These very common wounds pose problems of repair far greater than when the extensor tendons are injured on the dorsum of hand. In fact, at the finger level, we will have to deal not merely with extensor tendon injuries, but with injuries of an entire extensor apparatus shaped as a fibrous fascia, spread out all over the dorsal aspect of the finger, close to bones and joints, to which it adheres as soon as it is traumatized.

This fascia consists of the terminal fibres of long extensor tendons and of the intrinsic muscles, supplemented by passive fibrous structures, called retinacula.

These multiple tendon bundles compose, together with the flexor apparatus a most compound mechanism, whose balance must be preserved (Tubiana and Valentin, 1963) (Fig. 16.1).

We consider here only injuries of the fingers, omitting the thumb and adopting the local topography of Verdan (1966), with five zones for the fingers. Thus injuries are identified for the extensor apparatus at the level of each digital joint and in the two intermediary areas.

**AT THE DISTAL INTERPHALANGEAL JOINT (DIP)**

The terminal extensor tendon, formed by the two lateral bands united, is inserted on the dorsal aspect of the distal phalanx at its base, throughout nearly all its width. It is a thin fibrous membrane, tightly fastened to the joint capsule with which it partly merges. The tendon has an excursion of about 4–5 mm. We must remember that the extension of the distal phalanx results from both the common extensor and the intrinsic muscles, a part of this extension being a passive movement which only follows the extended middle phalanx by means of the oblique fibres of the retinacular bundle. These different structures explain the various amounts of deformity and the possibility to compensate partially for the lack of extension, according to the injuries. Every impairment of the ruptured extension mechanism produces a dropping of the distal phalanx, more marked the more distal the injury. The torn joint capsule is responsible for the worst deformities. An avulsion of the bone insertion of the tendon involves similar deformities (Fig. 16.2).

Any surgical repair in this area is particularly difficult to perform, on account not only of the joint itself being directly concerned, but also because of the thinness of the covering layers. The skin is extremely fine and frail, its blood supply is poor, especially since when the finger is hyperextended it loses colour immediately. The nail matrix so near makes a good approach difficult.

Complications are to be expected when the operation is not made with the utmost care. It is advisable to put the proximal interphalangeal joint in flexion during part of the treatment, so as to release all tension from the interossei; it will be necessary to keep the distal joint still in hyperextension, for some weeks.

**PRIMARY REPAIRS**

In the presence of a wound, when this one is tidy, a primary suture will be performed.

The wound, usually transverse or oblique, is extended longitudinally and the flap so created may form an obtuse angle (Fig. 16.3). The skin should be manipulated with care, by sutures. We must remember that the nail matrix extends itself proximally about 5 mm beyond the visible part of the nail.

The tendon, near its insertion, is thin, so the suture itself must be fragile; it has to be relaxed by putting the distal phalanx in hyperextension. This position can be more easily held by putting in advance a Kirschner wire 10/100 before the suture, the distal interphalangeal joint being fixed in slight hyperextension (5°). Hyperextension must not be excessive, for the skin does not tolerate it for long. The wire is placed on the lateral side of the digit and crosses the joint obliquely.

We do not put any more mid-longitudinal wire, since we had fibrous scars on the pulp, quite disturbing on pressure.

The tendon is usually repaired by means of a loop inserted into the lateral bands, the suture of both ends being improved with some 'U' points, using very thin nylon. Lorthioir recommends a double loop, laced through each band.

The digit is then dressed with a splint, keeping the proximal interphalangeal joint at a 40 degrees flexion, to release the extensor lateral tendons by the gliding of the dorsal fascia, which is drawn down by the central tendon insertion. The splint is removed on about the 25th day, to permit the motion of the proximal IP joint; the wire is also taken away, but the distal joint is kept immobilized during two further weeks by a short moulded splint. The same splint will then be applied every night for two more weeks.

When the conditions for a primary suture are not present, especially with a contused wound, an effort can be made to treat such injuries conservatively, the distal joint being kept in extension during six to seven weeks. Another operation, such as a tendon repair or arthrodesis will sometimes be necessary.

