THE MICROANATOMY OF DUPUYTREN’S CONTRACTURE
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SUMMARY
The palmar fascial ligaments have been examined by microdissection using an operating microscope in fresh and preserved cadaveric hands. The palmar fascia is seen to be a precise three dimensional system of skin ligaments having discreet transverse, longitudinal and vertical fibre systems. In the normal hand there is relative motion between the ligament systems on movement. The longitudinal fibres provide a system of skin anchorage which operates irrespective of the position of the underlying joints and acts particularly to resist shearing forces in gripping.

The distribution of the lesions of Dupuytren’s Disease has been recorded in a series of clinical cases; nodules, skin pits, distortion of the palmar creases, cords and joint contractures, and the pathogenesis of the disease is related to the anatomy of the palmar ligaments.

The disease is described as a process of contracture along anatomical pathways.

A hypothesis for the development of Dupuytren’s Disease is presented whereby the loss of normal motion between palmar fascial ligaments gives rise on use of the hand to stress concentrations which stimulate fibrous tissue deposition and contracture.

ANATOMY OF THE NORMAL LIGAMENTOUS SYSTEM OF THE PALMAR SKIN
The fine ligamentous system of the palmar fascia lies just beneath the skin. It is cut through in almost every hand operation without being noticed.

Anatomists have often viewed the palmar fascia or aponeurosis as a static fibrous sheet. Gray (1973), for example, shows an imprecise planar triangular structure. The term “Fascia” however belies the precise specialisation of structure and function of the system of palmar ligaments. A much more detailed examination of these ligamentous structures has been performed by Stack (1973) by microscopic study of sequential cross-sections of the hand.

McFarlane (1974) has described the patterns of the diseased fascia in the fingers in Dupuytren’s Contracture and has also presented the previous literature on the anatomy of the fascial structures in the fingers.

This investigation is concerned mainly with the distal palm. In this area a very precise examination of the palmar aponeurosis and the central spaces of the hand has been undertaken by Bojsen-Møller and Schmidt (1974) who examined in detail the fasciae in the distal palm and the sagittal septa extending to the shafts of the metacarpal bones, concentrating particularly on the way in which pus accumulates in the hand rather than on Dupuytren’s Contracture.

The significance of the palmar ligaments in the pathogenesis of the lesions of Dupuytren’s Disease lies in their precise three-dimensional arrangement. That there is a discreet deep transverse fibre layer was well appreciated by Skoog (1948). Wood-Jones (1941) emphasised the individual groups of longitudinal fibres corresponding

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Fig. 1. Dissection of the palmar fascial ligaments to show the piecemeal removal of the skin. In this case there is one transverse palmar crease and the longitudinal fibres are seen passing beneath this.

Fig. 2a Dissection of the palmar fascia. The transverse fibres are seen to lie on a deeper plane than the longitudinal fibres and the most distal of the transverse fibres are seen to coincide with the distal palmar skin crease which has been preserved on a small tongue of skin at the right hand side. At the very top of the figure a few superficial transverse natatory fibres are seen.

to the finger rays and attributed these to phylogenetically degenerated tendons of a metacarpophalangeal joint flexor. He noted, incidentally, that the palmar fascia is a structure usually present in chimpanzees but rarely in gorillas and perhaps a metacarpophalangeal joint flexor is necessary in tree living primates but not in those like the gorilla tending to live on the ground. As the palmar fascia is present in all humans, perhaps man has found another function for it as a skin anchor. Although the transverse and longitudinal fibres have been recognised little attention has been paid to the vertical fibres in the region of the palmar creases as previous methods of study have often removed these together with the overlying skin.

This work was undertaken to chart precisely the three-dimensional relationships of this palmar ligamentous system.

MATERIALS AND METHODS

Nine fixed and thirty-one fresh cadaver hands have been examined. Careful dissection has been undertaken in more than fifty finger rays (each lasting up to 10 hours). This has been performed with the magnification of an operating microscope at 10 to 20 times magnification. The essentially new technique has been the preservation of the overlying skin which has been carefully reflected and removed piecemeal (Fig. 1) under high magnification only after definition of the fascial attachments to the skin. This technique has differed from previous descriptions of the palmar aponeurosis where in general the palmar skin has been removed entirely before dissection of the palmar aponeurosis.
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Higher power view to show the insertion of the longitudinal fibres into the skin. It is seen that the longitudinal fibres of the middle and ring finger rays insert into the skin mid-way between the distal palmar crease and the proximal finger crease. The index fibres insert more proximally. This illustration has been photographed underwater and a few fine vertical fibres are seen floating on top of the longitudinal fibres like small pieces of cotton wool.

