THE "LUMBRICAL PLUS" FINGER

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The lumbrical muscles in the hand arise from the tendons of flexor digitorum profundus in the palm and are inserted, wholly or in part, into the dorsal extensor expansions on the backs of the proximal phalanges of the fingers. Each lumbrical muscle has, therefore, an origin with a certain range of movement to which it can adjust its contractile length and still control extension and flexion of the interphalangeal joints through the medium of its insertion (Fig. 1). The lumbrical muscles have been shown to contain a large number of

FIG. 1

The normal action of the lumbrical muscle during flexion of interphalangeal joints. *Left*—Palmar aspect. *Right*—Radial aspect. F.D.P.: flexor digitorum profundus.

FIG. 2

Four conditions which can cause "lumbrical plus". 1) Severance of flexor digitorum profundus. 2) Avulsion of flexor digitorum profundus. 3) Over-long flexor tendon graft. 4) Amputation through middle phalanx.

FIG. 3

FIG. 4

Clinical test for lumbrical plus. Figure 3—With the patient relaxed and not gripping, the affected finger can be fully flexed passively with ease. Figure 4—With the patient gripping with all fingers, the affected finger extends actively at the interphalangeal joints. This is paradoxical extension.

FIG. 5

FIG. 6

FIG. 7

Figure 5—The normal arrangement of the lumbrical origins. Note in the forearm the independence of only the flexor digitorum profundus to the index finger. Figure 6—Illustrating the tendency to sideways displacement of a loose profundus tendon caused by the bicipital origin of the lumbrical muscle. Figure 7—Displacement towards the ulnar side only occurs with the flexor digitorum profundus to the middle finger.

FIG. 8

FIG. 9

When the ring or little finger is affected, diversion of the pull through the lumbrical muscles is limited by the bicipital origin and lack of independent profundus action.

proprioceptive nerve endings and their main function in the normal hand may, in fact, be the coordination and control of delicate movements of flexion and extension of the fingers.

There is, of course, a limit beyond which the bellies of the lumbrical muscles cannot be extended or stretched and consequently a limit to any abnormal proximal shift of the origins at the profundus tendons. When this limit is reached any further proximal shift of a profundus tendon will exert traction on the lumbrical insertion and extend the interphalangeal joints. This can occur only when the distal attachment of the profundus tendon in the finger is disrupted by division or by detachment of its insertion, or when the tendon has been replaced by a free tendon graft which is too long (Fig. 2). The clinical manifestation of this diversion of profundus power through the lumbrical to the extensor apparatus is "paradoxical extension" of the interphalangeal joints: when the patient attempts to maintain full flexion of the finger, the interphalangeal joints actively extend (Figs. 3 and 4). When the profundus tendon still has a distal attachment in the finger but this is too loose, he may be able to flex the fully extended interphalangeal joints but only to the point at which the pull through the lumbrical equals the pull on the distal part of the profundus tendon. This not infrequently occurs when a flexor tendon graft is too long.

FIG. 10

FIG. 11

A case of amputation through the neck of the middle phalanx with consequent division of the flexor digitorum profundus. The greatest amount of active flexion is shown before (Fig. 10) and immediately after division of the lumbrical muscle (Fig. 11).

FIG. 12

FIG. 13

A case of avulsion of the insertion of the flexor digitorum profundus. The greatest range of active flexion before (Fig. 12) and immediately after division of the lumbrical muscle (Fig. 13).

This "lumbrical plus" phenomenon occurs most commonly in the middle (long) finger. From the mode of origin of the lumbricals, one might expect it to be commonest in the index. However, in the case of the index, the patient can easily prevent pull through the lumbrical by not contracting flexor profundus when he flexes the proximal interphalangeal joint with flexor superficialis. In the case of the ulnar three fingers he cannot avoid pulling on flexor profundus to the affected finger when he fully flexes the normal fingers into the palm when gripping: this is caused by the lack of independent action because the tendons to these fingers more or less come from one muscle belly in the forearm (Fig. 5). The usual arrangement of the lumbrical origins is such that, when the profundus to the long finger is detached distally, the tendon is inclined to the ulnar side at the level of the lumbrical origin by the pull of the next lumbrical origin. This causes further tightening of the lumbrical apparatus to the long finger because it has to go round the radial side of the base of that digit to reach its insertion (Figs. 6 and 7). In the case of an affected ring or little finger, diversion of profundus pull through the associated lumbrical is limited by the bicipital lumbrical origins (Figs. 8 and 9).

This lumbrical plus phenomenon has long been recognised by many hand surgeons (Fowler has referred to it in discussion), but few, perhaps, realise the dramatic improvement in function that can be gained, in a case with well developed paradoxical extension, when the lumbrical concerned is divided under local anaesthesia. The paradoxical extension is abolished and the patient may be able immediately to flex the interphalangeal joints (Figs. 10 to 13). It has been my custom to resect the lumbrical at the level of the base of the fibrous flexor sheath in the palm—a simple procedure. So far I have found no disability arising from lumbrical division, but probably it would be contra-indicated in the index and middle fingers in a case with concomitant ulnar nerve paralysis. I have for some time routinely divided the lumbrical when inserting a flexor tendon graft in order to prevent the development of "lumbrical plus" should the graft be a little too long.