**RUPTURES**

Distal ruptures of the extensor apparatus follow after closed injuries. It is sometimes a violent injury, easy to detect as dur-
ing a football game; in other cases trauma is mild and we see ruptures happening in housewives turning up mattresses or folding sheets, it can even go unnoticed. The most frequent mechanism is a blunt flexion of the distal phalanx, previously held in extension. A blow on the head of the finger can involve a fracture by compression of the base of the distal phalanx with sudden flexion. These injuries are seen on every finger, but rarely on the thumb. They show a permanent flexion of the distal phalanx, from 30 degrees to 40 degrees, according to cases, no matter what the position of the other joints may be. The patient can increase the flexion of the injured phalanx, but he cannot extend it beyond the starting position. Passive extension remains normal. The oedematous infiltration and fibrosis progressively reduce the joint range. This rather mild symptomatology bothers the patient only a little and spontaneous healing is expected. The persisting deformity ultimately brings the patient to the surgeon.

X-rays examination can show a bony avulsion. Ruptures are mostly treated conservatively by splintage (Fig. 16.4).

As after suture, the distal joint may be fixed in extension by a wire and immobilization completed by a splint maintaining the PIP in flexion. In case of spontaneous rupture, we protect the tendon healing by longer immobilization.

The Kirschner wire, has to be placed with the utmost precautions, and removed as soon as inflammation is detected.

We do not use, as Pratt proposed it, the same wire to fix both the DIP in extension and the PIP in flexion.
Injuries to the Extensor Apparatus on the Dorsum of the Fingers

Figure 16.2
Mallet finger deformity.

Use of a wire, on account of its dangers leading to infection, might be criticized, but even a mere splint, apparently harmless may produce pressure sores. In lieu of wire, a plaster cast is best for immobilization. Bunnell pointed out that the patient is best holding the corrected position of his finger against his thumb. A narrow plaster splint is first set upon the dorsal surface of the finger, covered with jersey from its base; its end has to reach the nail. After it is dried, a palmar narrow splint is placed up to the pulp and left until dry. Both splints are then joined in a case.

A prognostic distinction should be made, between: spontaneous ruptures, secondary to light trauma and pathological ruptures from injuries such as a heavy blow on the end of the digit, often with bony avulsion. In these cases the repair seems easier.

Figure 16.3
Wound of the extensor system at the distal interphalangeal level. It is necessary to make the wound larger at its extremities to avoid creating acute angles with a poor blood supply.

Our experience is too limited to allow me to say more than that in cases showing deformation up to 60 degrees, it would seem best to resort immediately to a surgical re-insertion of the tendon, using the technique pointed out by Esteve (1964): viz. a nylon thread, with a needle at both ends is fastened to the proximal extremity of tendon; both needles pass into the periosteum of the distal phalanx, out through the nail at the two corners of the lunula, stretched to draw up the tendon, and then knotted firmly, until a slight hyperextension of distal phalanx is attained.

Surgery is also indicated in the rare cases of major bony divulsion, with palmar subluxation of the distal phalanx. If the DIP is put in hyperextension, the displacement is even accentuated, so fixing the bony fragment, together with a trans-articular wire allows for stable correction of the deformity. We have never carried out a primary arthrodesis of the DIP joint and reserve it for late failures.

SECONDARY REPAIRS

We make no distinction from the indication of secondary treatment, whether for wounds or for ruptures, except in those cases when bad scars endanger a direct surgical approach.

It is difficult to fix a time limit for conservative treatment. We have been able to succeed with simple immobilization even six months after an accident, but it is likely, and statistics of Stark, Boyes and Wilson clearly confirm that the miscarriage percentage increases with the delay after the 10th day.

Besides, a long and uncertain orthopaedic treatment brings about considerable annoyance to a manual worker, so that we hesitate to prescribe it after the second month, having discussed with the patient other possibilities: either surgery or acceptance.