A palmar degloving injury to show the distal attachment of the skin and the plane of separation superficial to the longitudinal fibres.

This examination has therefore been performed at magnifications greater than those used in normal clinical surgery, but less than those for histological study. Three-dimensional tracking of the fine ligaments has thus been possible.

Detailed areas of the anatomical findings have been confirmed by low power scanning electron microscopy. This has been undertaken on large blocks of tissue (15mm) to facilitate orientation, on a specially prepared stage.

ANATOMICAL FINDINGS
The ligamentous systems of the palm will be considered individually as Transverse, Longitudinal and Vertical fibres:
1. Transverse fibre layer:
The deepest layer of the palmar fascia is the layer of transverse fibres well described by Skoog. There is some confusion about the nomenclature of these fibres but they are generally called the deep transverse fibres. As shown from Fig. 2, these are not to be confused with the superficial transverse ligamentous fibres which form part of the natatory ligament system at the base of the finger.
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webs (Fig. 2; also McFarlane, 1974), or the deep transverse metacarpal fibres which lie on a much deeper plane. The fibres of Skoog run across and are fused with the anterior fibres of the flexor tendon sheaths and these pass on the radial and ulnar borders of the tendon sheaths to fasciae over the thenar and hypothenar muscles respectively. Unlike previous descriptions it has been noted that the most distal extent of these fibres underlies the distal palmar crease of the hand and this fact is of surgical significance as dissection of the longitudinal fibres proximal to the distal palmar crease in a plane superficial to the transverse fibres is safe in that nerves and vessels will not be encountered. Under magnification (Figs. 2a, 2b), the transverse fibres appear as discreet unbranching silvery glistening tendinous structures.

2. **Longitudinal fibres:**

On a more superficial plane are the longitudinal fibres also silver glistening structures under the microscope. These are Wood Jones fibres of the phylogenetically degenerated metacarpophalangeal joint flexor. All these fibres were noted to insert into structures distal to the transverse fibres. In the normal hand they do not insert into the transverse fibres or into the skin at the palmar creases. Proximally, the longitudinal fibres run from the palmaris longus tendon or from the region of the flexor retinaculum at the wrist. Fahrer (1980) has suggested that in the absence of the palmaris longus tendon the flexor carpi ulnaris may act as a tensor of the palmar fascia by fibres which run from the flexor carpi ulnaris tendon into these longitudinal fibres. Although there are some longitudinal fibres across the whole width of the central third of the palm (triangular area), they are noted to be particularly condensed (Fig. 2) in the mid line of the finger rays, thereby producing four well defined longitudinal bundles to the index, middle, ring and little fingers and, in addition, there is a fifth well defined longitudinal bundle running to the thumb, although this tends to lie towards the radial side of this digital ray.

3. **Vertical fibres:**

By contrast, with the transverse and longitudinal fibres, the vertical fibres are thin, filmy and much weaker as shown by the plane of separation in a palmar degloving injury (Fig. 3) superficial to the longitudinal fibres. Incidentally, in a palmar degloving injury it is often noted that the hand skin is avulsed proximally but it remains attached distally where the ligamentous attachments are greater. Under naked eye the vertical fibres appear as flimsy structures scattered around the palm, as shown (Fig. 2a), but they are particularly concentrated for a few millimetres on either side of the skin creases, i.e., they are not confined to the apex of the palmar skin creases. There are also strong condensations of vertical fibres over the thenar and hypothenar eminences of the hand. The vertical fibres run down into the hand (Fig. 4) from the dermis superficially and they run between the individual longitudinal fibres and between the individual transverse fibres; they then pass more deeply in the palm to the flexor tendon sheaths and the metacarpal bones.

If the entire network of palmar ligaments in the distal palmar is considered by reference to a cross section (Figs. 5a, b), it is seen that in the depth lie the transverse fibres and then the longitudinal fibres on a more superficial plane cut transversely.
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The arrow indicates vertical fibres beneath the proximal palmar crease.

