

# USE OF THE TENDON OF THE PALMARIS LONGUS MUSCLE IN SURGICAL PROCEDURES: STUDY ON CADAVERS

LUIZ CARLOS ANGELINI JÚNIOR<sup>1</sup>, FELIPE BERDELLI ANGELINI<sup>2</sup>, BRUNA CRAVEIRO DE OLIVEIRA<sup>3</sup>, SONIA APARECIDA SOARES<sup>3</sup>, LUIZ CARLOS ANGELINI<sup>3</sup>, RICHARD HALTI CABRAL<sup>3</sup>

## ABSTRACT

**Objective:** Demonstrate that the tendon of palmar long can be estimated in relation to its length and width before using it as a graft in surgical procedure. **Methods:** There were examined 60 forearms of 30 corpses of black ethnicity; measure the length and width of the tendon of the palmaris longus muscle and compared the length of the forearm. **Results:** There are notes their absence unilateral right in two female corpses. The medium length and width were more or less

respectively 11.9, 15.2 mm and 4.1 + 1.5 mm. The total average forearm length of 275.4 was more or less 17.9 mm. **Conclusion:** There is a significant relationship between the length of the tendon and the length of the forearm; so we can evaluate the size of the tendon of the palmaris longus muscle when it is necessary to use it for grafts. **Levels of Evidence IV, Case series.**

**Keywords:** Muscle. Microsurgery. Cadaver.

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## INTRODUCTION

After originating from the medial epicondyle of the humerus, the palmaris longus muscle, the thinnest of the flexor muscles of the carpus, is situated in the anterior region of the forearm, covered by the fascia; it occupies the region that lies medial to the radial flexor of the carpus and lateral to the flexor carpi ulnaris, covering posteriorly part of the superficial flexor digitorum.<sup>1</sup> Its short, fleshy belly extends downwards becoming a tendon halfway along the forearm.<sup>1</sup> In the distal third of the forearm this tendon overlaps the median nerve and lateral border of the tendons of the flexor digitorum superficialis. It is irrigated by the ulnar recurrent arteries and innervated by a single branch or trunks of the median nerve that extend in the direction of the pronator teres and flexor carpi radialis, arriving at the palmaris longus posteriorly, after perforating the flexor digitorum superficialis.<sup>1</sup> It has multiple insertions. In the carpal region it splits into two fascicles. The internal, more voluminous fascicle attaches to the anterior surface of the transverse carpal ligament; the external fascicle is confused with the origin of the thenar muscles, especially the abductor pollicis brevis.<sup>1</sup> To a lesser extent it also inserts into the distal an-

tebrachial aponeurosis and into fibrous walls that separate it from the neighboring muscles; due to its topographical importance it is used as a reference in wrist surgery.<sup>1</sup> As it is considered an accessory muscle and not essential for normal function, as its absence has not been associated with loss of grip and pinch strengths,<sup>2</sup> this tendon is used as a graft in a large number of surgical procedures, such as: chronic injuries of the flexor tendons,<sup>3,4</sup> ligament reconstructions,<sup>5</sup> pulley reconstruction,<sup>6</sup> ocular defects, reconstructions and ligaments of the thumb and elbow, blepharoptosis<sup>6</sup> and other surgical reconstructions.<sup>5,6</sup> Among vertebrates the palmaris longus is restricted to the mammals and well developed in species with weight-bearing gait. For example, the palmaris longus is always present in the orangutans, but is variably absent in chimpanzees and gorillas. In human beings many authors consider it to be a tensor<sup>7</sup> of the palmar aponeurosis and that it possibly contributes to wrist flexion.<sup>8</sup> Described as one of the muscles with most anatomical variation it is classified as a muscle in phylogenetic regression. Morphogenetically its tendon and muscle are developed and regulated by a HOX gene.<sup>9,10</sup>

All the authors declare that there is no potential conflict of interest referring to this article.

1- Hand Surgery Clinic of Hospital do Servidor Público Municipal (HSPM) – São Paulo, SP, Brazil.