Acceptance is often recommended. One tends to take lightly the after-effects of a mallet-finger: the functional impairment is usually of little import, although catching the extremity of a deformed finger be not without inconvenience. Moreover, the pulp grasp with forefinger and middle finger against the thumb, is far more frequent than the terminal grasp in flexion of DIP. Therefore, stiffness in flexion of this joint can be an important functional loss, in certain jobs. Pain is not infrequent and may persist for a long time. Finally, the aesthetic problem is not to be underestimated for many subjects, especially women.

Leading people to believe that deformation will lessen with passing of time is actually to hope that the patient will adapt himself to his handicap. Such adaptation is possible to some degree, by means of a growing hyperextension at the PIP to compensate for the falling of the DIP.

One ought to admit that these conservative advices have arisen from lack of a confident treatment. The surgical treatment is not without inconveniences, the results being not always satisfactory. We therefore only operate on troublesome deformations of over 40 degrees.

A number of proceedings have been recommended, but all leave a percentage of disappointments.

Instead of merely folding the callus, it is preferable in our opinion to practice a callus resection, and a suture. Vilain obtained good results by shortening the tendon, approached in the sound area, above injury; the tendon is cut, then overlapped and sutured while Esteve (1964) remains faithful to tendon re-insertions.

Figure 16.4
Stack's splint in polyethylene.
Brooks and Graner's operation for mallet deformity. (A) Elliptic excision of the skin and of the tendon callus. (B) Immobilization of the distal interphalanx by a pin.

Grafting technique used by the author for old mallet deformities. The graft is fixed to the base of P3, the two extremities are crossed on the median line, then are slipped into the lateral extensor tendons. The tension is regulated by the transverse points more or less bringing together the lateral tendons.

Tenotomy of the central extensor tendon insertion was first proposed by Fowler, to correct the falling of the DP in late injuries—thus allowing a proximal retraction of the terminal bands and the fibrous scar. A buttonhole is not to be feared, for the triangular ligament preventing any subluxation of the lateral bands. A splint immobilizes PIP in slight flexion and DIP in extension during three weeks; then, the PIP and DIP are kept in extension up to two weeks.

Arthrodesis is reserved for cases where the joint becomes stiff in a bad position. When the PIP is mobile, the distal joint will be fused in slight flexion, this position having been discussed with the patient himself.

AT THE MIDDLE PHALANX

Injuries in this area are due to open wounds, and dropping of the distal phalanx is generally limited, since the distal joint capsule is intact and only rarely does the injury extend the whole width of finger.

The technique of primary suture is similar to that previously described. Deep adhesions are often found after fracture of the middle phalanx, demanding sometimes a secondary tenolysis.

AT THE PROXIMAL INTERPHALANGEAL-JOINT (PIP)

Most complexity is found in this area, both anatomically and physiologically.

The extensor apparatus comprises at this level, essentially one central and two lateral tendons.

The central slip of the common extensor receives the so-called spiral fibres from the interosseous muscles, forming together the central extensor tendon, crossing the dorsal side of PIP fused with the capsule, inserting itself on the base of the
middle phalanx. The amplitude of movement attained here, is about 8 mm (Stack). This middle tendon has physiologically a most important role in extension of the three phalanges: it extends the middle phalanx where it inserts, except when the metacarpophalangeal is in hyperextension. It also has an indirect action on both other phalanges. It helps to extend the P.Phalanx pushing back its head when the PIP joint is flexed. It still extends the DP along the first half of its amplitude, owing to passive coordination through the retinacular ligament.

Both the lateral bands of the interosseous muscles receive fibres from the common extensor, thus forming the lateral tendons. Each of these fibrous structures glides along the postero-lateral side of the joint during flexion, but any side-displacement is checked by two fibrous structures: the triangular ligament and the retinacular ligament. The transverse fibres of the latter prevent the lateral extensor tendons from gliding toward the middle line during extension of PIP and in flexion, the tension of these transverse fibres draws the lateral extensor tendons on the sides of joint. This ventral displacement is then limited by the triangular ligament which joins lateral extensor to the central tendon on the back of the middle phalanx.