A higher power view shows that the longitudinal fibres, which are passing diagonally across the illustration, are discreet from the vertical fibres which are very much finer in structure. Traction is being applied to the overlying skin and the vertical fibres seem to be ‘Tenting’ the longitudinal fibres.

A silk suture has been wrapped around the vertical fibres and these can be pulled backwards and forwards in relation to the longitudinal fibres. The transverse fibres are not shown in this figure as they lie at a deeper level.
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Fig. 5a Cross section of the palmar fascia.

Fig. 5b Cross section of the palmar fascia to show the longitudinal fibres here cut in cross section, lying in channels between the skin superficially, transverse fibres deeply and vertical fibres laterally.

The longitudinal fibres therefore appear to lie in channels with skin superficially, transverse fibres deeply and vertical fibres laterally. The channels are shown in the dissection of a Simian hand (Fig. 7).

If the distal attachments of the longitudinal fibres are now considered by reference to a longitudinal cross section (Fig. 6) from the mid-palm to beyond the proximal finger crease, it is again seen that the transverse fibres now cut transversely, terminate under the distal palmar skin crease. The longitudinal fibres run distally through their channels between the transverse fibres and skin. This arrangement is confirmed in a normal hand by reference to a histological cross section (Fig. 8). The longitudinal fibres arise proximally from the palmaris longus or flexor retinaculum and there are three types of distal insertion.

Fig. 6a Longitudinal section of the palmar fascia of the ring finger.

Fig. 6b Longitudinal section to show the three types of insertion of the longitudinal fibres.
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The longitudinal fibres are here seen passing beneath the distal palmar crease. This is most apparent in the ring finger ray. In the middle finger digital ray there is a suggestion that some fibres are passing upwards into the skin in the region of the distal palmar crease, but at higher magnification these were noted to be vertical fibres. The longitudinal fibres do not insert into the skin at the palmar crease. This hand is the same dissection as Figure 1.

The most superficial of the fibres (Fig. 6b) insert into the skin of the distal palm at an area roughly mid-way between the distal palmar crease and the proximal finger crease (Fig. 6b, 11). An indentation can be seen at this point in most normal subjects on flexing the palm (Fig. 9).

More deeply (6b, 10, 11), some fibres turn down into the depth of the hand distal to the transverse fibres and pass distally to the fingers to interdigitate with Cleland’s ligaments and to form the lateral digital sheet as shown by McFarlane. Some of these fibres stop short of the fingers and attach to the apex of the web skin.

The deepest fibres (6b, 10) turn down around the sides of the flexor tendon sheath at metacarpophalangeal joint level fanning out around the sides of the metacarpophalangeal joint. The more proximal, therefore, attach to the metacarpal and the more distal to the base of the proximal phalanx. The significance of this precise arrangement of fibres beneath the distal palmar crease lies in the fact that in the normal hand the longitudinal fibres can move a little in relation to the deep transverse fibres and skin. This normal relative motion between the different fibre systems has been confirmed as a constant finding in normal hands that has not been previously reported. The small amount of motion that is possible for the longitudinal fibres in the channel does not amount to an excursion similar to that which occurs between tendons and sheaths (McGrouther and Ahmed, 1981). The
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Fig. 8  Histological longitudinal section of normal palmar fascia beneath the distal palmar crease. The distal palmar crease lies in the middle of the illustration. The longitudinal bundle of fibres is shown inserting into the dermis on the left hand side of the picture and another part of the longitudinal fibres is seen on the right side. The transverse fibres are seen cut in cross section beneath the longitudinal fibres. These so not extend any further distally than the distal palmar crease. Fine vertical fibres are seen scattered throughout.

Total range would be merely of the order of a millimetre or two and the purpose of this motion is to allow the layers of the hand, i.e., skin, longitudinal fibres, transverse fibres and deeper structures, to slide to some extent over one another in flexion of the distal palm. This necessity for one layer to slide over another in flexion is similar to the motion that occurs between the leaves of a telephone directory on folding. A similar channel exists beneath the proximal palmar crease.

