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Anomalous fibrous cords in the hand and the phylogeny of the
flexor digitorum sublimis tendon.

The fibrous cords are evidently remnants of the ancestral short flexor muscles of the hand which are normally represented by the distal part of the flexor digitorum sublimis tendons, according to Eisler's theory. They were attached proximally on the radial sides of the bases of the proximal phalanges of the fourth and fifth digits and extended distally to bifurcate like the flexor digitorum sublimis tendons and insert on either side of the volar surface of the middle phalanx. The coexistence of the cords with normal flexor digitorum sublimis tendons apparently either contradicts this interpretation or disproves the theory. Also Bardeleben and Kajava state that the flexor digitorum sublimis tendon may exist side by side with the short musculature in certain mammals, and Fromont describes an anomaly in the human hand showing this condition. Since there are compelling reasons both from comparative anatomy and embryology for Eisler's theory, it is probable that in these apparently contradictory instances the rudiments of the short flexors split to go only in part to the sublimis tendon, while the rest was retained to form more or less perfect short superficial flexor muscles.

ANOMALOUS FIBROUS CORDS IN THE HAND AND THE PHYLOGENY OF THE FLEXOR DIGITORUM SUBLIMIS TENDON

E. D. CONGDON

TWO FIGURES

Tendon-like cords were found in one hand of an aged male subject during the course of dissection by Mr. A. F. Warren. They lie upon the volar sides of the fourth and fifth fingers of the right hand and are closely similar in form and position (fig. 1). Each extends distally from an attachment on the radial side of the base of the proximal phalanx to the volar surface of the vaginal ligaments and there bifurcates. The slips thus formed pass to the opposite sides of the middle phalanx to insert into the vaginal ligament the adjacent fascia and the border of the dorsal extensor aponeurosis. Although of a somewhat less compact structure than a tendon, they can by no means be described as mere condensations of fascia. They did not bring about any marked flexion of the digits in the cadaver, and probably did not hamper movement during life.

The muscles to which the cords seem related are the short superficial digital flexors of amphibia, reptiles, and mammals. These take origin usually upon or in the volar fascia and have insertion in part at least by a pair of slips upon the sides of the metacarpo-phalangeal joint or more distally. The cords differ from the muscles in the position of their proximal ends. Instead of passing to the palmar aponeurosis along the mid-line of the digit they are deflected to the side of the base of the proximal phalanx. The dissimilarity is not great, however, because the cords are in continuity on the phalangeal bases with slips of insertion of the palmar aponeurosis. The relationship of the cords are not like those of the lumbricales or interossei, nor are either of these muscles abnormal or lacking.

The presence of ten short digital flexors in urodele amphibians, in monotremes, and marsupials is generally accepted as sufficient reason for regarding the structures as an ancestral muscle for man and other mammals possessing the flexor digitorum sublimis muscle. As will be seen Testut and Fromont have also described the primitive short superficial flexors in the adult human hand. It can be accepted with a large degree of confidence then that the anomalies in question are actual short superficial flexor remnants.

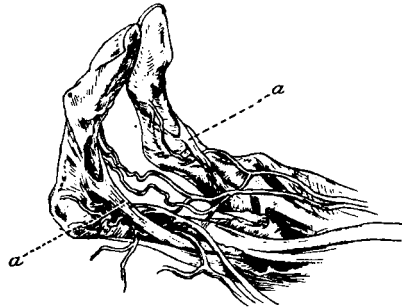


Fig. 1 Hand (after Fromont, with parts omitted) showing abnormal digital muscles. *a.a*, tendon of flexor digitorum sublimis upon which are inserted muscles (*c.c*), interpreted here as short superficial digital flexors; *b.b*, muscles interpreted as short superficial digital flexors taking the place of tendons of flexor digitorum sublimis. $\times \frac{1}{2}$.

The flexor digitorum sublimis muscles of man and many mammals said to arise in part from the short superficial flexor muscles lie in large part within the fore arm, but send their tendons through the palm to the digits. Here they bifurcate to insert on either side of the second phalanx. The flexor digitorum profundus, a companion muscle, whose muscle belly is also in the arm, inserts on the distal phalanges by tendons which pass between the bifurcations of the sublimis insertion. Eisler ('95) suggested that the terminal portion of the sublimis tendon with its bifurcated insertion might be nothing else than a degenerated superficial flexor muscle which after having changed completely to tendon had come, by means of its attachment to the palmar

aponeurosis, to be continuous with a part of the fore arm flexor mass which earlier inserted on the palmar aponeurosis.

McMurrich's careful study of the flexor muscles of amphibians, reptiles, and mammals ('03) gave confirmation and amplification to Eisler's suggestion. It received support of another kind when Gräfenberg ('05) found that a short flexor musculature in the hand of the human embryo connected with a fore arm mass to form a flexor sublimis.