Any disturbance to that delicate mechanism produces finger deformities. The digits can actually be compared to a chain of bones and joints. In such a multiarticular system, an intercalated bone, such as the proximal phalanx, can only be kept in balance by a minimum of three muscles (Landsmeer). If the balance of this chain is broken, three varieties of deformation are to be found; each with a characteristic name:

The 'claw-hand' resulting from an hyperextension of the MP, and flexion of the PIP; it is the result of a paralysis of the interosseous muscles.

In the 'swan-neck', (Fig. 16.7a) the PIP joint is in hyperextension and DIP in flexion. This deformation may be due to many causes, including excessive traction on the extensor apparatus, inserted on the base of the middle phalanx. It is not a true injury of the extensor apparatus.

With the 'button-hole' (Fig. 16.7b) deformity the initial injury involves the central extensor tendon, allowing a flexion deformity of PIP joint, together with DIP hyperextension.

**'BUTTON-HOLE' DEFORMITIES**

Any section, avulsion, rupture or progressive destruction of the central extensor tendon, is followed, whenever the triangular blade is also torn, by a volar luxation of the lateral tendons, producing a kind of ‘button-hole’, through which the head of the proximal phalanx prolapses.

The result thereof is a digital zig-zag deformity—first by action of the superficial flexor tendon; and then the distal phalanx passes into hyperextension, because it now receives all the extension forces since the middle tendon has become disinserted. Moreover, the lateral tendons being volar dislocated become stretched from the bulk of the PIP joint.

The retinacular ligament has a two-fold role in fixing that deformity—by its transverse fibre maintaining palmar laxation of the lateral bands and by retraction of its fibres fastening middle phalanx in flexion and distal phalanx in extension.

**AETIOLOGY**

Button-hole deformity is due to various causes: trauma (sections, avulsions or ruptures of the middle extensor tendon) or rhumatoid polyarthritis. In a series of 32 operated post-traumatic button-holes, we found 20 sections and 12 ruptures. A male predominance occurs in two-thirds of cases, both for section and for rupture.

The average age for sections is 39, for ruptures 27. That average is far below the age of subcutaneous ruptures of other tendons.

The causal trauma for ruptures accounting for a button-hole is important: among 12 ruptures, we found four IP luxations, five violent blows, and that suggests a traumatic rupture of previously normal tendon. In our series, the left hand is most often involved, the lateral fingers being more frequently injured.

**TREATMENT**

We ought to distinguish recent lesions, easy to reduce, from late lesions with retractions. Recent injuries: A wound of the extensor tendon, on the back of the PIP joint does not usually produce an immediate button-hole deformity but one usually appears later, when the lateral tendons, after retractions are drawn forwards. The opening into the joint, has to be closed as soon as possible, to prevent infection. The soft tissue conditions decide the possibility of repairing tendon injuries. When local conditions are favourable, an immediate repair is undertaken, as anatomical as possible. A methodical exploration of injuries is obviously required.

The central tendon, if divided, will be re-implemented or sutured. Injuries to lateral tendons have also to be repaired. They are to be kept in their physiological position, partially reconstructing the triangular ligament with a few sutures, which approximate the distal portion of the lateral tendons to the central tendon margins.

A splint immobilizes the wrist in extension for three weeks,
metacarpo-phalangeal joint in very slight flexion in order to release tension on the tendon suture.

Results of repairs of those wounds of the PIP joint, are usually satisfactory when the skin and extensor apparatus are cleanly cut. On the contrary, repairing of contused wounds, irregularly shaped, is often complicated by stiffness in extension, mostly due to adhesions, even if there was no joint involvement at the outset.

Re-education has little success when scars are dense. A tenolysis, undertaken not earlier than three months after the primary operation (Verdan, 1966) can be useful; yet it happens that superficial adhesions are such, that their section may leave a weakened tendinous apparatus, tending towards relapse of the initial button-hole injury. In these cases, our aim is to place the finger in a functional position, where a certain range of mobility, though limited, can be of use. A temporary wire fastens the PIP joint in such a position and movements of the DIP are rather encouraged.