The arrangement in the index is different (Fig. 2b) in that the longitudinal fibres insert more proximally into the palm. The channel arrangement, therefore, does not exist.

DISCUSSION

What is the function of the Palmar Fascia? There has been much philosophical speculation on this point. Some clues can however be deduced by considering the function of the palm. The hand is a tool, an interface between man and his environment acted upon by all the forces generated by the forearm muscles and even body weight on occasions. It is not exempt from satisfying the Laws of Natural

Fig. 9  Longitudinal fibres insert at the point marked ‘X’ and an indentation is seen in this area on flexing the palm.
Physics and must therefore conform to Newton's Third Law of Dynamics:—To each force there is an equal and opposite reaction. The forces acting on the palm are normal (perpendicular to the surface) and shearing (acting in the plane of the palmar skin), these being longitudinal or transverse. By the Laws of Vectors all forces can be resolved into these 3 components. To give examples of such forces, standing on one's hands would produce high normal forces, sliding down a Fireman's pole would produce high transverse shearing force, and gripping a golf club would produce high longitudinal shearing force as the club tends to rotate in the hand on striking the ball.

There must be an internal anatomical arrangement to provide the reaction balancing externally applied forces, and the development of this system will be greatest where most force must be balanced to prevent damage. Areas of the hand having high normal forces have well developed shock-absorber pads (e.g. the finger pulps) but areas requiring to resist much horizontal shear must have a horizontal structure to resist avulsion or degloving injury. The palm of the hand therefore has a longitudinal system of ligaments for this purpose.
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Fig. 12 The distribution of nodules in 64 patients. This shows the numbering system used to identify the sites of the nodules in Table 1.

An engineer would be hard pressed to design a system of skin anchorage effective in any degree of flexion on such a mobile frame as the skeleton of the hand. Evolution has produced a system which seems to be effective.

An added point of interest is that each skin ligament has an origin and insertion, and on tightening the ligaments, callosities (or blisters) map out the areas of skin attachment since the immobilised skin suffers shearing trauma.

TABLE 1
DISTRIBUTION OF NODULES—64 PATIENTS

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<th>3</th>
<th>4</th>
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<td>14</td>
<td>14</td>
<td></td>
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<tr>
<td>2, 3 ±4</td>
<td>4</td>
<td>13</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1, 2</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<td></td>
</tr>
<tr>
<td>3, 4</td>
<td>1</td>
<td>1</td>
<td>5</td>
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<td></td>
</tr>
<tr>
<td>None</td>
<td>4</td>
<td>8</td>
<td>13</td>
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</table>

THE LESIONS OF DUPUYTREN'S DISEASE AND THEIR PATHOGENESIS

The lesions of Dupuytren’s Disease are nodules, skin pits, distortions of the palmar creases, cords and joint contractures. A precise morphological description has been prepared of the incidence and sites of these features.

In a series of 80 hands in 64 patients the distribution of the visible and palpable lesions has been documented and recorded photographically. 124 digital rays were involved and careful operative dissection has subsequently been performed in 63
Nodules

To facilitate description the sites of the nodules have been numbered according to Figure 12 as follows

1. Proximal to the Proximal Crease.
2. Distal to the Proximal Palmar Crease, but proximal to the Distal Palmar Crease.
3. From the Distal Palmar Crease to the Proximal Digital Crease.
4. In the proximal segment of the finger or more distally.

It may be noted by reference to Figure 12 or the reader’s own hand that the distal palmar crease runs from the ulnar border of the hand to the web between the index and middle fingers and therefore for the index the above areas for description of the nodules would be different. In this series however, no nodules were found in the palm in the line of the digital ray of the index.

The most important factor in relation to nodules is that they were found to occur along the lines of the longitudinal fibres of the palmar fascia, i.e. in the line of the finger rays, generally in the mid-line but near the webs they were occasionally off centre, in this case on the superficial natatory ligament system.

Twenty-seven per cent had no nodules (Table 1). When present the commonest pattern was a line of nodules all along the longitudinal fibres from proximal to the proximal palmar crease to the finger (1, 2, 3, 4). Isolated nodules were also found between the palmar creases or distally (Fig. 13) but no isolated nodule proximal to the proximal palmar crease occurred in this series.