With this view of the origin of the flexor digitorum sublimis muscle it is not to be expected that any mammalian finger will possess at the same time one of its tendons and a short superficial flexor muscle. Kajava ('11) who has examined the digital flexor musculature of monotremes and eleven species of marsupials found, as did McMurrich for other animals, that the two never occurred together in the same digit. Yet Kajava states that there are certain insectivora and carnivora which do possess both the flexor superficialis brevis and the sublimis; Bardeleben ('90) much earlier made a like claim for Hyrax and, according to Eisler (95), for *Paradoxurus*.

References by two authors to aberrant muscles of the human hand related to the anomaly here described bring confirmation to the theory of end-to-end fusion for the sublimis, but at the same time in part offer difficulties similar to those found by Kajava and Bardeleben. Testut is quoted by Kajava from a work which was not accessible as giving instances of the occurrence of a short flexor in the human hand for the little finger which had replaced the corresponding sublimis tendon.

Fromont found a similar displacement of the flexor sublimis in two digits of the hand. His figure is copied here (fig. 2b). A better confirmation of the theory of end-to-end fusion by a reappearance of the primitive structures could scarcely be desired. The condition of the musculature of two other digits were found however to be more involved, the flexor sublimis was present in each of them, but there were also other slender muscle bellies taking origin from the transverse carpal ligament, and inserting on the sublimis tendons (fig. 2a). The conclusion seems necessary that in these two digits part of the embryonic

rudiment derived from the ancestral short flexor have given rise to the corresponding muscles in the adult. The relationships and origin of these slender muscles are also like those of the two larger short superficial flexors. Fromont terms the two of the four short muscles which insert on the sublimis tendons superficial lumbricals, but likelihood of identity with lumbricals is excluded by their relationships and by the presence of almost normal lumbricals in the usual position in the digits to which they are related.

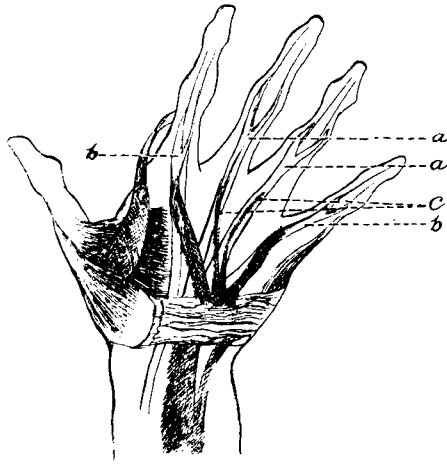


Fig. 2 Fourth and fifth digits of left hand with tendinous cords (*a.a*) apparently representing remnants of short superficial digital flexors. $\times \frac{1}{2}$.

It has been seen that the instances of abnormal human muscular development described by Testut, Fromont, and the writer confirm the comparative anatomical evidence taken from a wide field by Eisler, McMurrich, and Kajava for the theory of end-to-end fusion to the extent that they reveal a tendency toward the formation of short superficial digital flexors in man. But at the same time the anomalies of Fromont and the writer present a difficulty for the theory in the simultaneous occurrence of the short superficial flexors and the tendons which are supposed to arise from them. Observations of a like condition in the

normal structure of a few other mammals have already been referred to. A possible explanation of this contradiction is that when muscle and tendon appear together, the short flexor rudiment divided at an early developmental period to give rise to both the muscle and the tendon. The supposition that there were paired short superficial flexors in the human ancestry as in some other mammals and that their rudiments give origin one to the muscle and one to the tendon is not probable because of the rarity of the anomaly.

BIBLIOGRAPHY

- BARDELEBEN, KARL V. 1890 Über die Hand- und Fuss-Muskeln der Säugetiere, besonders die des Praepollex (Praehallux) und Postminimus. *Anat. Anz.*, Bd. 5.
- FISHER, P. 1895 Die Flexores digitorum. *Verhand. Anat. Gesell., Anat. Anz.*, Bd. 10.
- FROMONT 1895 Anomalies musculaires multiples de la main. Absence du fléchisseur propre du pouce. Absence des muscles de l'eminence thénar. *Lombri-caux supplémentaires. Bulletins de la Société anatomique de Paris*, 5^{me} Série, T. 9.
- GRÄFENBERG, E. 1905 Die Entwicklung der Knochen, Muskeln und Nerven der Hand und der für die Bewegungen der Hand bestimmten Muskeln des Unterarmes. *Anat. Hefte, erste Abt.*, Bd. 30.
- KAJAVA, Y. 1911 Die kurzen Muskeln und die langen Beugemuskeln der Säugetierhand. I. Monotremata und Marsupialæ. *Vergleichend-anatomische Untersuchungen. Anat. Hefte, erste Abt.*, Bd. 42.
- McMURRICH 1903 The phylogeny of the palmar musculature. *Am. Jour. Anat.*, vol. 2.