When local conditions are bad, arthrodesis or amputation can be considered.

Recent ruptures are usually treated conservatively. A metal splint together with a cast maintain the wrist in extension, metacarpo-phalangeal joint slightly flexed at 10 degrees, PIP in extension and DIP at 45 degrees flexion for four weeks. Then, only PIP is kept immobilized in extension, with the help of a short splint, for another week.

Surgical repair seems to be indicated for such recent ruptures, in two circumstances:

1. In ruptures with bony avulsion, when control X-rays taken after PIP immobilization in extension show persistent displacement of the bony fragment which depending on its size, should either be directly fixed or, if it is too small, reimplanted by the tendinous end to the base of middle phalanx. The joint can be effectively maintained in extension by a fine Kirschner wire, obliquely placed. This is left for 10 days, then replaced by a splint.

2. In ruptures following a PIP joint dislocation, it can be of interest to operate, so as to make an exact assessment of injuries and to repair, beside the extensor apparatus, the articular capsule and cartilage, and the lateral ligament as well.

OLD LESIONS

Old button-hole deformities, either after non-treated wounds or to ruptures, pose similar problems, which can be considered together.

Late repairs of button-hole deformity are delicate and operations justified only when such deformities produce a functional disturbance. Attempts should be made only when the joints have sufficient suppleness. Physiotherapy is often necessary before operating, stressing mainly the active mobilization of the DIP whose flexion requires for a distal displacement of the extensor apparatus. Physiotherapy can involve serial corrective splints, to reduce flexion of the P2. It often happens that such precautions suffice to correct the deformity, making operation unnecessary.

Operation in selected cases, when a decision is made, will involve:

1. correction of the deformity
2. repair of the extensor apparatus.

We use a sinuous incision. Correcting the deformation. Freeing the lateral bands and drawing up all the extensor apparatus is essential as the displaced ligaments adhere forward to the capsular layer. One must carefully dissect them to replace them back in their normal dorso-lateral position and thus the transverse fibres as well as most of the oblique fibres of the retinacular ligament are disinserted.

Sometimes, when the deformity is late and severe, the distal joint cannot be flexed, by merely liberating the lateral tendons. Those are precisely the cases where their tenotomy has to be considered.

Repair of the extensor apparatus. As normal as possible anatomical conditions have to be restored, therefore the most urgent step consists in repairing the middle tendon, which must be stretched and reimplanted on the base of the middle phalanx. With this principle in mind, several repair procedures were described.

1. Shortening of callus. Mere plication has always disappointed us.
2. Reconstruction of the middle tendon. If it has not degenerated, the central tendon can be reconstructed and
reimplanted either on the distal stump or directly into the bone, after the proximal end has been freed. The fibrous callus is resected, care being taken to retain any distal tendon insertion on the base of middle phalanx.

Many choices can be considered: It may happen that the proximal end allows without excessive strain the extensor apparatus to be drawn forwards and either reimplanted on the middle phalanx base or sutured with the distal tendon end. In other cases, when the defect is too large, some local fibrous tissue, can be used, else a lateral tendon or a tendinous graft is inserted.

Local fibrous tissue. A small flap from the dorsal aponeurosis, may be capable, once folded, of filling the gap between both tendon ends. Moreover, the lateral bands must be drawn toward each other in their distal part, to reconstruct the triangular ligament. The results can be satisfactory, but seldom perfect!

Using the lateral tendons. These can be utilized in a variety of ways:

- Pushing upwards the lateral bands all along their rim is not physiological and impairs flexion.
- Planas uses one of the tendons, severed at its proximal end, leading it over to the midline, yet criticizes his own procedure, and he admitted being unable to get a good flexion of the distal joint. Flexion is only possible when the lateral tendons remain free to glide over the lateral aspects of the proximal joint letting the terminal tendon run about 4 mm, the medial one running on its part 8 mm. For that reason Matev lengthens one lateral band running to the distal joint and fixes the other on the base of middle phalanx (Fig. 16.9).
- Littler, as we will see it, uses both lateral tendons, after their tenotomy, overturning them in order to remake a middle tendon.