Fig. 13a A nodule distal to the distal palmar crease. On attempting to forcibly extend the fingers, blanching of the skin distal to the nodule is apparent, indicating the increased tension in the skin in this area.

Fig. 13b Dissection of a cadaveric nodule similar to that shown in 13a. The small tongue of skin in the centre of the illustration shows the distal palmar crease with a distal bunching of the skin and an indentation distal to this.

Fig. 13c A diagrammatic representation of the origin of a nodule in this site.
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Fig. 14a  Nodule distal to the distal palmar crease with a further nodule proximally.
Fig. 14b  Transverse fibres lying in a deeper plane. The longitudinal fibres involved in the Dupuytren’s contracture are inserting into the nodule.
Fig. 14c  Low power scanning electron microscope picture (x 20 magnification) showing the structure of a nodule. The longitudinal fibres are seen inserting into the dermis.

Fig. 15a  The origin of skin pit. The early stage is an indentation at the skin insertion of the longitudinal fibres.
Fig. 15b  Shallow pit has formed at the point ‘X’
The pathogenesis of nodules was investigated by dissecting these at operation. The pattern of disease was different in each digital ray but a constant feature in all cases of palmar involvement was a loss of the normal mobility of the longitudinal fibres over the transverse fibres. Generally the longitudinal fibres in this distal palmar area had lost their silvery tendinous appearance and become white or grey and amorphous. If the previous anatomical description is borne in mind it is possible to understand the clinical picture and pathogenesis of the nodules when each part of the longitudinal fibre system becomes involved with the disease process.

If the contracture involves the most superficial of the longitudinal fibres the distal skin attachment will be pulled proximally causing an indentation at the skin attachment site and bunching of the skin just distal to the distal palmar crease. This skin bunching is apparent clinically as a nodule, as shown in Figures 13 and 14.

This provides an explanation for the observation of Hueston (1976) that the nodules are superficial to the plane of the palmar fascial ligaments.

### Table 2

<table>
<thead>
<tr>
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<th>Index</th>
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<th>Little</th>
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<td>—</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Distal Palmar Crease</td>
<td>—</td>
<td>1</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Insertion of Longitudinal Fibres</td>
<td>—</td>
<td>3</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Elsewhere</td>
<td>3</td>
<td>—</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**Pits**

Table 2 shows the distribution of 48 pits in 21 patients and it is seen that the pits are found in certain well defined areas such as the distal palmar crease and the point of insertion of the longitudinal fibres into the dermis. (Figure 15).

It seems that a pit at the distal palmar crease arises when adhesions develop between the longitudinal and vertical fibre systems (Figures 15e and 15f) and Dupuytren's Disease in the more proximal palmar fascia will pull on the pit so that its mouth faces distally.

When pits and nodules occur without joint contracture it seems that the Dupuytren's Contracture process is confined merely to the more superficial of the longitudinal fibres.
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Fig. 15e Shallow skin pits have developed at the skin insertion site and at the distal palmar crease. An indentation was also apparent in this case at the wrist crease.

Fig. 15f A skin pit at the distal palmar crease.

Fig. 16a Skin involvement of the little finger with an extension to the natatory fibres of the ring finger.

Fig. 16b Diagrammatic representation of skin involvement.
Fig. 16c  Longitudinal fibres to the little finger have been dissected out.

Fig. 16d  Distally the longitudinal fibres of the ring finger are seen to propagate through dermal or subdermal fibres and join with the lateral digital sheet on the radial side of the little finger.

Fig. 16e  The extension to the natatory fibres of the ring finger have been isolated.

Fig. 16f  The excised specimen. Note that a small skin island has been preserved for microscopic orientation purposes.
Distortion of the Palmar Creases

One of the earliest changes is a deepening of the palmar creases. The deepened creases persist on full extension of the metacarpophalangeal joints (Fig. 19a) whereas in the normal hand, as the reader will note by reference to his own, the palmar creases flatten out and are simply linear marks. This deepening may be accompanied by broadening of the crease itself, as described by Hugh Johnson (1980) in his own palm. Horizontal distortion may also occur (Fig 19c) and is proof that the skin is no longer mobile over the longitudinal fibres. (Again the reader can confirm the normal mobility of his palmar creases longitudinally over the longitudinal fibres by flexing the palm and pushing the skin in the region of the palmar creases proximally and distally. This ability is lost in Dupuytren’s Contracture.)

