In Green DG (ed): Green's Operative Hand Surgery, 2nd edition. Churchill Livingstone, Melbourne, 1988
18. Zacharia AG, Gelber RR: Silastic implant of the first dorsal interosseous space (correspondence). Int J Lepr, 53: 643-4, 1985
19. Zancolli EA: Structural and Dynamic Bases of Hand Surgery. The C.V. Mosby Co. St. Louis, 1974