Tendon grafts. These can also be used, using as motor either the extensor longus, the interossei or even the flexor digitorum superficialis. The middle tendon can be reconstructed by a single graft or by lacing a fine tendinous strip, inserted through the tendon (Nichols) (Fig. 16.10A). This lacing can be to the distal stump or to the bone when it is implanted at the site of insertion of the original tendon, in the middle part of the base of middle phalanx. When a tunnel is made in the bone, one must make sure that it is not too anterior nor too long transversely.

Fowler uses a thin graft the middle of which he attaches to the base of the middle phalanx; he then crosses the two ends over the dorsal aspect of the PIP and sutures them laterally to the interossei tendons at the root of the finger, (Fig. 16.10B) or, if these muscles are not utilizable, to the two terminal bands of the flexor superficialis in the palm.

We have used a Y-shaped graft, and then three-pronged grafts; the proximal end is laced into the dorsal aponeurosis, bringing it distally; it is then fixed to the base of the middle phalanx and split longitudinally before running over the joint, the two halves being fixed at their end to the lateral tendons, thus preventing their volar displacement (Fig. 16.11).

3. Tenotomy. This procedure has been suggested by Fowler for old, deep, fixed lesions. By dividing the distal insertion of
The trident graft (R. Tubiana). The graft slipped into the whole of the extensor system at the proximal part of the finger is fixed to the base of the second phalanx. The graft, before crossing the articular space of the proximal interphalanx, sends out small strips which are fixed to the lateral extensor tendons.

the terminal extensor tendon on the distal phalanx the hyperextension dislocation of the lateral tendons is reduced. If, however, the tendon is divided more proximally, so as to spare the distal insertions of the retinacular ligament, extension of the distal phalanx can be partially preserved (Dolphin) (Fig. 16.12).

4. Tenotomy combined with reconstruction of the middle tendon. Tenotomy of the lateral tendons, so as to flex the DIP can be combined with one of the procedures of reconstruction of the middle tendon. In these cases, according to Littler (Fig. 16.13 and 16.14), it will be of interest to resort to selective tenotomy. He cuts the two lateral tendons at the level of the middle phalanx and spares the distal oblique fibres of the retinacular ligaments which run to the terminal tendon, as well as the more peripheral portion of the lateral radial tendon in continuity with the tendon of the lumbrical. The lateral tendons, once they have been cut, are folded over on themselves and fixed to the base of the middle phalanx so as to replace the middle tendon. In this way, two extensor systems are constructed, one

Littler’s procedure for the correction of buttonhole deformities. The insertion of the lateral tendons into the base of P2, in association with tenotomy, permits a redistribution of the extensor forces at the level of the two distal phalanges.

Littler’s procedure. The lateral tendons sectioned at the level of the diaphysis of P2 are cut back on the median line and fixed to the base of P2 to reconstruct a lesser extensor tendon. The lumbrical tendon and the oblique fibres of the retinacular ligaments make up an extension system for the last phalanx. A pin maintains the IPP in extension.

Littler’s procedure for the correction of buttonhole deformities. The insertion of the lateral tendons into the base of P2, in association with tenotomy, permits a redistribution of the extensor forces at the level of the two distal phalanges.

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for each IP joint; all the active extension takes place at the PIP joint, while the oblique retinacular ligaments exert an 'active tenodesis' effect which is reinforced by the lumbrical so as to prevent dropping of the distal phalanx.

5. Arthrodesis of the Proximal Interphalangeal Joint. This is proposed for either painful stiffness of the joint, deformities of the joint surfaces or to correct severe fixed flexion deformities. The indications for this procedure must be weighed carefully, as fixation of the PIP joint must be functionally less crippling than the 'boutonnière' primary lesion.

6. Articular Implants. They represent now another alternative to arthrodesis, in old cases with fixed deformities. Arthroplasty with the help of a small silicon implant (Swanson) can be considered but only with intact flexor tendons.

The extensor apparatus is longitudinally incised, to insert the implant; with possible plication in order to keep it taut (see chapter on articular implants).