Hueston has attributed the direction of distortion of the palmar creases to the balance of pull between different contracting foci of the disease. This is a factor but once the skin is adherent to the longitudinal fascial ligaments passive pulling by extension of the fingers is also important.

Horizontal distortion of palmar creases was noted in 80% of those with palmar nodules.

An indentation at the wrist crease was frequently seen (fig. 15a, 16a, 19c) in both those with and those without a palmaris longus tendon. Often the indentation became more marked on passive extension of the finger, indicating fibre continuity between this point and the finger. It was assumed that some of the proximal longitudinal fibres of the fascia were attached to skin at this point, but specific dissection has not been performed here.

Cords

Cords are difficult to accurately identify by inspection and palpation except where they bowstring across a concavity or lie just beneath the skin. In the operated patients having palmar involvement, all had cords proximally. These generally appeared white or grey and amorphous for some distance proximal to the creases but further proximally they were silvery and tendinous. Some mature cords, in the absence of nodules were tendinous throughout their lengths and in these it was often difficult to say where the “diseased” tissue started and stopped. This is a general difficulty experienced by surgeons. What one surgeon will consider an excision of diseased tissue, another will consider a prophylactic excision of uninvolved tissue and others would leave this tissue alone. An appraisal of the relative merits of different forms of treatment is beyond the scope of this work, but many of these therapeutic judgements are based on the appearance of the fascia at the time of exploration.

Cords distal to the distal palmar crease were of three types

1. When the most superficial fibres of the longitudinal bundle were involved, the fibres either terminated at the skin attachment forming a pit or were propagated distally in a number of ways.

The contracture process may propagate distally perhaps through the dermis or through some fine fibres just deep to the dermis to reach the finger ligaments (Fig. 16). McFarlane described this as the central cord and although fibres extending
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Fig. 17a Involvement of the longitudinal fibres of intermediate depth, in this case producing flexion contractures of metacarpophalangeal and proximal interphalangeal joints.

Fig. 17b Diagrammatic representation.

Fig. 17c The more superficial fibres were also involved in this case, giving a band of skin involvement as shown in 16b.

Fig. 17d Fibres of intermediate depth have been isolated and are seen to be passing to the lateral digital sheet on the radial side of the ring finger.

Fig. 17e After removal of the longitudinal fibres, the transverse fibres of Skoog are seen proximal to the excised longitudinal fibres and the transverse fibres distally are superficial natatory fibres.

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Fig. 18a Involvement of the deepest longitudinal fibres.

Fig. 18b Diagrammatic representation of involvement of the deepest longitudinal fibres.

distally in the midline of the finger are well noted in Dupuytren’s Contracture, they do not occur in the normal hand. Propagation of the contracture through the dermis almost certainly occurs and is clinically described as skin involvement. It is not difficult to imagine how this can arise as the normal ligaments appear to insert into the dermis and therefore any tension transmitted along the normal fibre will be transmitted into the dermis, as can be demonstrated by blanching of the skin on full extension. This lesion proximally results in “work hypertrophy” of the dermis.

Alternatively distal propagation of contracture of the most superficial fibres may be found through the natatory ligaments.

Cords arising by either of the above mechanisms are the pretendinous cords of McFarlane (1974).

2. The intermediate depth longitudinal fibres (Fig. 17)

3. The deepest longitudinal fibres (Fig. 18)
2 and 3 are discussed below under joint contractures.

Joint Contractures

If the deeper fibres (Fig. 6b “to finger”) (Fig. 17) are involved with the contracting process then tension will be transmitted to the lateral digital sheet and Cleland’s ligaments and finger retraction is likely to occur with particularly proximal joint flexion. The various patterns that may occur have been well described by McFarlane.

If the deepest fibres are involved (Fig. 18) contraction of these proximal to the metacarpophalangeal joint will not produce finger retraction but contraction of fibres distal to the metacarpophalangeal joint will produce flexion of the metacarpophalangeal joint. This type of metacarpophalangeal joint flexion contracture due to deep contracted fibres would be unlikely to be amenable to a
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Fig. 18c Deepest fibres are seen passing around the sides of the flexor tendon sheath.

