

Assessment of the Presence or Absence of Palmaris Longus and the Fifth Superficial Flexor Tendon in the Iranian Population: Are these tendons evolutionary?

Afshin Ahmadzadeh Heshmati (1)

Ali Karbalaiekhani (2)

Alireza Saied (3)

Mohsen Rouhani (4)

Mahsa Aboei (4)

Farzad Abroud (4)

Elahe Havoshk (4)

(1) Assistant Professor of orthopaedics, Kerman Neuroscience research centre, Dr Bahonar Hospital, Kerman University of Medical Sciences, Kerman, Iran

(2) Assistant Professor of hand surgery, hand surgeon, AJA University of Medical Sciences, Emam reza hospital, Tehran, Iran

(3) Associate Professor of Orthopedics, Medical Informatics Research Centre, Kerman University of Medical Sciences, Kerman, Iran

(4) Student of Medicine, Students Research Committee, Kerman University of Medical Sciences, Kerman, Iran

Correspondence:

Saied A.R. M.D., Orthopedics department,

Dr. Bahonar hospital, Kerman neuroscience research center,

Tel: +983412114375, +989133410521, telefax: +983412448546,

Email: arsaied@kmu.ac.ir

Abstract

Introduction: The lack of a Palmaris longus tendon and the absence of a fifth superficial flexor function are normal variations found in the human wrist and hand. The purpose of our study was to assess the incidence of both of these variations and also to answer the question of whether they are evolutionarily conserved muscles.

Methods: The study population was volunteers (or informed consent from parents) from preschools, grammar schools, high schools and universities, offices, and nursing homes who were examined for the presence of the Palmaris longus tendon and for variations of the fifth superficial flexor.

Results: By the end of the study, 1180 individuals were enrolled and their data were recorded. Of the total 2,360 hands studied, 1,688 had a Palmaris longus tendon (71.4%) and 1,284 had a functional fifth superficial flexor (54.4%). In 886 hands fourth flexor-dependent function was found (37.5%) and ultimately in 190 (8%) the function was absent.

Presence, dependent function, or absence of fifth flexor or Palmaris was not related to age, hand side or dominance. Fifth flexor variations were not related to sex, but unilateral absence of Palmaris longus was 1.5 times more common in women. No difference was found between the sexes regarding variations of the superficial flexor. No correlation was found among the variations between one tendon and the other within one hand and/or that individual's other hand.

Conclusion: The findings of the present study are similar to those found in some other similar reports related to variations in these tendons. It seems that Palmaris longus and the fifth superficial flexor function are not evolutionarily determined, at least in the studied population.

Key words: Palmaris longus, fifth superficial flexor, variation, evolution.

Introduction

The Palmaris longus is one of the most variable muscles of the body and may be absent in some individuals (1). The fifth superficial flexor of fifth finger is also among the variations of the human body, and in some individuals it is not detectable or not present. This claim is controversial: some studies have concluded that this tendon is absent in certain individuals (2, 3) while others have concluded that the absence is functional rather than anatomical (4). Both of these tendons have been considered to have evolved (5). In the present study our main purpose was to assess the frequency of these variations in relation to an Iranian sample population and to answer the question of whether they are evolutionarily determined.

Materials and Methods

This prospective study was performed on a population comprised of volunteers from preschools, primary schools, high schools, universities, offices and nursing homes in the city of Kerman, Kerman province, Iran. Institutional ethics committee permission was granted. In each case, if informed consent was given by the individual, s/he was examined by an examiner trained for that purpose. At first the classic test for the presence of Palmaris was performed, in which the individual would place his or her fifth and first fingers in opposition to each other while flexing the wrist. If the Palmaris longus tendon was visually detected and palpated, the individual was assumed to possess the tendon (6). If this visual examination and palpation test was negative, then the other tests were performed to confirm the absence of the tendon, and if the results were negative for all tests, the individual was assumed to be without the tendon. Contradictory or suspicious cases were excluded from the study.

The fifth superficial flexor was assessed by asking the volunteer to flex the Proximal interphalangeal joint (PIP) at least 90 degrees while the examiner kept the second, third, and fourth fingers fully extended. The individual was considered to have a functional Flexor Digitorum Superficialis (FDS), if s/he could. If the test result was negative, then the examiner would release the fourth finger and repeat the examination. If this time the PIP was bent to 90 degrees, it was a dependent tendon, and if not, the individual had a nonfunctional or completely deficient fifth FDS (4).

Results

By the end of the study, 1,180 individuals and thus 2,360 hands were enrolled, comprising 433 males and 747 females. The mean age of the individuals was 26.64 ± 17.94 , with a range of 5 to 91. 1,132 individuals were right-handed (95.9%), 414 men and 718 women.

The Palmaris Longus tendon was present bilaterally in 730 (62%) and absent bilaterally in 222 (19%). In 228 individuals the tendon was present on one side, 101 in the right hand and 117 in the left. Of the total 2,360 hands, the tendon was present in 1,688 (71.4%) and absent in 672 (28.6%). Of the male hands studied, 679 (78.4%) possessed the tendon and in women's hands, the tendon was present in 1,005 (67.3%). Of the right hands studied, 831 (70.5%) possessed the tendon, and of the left hands, the tendon was found in 853 (72.2%). Of the total dominant hands, 1,624 of 2,264 dominant right hands (71.7%) and 65 of 96 dominant left hands (67.5%) featured the Palmaris longus tendon. These results are shown in Table 1.