**DISCUSSION**

It would appear that the main object must be the restoration of the normal balance between the various elements of the extensor apparatus. In particular this involves:

1. Reinserting an active extensor tendon on the middle phalanx; and
2. Replacing lateral extensor tendons in their physiological position and relaxing the oblique fibres, thickened and bent, of the retinacular ligament.

In every case, the tension of the central tendon must be accurately balanced with that of the lateral because there is a real risk of transforming the 'boutonnière' into 'swan neck' deformity.

Several procedures need to be combined. Reinsertions or sutures of the middle tendon have produced fairly good results, but they are feasible only when there is minimal retraction of the proximal part of the severed tendon. Tenoplasty of lateral tendons ought to be considered only when the latter are in good condition, its indication remains therefore quite limited.

Grafting is useful to repair defect in the extensor apparatus, after having freed retractions, when the loss cannot be filled by using adjacent scar tissues. Lacing the graft into the extensor apparatus contributes to its good tension.

Grafting can give excellent results. The long extensor can be used as a motor when its tendon is available at the level of the proximal phalanx and if adhesions at that level are not severe. Otherwise, it is preferable to use Fowler's procedure, on the interosseous muscles.

Tenotomy is considered in some cases with late lesions to correct hyperextension of the distal phalanx, combined with moderate deformity of the middle joint. But one has to bear in mind that the deformity in flexion of the PIP joint is compensated functionally by the hyperextension of the distal joint. Selective tenotomy combined with other procedures of restoration of the middle tendon, is not sufficient to achieve flexion of the second phalanx.

Arthroplasty and arthrodesis are reserved for cases showing severe and irreducible deformity of the PIP joint. Arthroplasty with implants is more attractive, but it requires a good flexor tendon and a retrievable extensor apparatus still. It would be wiser to be content with arthrodesis, if the patient performs heavy manual labour.

**AT THE LEVEL OF THE PROXIMAL PHALANX**

The extensor apparatus is stretched out on all the dorsal aspect of the phalanx.

Lesions at that level are mainly traumatic: division, total or often partial occur, as well as adhesions after fracture of the phalanx.

Wounds require primary suture. Secondary tenolysis is frequently required.

**AT THE LEVEL OF THE METACARPO-PHALANGEAL JOINT (MP)**

Each long extensor tendon (proper tendon of index finger and of fifth digit merge with the common extensores at this level) crosses the dorsal aspect of the phalanx. They are maintained along the axis of each digit, first by irregular and lax insertions at the base of the proximal phalanx and then chiefly by the sagittal bands crossing the lateral aspects of the joint, fixing themselves to the deep transverse metacarpal ligament. They actually represent the true proximal insertions of that tendon thus kept over the dorsal aspect of the joint.

The excursion of extensores longi digitorum is about 15 mm.

Extension of the proximal phalanx depends on two motor systems:

1. A direct motor: the common extensor insertion on the base of the proximal phalanx. However this is slackened by flexion of the IP joints involving a distal gliding of the dorsal aponeurosis whose action is effective only when the PIP is extended.
2. An indirect motor: the pressure exerted on the head of proximal phalanx through the base of the middle phalanx which pushes it dorsally, acting so more and more as the PIP is more flexed.

When the MP joint is in hyperextension, all effort of the extensor longus is absorbed by its proximal insertions on the first phalanx and by the sagittal bands. Such hyperextension must be prevented whenever the extensor longus has to fully act on the distal phalanges as in the correcting of claw deformity.

Two types of lesions may be encountered at the level of the MP joint: the tendon may be severed or it may be displaced laterally.

Section of the extensor tendon results in loss of extension at the proximal phalanx. Extension of the distal phalanges is performed by the interossei and lumbrical, when these muscles are intact. Retraction of the tendinous extremities is limited by the sagittal bands and by the junctura tendinum.

After tendon injury one usually finds an open joint capsule and sometimes a tear in the sagittal bands and the dorsal axis of the joint. These three structures must be carefully sutured and immobilized for four weeks, the wrist and finger in exten-