Fig. 18d The excised specimen.

closed fasciotomy. Another type of metacarpophalangeal joint contracture is that which occurs when the most superficial of the longitudinal fibres are involved in a contracture which propagates distally in the dermis or subdermal fibres and this type of metacarpophalangeal joint contracture is usually associated with a subcutaneous band which is amenable to fasciotomy, (Fig. 16b)

DISCUSSION

Despite the many combinations and permutations of the individual lesions of Dupuytren's Contracture there are clearly recognisable clinical patterns of the distribution of the disease.

In its mildest form the disease may present as a line of nodules or pits in the distal palm and may never progress beyond this stage (Hueston, 1963, Gonzales, 1978). The nodules may even regress after a time. In its most severe form Dupuytren's Contracture may cause flexion deformities of the metacarpophalangeal and proximal interphalangeal joints with widespread nodules and cords and involvement of the skin.

It must be emphasised however that the pattern of Dupuytren's Disease is not random and McFarlane has shown in the digits that the pattern appears to follow anatomical pathways and the same has been noted here in the palm.

A very much larger series of patients would be necessary to document overall the relative frequencies of distribution of the lesions. This series has been collected merely to show that there is a repetitive and predictable pattern and that this is related to the anatomy of the palmar fascial ligaments. The distribution of lesions would be expected to vary in any case with the length of history, age and other factors.
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Pathologically it has been clearly shown that there are two types of tissue present; mature fibrous tissue and this is probably a mixture of normal palmar fascia, and mature cords. Surrounding these and often more superficially there is immature fibroblastic tissue. Reference to Fig. 13 to 16 explains the finding of both types of tissue in a nodule. It is a daunting task for the pathologist to orientate such a specimen and microscopy has not been greatly helpful in solving the enigma as removal of the tissue from the body removes normal tension, destroying orientation, and generally the excision and examination have been performed by different individuals.

The transverse/longitudinal ligament channel system is only one of a number of critical zones in the hand where palmar fascial ligaments are crossing one another; i.e. this means that forces are being transmitted in different directions since the ligaments are a map of the forces acting. Loss of motion therefore will transfer forces from one ligament system to another at a point of crossing (critical zone) giving rise to a stress concentration; i.e. an increase in force/unit area of cross section. The anticipated outcome of such an event in an analogous inert engineering structure would be failure, leading to fracture. Biological systems rarely fail however, they hypertrophy instead. The concept of Work Hypertrophy of Luck therefore has a rational scientific basis. That ligamentous strength is in some way related to force transmitted is well known to sports trainers. One would have to postulate not only hypertrophy of the palmar fascial ligaments but also the laying down by fibroblastic proliferation of new collagen.

This is not in agreement with the work of Skoog who viewed fibre rupture as important. Rather than shock loadings we are considering physiological loadings in a ligamentous system prevented from transmitting normal loadings by adhesions.

It is easy to understand how the condition once reaching the stage of transverse to longitudinal adhesions, must progress to a Dupuytren's Contracture. What
Fig. 19c  Involvement of all of the ligamentous structures in one finger ray.

Fig. 20  Adhesions between the longitudinal and vertical fibres under the distal palmar crease. On gripping, force would be applied to the longitudinal ligament in the direction shown by the arrows, giving rise to a stress concentration within this ligament.

Therefore is the primary cause. Why should it not be the adhesions themselves. We know after all that conditions giving rise to adhesions can be followed by a contracture e.g. trauma, post traumatic sympathetic dystrophy, immobilisation etc. That some individuals get it and some do not could be explained on the basis of different propensities to form scar tissue and we know that there are age, familial and racial differences in skin scarring. Why not also in scars elsewhere? Drugs might affect this also.

Fig. 21  Hypothesis for the aetiology of Dupuytren’s contracture (see text).
The Microanatomy of Dupuytren's Contracture
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We can therefore build up a hypothesis for the aetiology of Dupuytren's Contracture where all the known factors act through a final common pathway of adhesions giving rise to stress concentrations. Use of the hand will do the rest. (Fig. 21).

The pathological process conceived is therefore similar to that causing post traumatic joint stiffness.

After all why should le Baron, no matter how influential, have a pathological process, and Maladie, uniquely his own?

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