480 individuals had functional FDS bilaterally (40.4%); in 273 individuals it was dependent on the fourth FDS bilaterally (23.2%), and in 32 individuals the fifth FDS was bilaterally nonfunctional (2.7%). Of the remaining 391 individuals, in 134 the right hand had a dependent and the left a functional FDS; in 135, the left side had a dependent tendon and the right a functional one; in 33, the right had a functional and the left a nonfunctional tendon; and ultimately, in 24 the left was dependent and right was nonfunctional (Table 2). Of the total 2,360 hands, 1,284 had functional FDS (54.4%), 886 had dependent FDS (37.5%) and 190 had nonfunctional FDS (8%). Table 3 shows FDS incidence in dominant hands.

Twenty-three right and 31 left hands had neither the Palmaris longus nor fifth flexor tendon. Twenty-three individuals had absent Palmaris and nonfunctional flexors bilaterally.

The results were analyzed with a generalized estimation equation and the conclusion was reached that the variations in the Palmaris longus and the fifth superficial flexor tendons' presence or absence were not related to age, side, or dominance. The fifth FDS variations were not affected by sex, but bilateral lack of Palmaris longus was 1.8 times more frequent in females, while there was no difference between the sexes with regard to the unilateral absence or presence of Palmaris. Again there were no correlations among the variations of Palmaris and the fifth flexor tendon.

Table 1. Palmaris longus situation regarding side and sex (p>0.05 in all)

Palmaris	male		female	
	right	left	right	left
present	324 (77/7%)	329 (78/9%)	486 (65/9%)	505 (68/3%)
absent	93 (22/3%)	88 (21/1%)	251 (34/1%)	234 (31/7%)

Table 2. Palmaris longus situation regarding bilateral absence or presence

	female	male	sum	p-value
Bilaterally present	431 (59/9%)	299 (69/2%)	730	<0/001
Bilaterally absent	170 (22/8)	52 (12%)	222	<0/001

Table 3. Fifth FDS situation regarding side and sex (p>0.05 in all)

Fifth FDS	Male		Female	
	right	left	right	left
Present	229	229	419	412
dependent	182	170	272	308
absent	22	34	56	27

Table 4. Fifth FDS situation regarding dominant side

Fifth FDS	Present	Dependent	Absent
Right dominant hand	1244 (54/9%)	885 (39/1%)	135 (6%)
Left dominant hand	46 (47/9%)	46 (47/9%)	4 (4/1%)
p-value	0/106	0/053	0/302

Discussion

In the present study we assessed the variations in the Palmaris longus and the fifth superficial flexor in an Iranian population, and also considered their presence or absence in relation to age and to each other; ultimately we found no correlations.

The variations in Palmaris longus have been studied extensively in different populations and very different findings have been reported, from the absence of the tendon in more than 50% (6) to its presence in more than 96% (7). In one study of an Iranian population, the 23% absence of the Palmaris longus tendon was the result that is closest to ours (8). For the fifth superficial flexor we could find only one epidemiologic study with results comparable to ours: about 6% absolute deficiency and 40% dependency on the fourth flexor. Another study found an absence of the tendon in 33% of the population, which is a lower incidence than in our findings (10).

As previously reported, Palmaris and fifth FDS are commonly considered evolutionary developments, disappearing with time over generations. This hypothesis has been examined in a study on an African population by assessing the difference of variations in different age groups and it was concluded that no obvious evolutionary trend was present (11). Another study with the same method reached the conclusion that the tendon was evolutionarily

determined (12). Our study assessed variations in the detection of these tendons with age, which we think is statistically more meaningful. We could not find any study that assessed an evolutionary trend for FDS.

Are the variations affected by the dominance of the hand? To the best of our knowledge only one study has tried to address this topic directly, and only regarding Palmaris longus. It concluded that the nondominant hand had a higher incidence of an absent Palmaris longus (13). Another study noticed this too, but not as its primary conclusion, and it noted that Palmaris was more frequently absent in the left-dominant hand (8). Again, we used the relation instead of difference and did not find a correlation, either for Palmaris or for the flexor. Our findings for flexor independence in relation to sex, age, and dominance are comparable to at least one previous study (14).

Another point to be noted is the correlation among variations in the tendons, as they have a common origin from the medial epicondyle and similar innervations. So, it may seem logical that variations are found together or at least that there is a relationship. To our knowledge, only one study has been performed to answer this question and has found no correlation (15). It considered the absence of presence (functional, non-functional) of the tendon, in contrast to the present study in which dependency on the fourth flexor was considered too, though the result was similar as no correlation was found.

Studies of Palmaris longus variations and their relationship with sex have reached different conclusions. In some, the absence of these tendons has been reported more frequently in females (16, 17, and 18). In others, no difference was reported (19 and 20) and at least one study found more frequent absence of the tendons in men (21). It is interesting to note the finding of a more frequent bilateral absence in women, and the equal incidence of a unilateral absence in men and women (22).

The last point is the fact that different statistics about variations in Palmaris longus are related to the studied race and location, but is it possible that different observers have different interpretations of a test on a single person? To the best of our knowledge no study has noted the interobserver and interobserver reliability of different tests performed for assessing these variations and this may be a good topic for further research. At least one study observed that different tests may give different results in one person (23), at least in relation to this topic.

The most important limitation of the present study is the fact that due to several considerations we included a larger population of young people than the elderly; the most obvious was their availability. The very sensitive tests that we used for statistical analysis, would have compensated for this, but of course not completely.

Based upon the findings of the present study, it seems that the tendons that are the subject of this paper, at least in the population studied, are not evolutionary and, in other words, are not related to age.

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