2- Sports Medicine of the Department of Orthopedics of Escola Paulista de Medicina da Universidade Federal de São Paulo (UNIFESP) – São Paulo, SP, Brazil.

3- School of Medicine of Universidade Metropolitana de Santos – Santos, SP, Brazil.

Study conducted at Universidade Metropolitana de Santos – Santos, SP, Brazil.

Mailing address: Av. Aclimação, 68 conj.31/32 – 3209-9095 – Fax 3208-3691. Aclimação - São Paulo – SP, Brazil. CEP: 01531-001. Email: [lcangelini@uol.com.br](mailto:lcangelini@uol.com.br)

The palmaris longus muscle can develop a proportion in relation to the forearm length genetically determined before birth.<sup>7</sup> The aim of this study is to demonstrate that the tendon of the palmaris longus muscle can be estimated in relation to its length and width before any surgical procedure.

## MATERIALS AND METHODS

The present study protocol was approved by the IRB of UNIMES 036/2011 - CAAE: 0048.0.161.000.11.

Sixty forearms were examined, consisting of 10 from women and 20 from men, all Afro-descendants, belonging to the laboratory of Human Anatomy of the Morphology Department of the Universidade Metropolitana de Santos. The cadavers, kept in a 10% formaldehyde solution, had their forearms dissected by means of anatomical dissection similar to what we use under surgical conditions. The measurements of the length and width of the tendons were made in millimeters with the help of the Universal Precision Digital Caliper Lee Tools 6 "150 mm". (Figures 1 and 2)

A measuring tape was used to measure the forearm length. The length of the tendon of the palmaris longus muscle was defined, in its distal part, as a point at which it crosses the distal wrist fold and in its proximal part as the most distal point between the muscle and the tendon. (Figure 2) The forearm length, which was defined from the ulnar styloid apophysis to the top of the olecranon (Figure 3), was also measured.

The ratio between tendon width and length and forearm length was evaluated using the Student's t statistical method.

## RESULTS

The presence of the right unilateral palmar muscle was not detected in two female cadavers in this study.

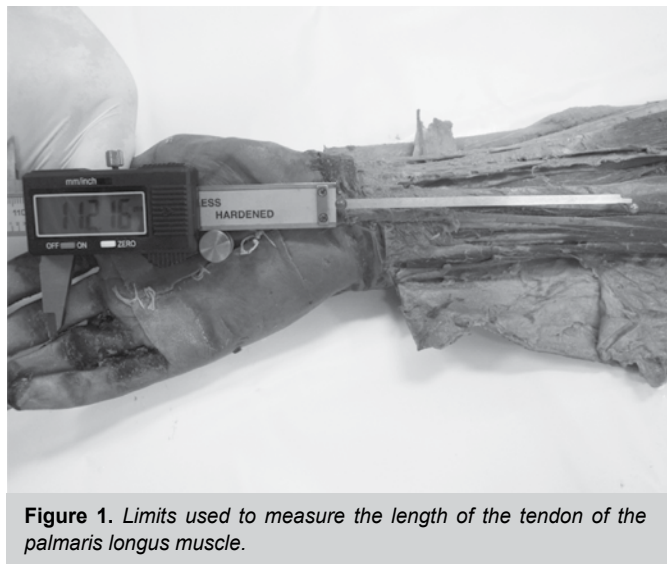
It was observed that between the two sexes there is significant correlation between tendon length and forearm length ( $r=0.53$ ;  $p<0.01$ ) and ( $r=0.549$ ;  $p<0.05$ ), respectively. The tendon width does not present statistical significance. The mean length of the male group added to that of the female group was 119.9mm; with the groups separate, the means were 123.6mm and 111.4mm, respectively. In relation to the forearm length the



**Figure 2.** Limits used to measure the width of the tendon of the palmaris longus muscle.



**Figure 3.** Limits used to measure the length of the tendon of the palmaris longus muscle.



**Figure 1.** Limits used to measure the length of the tendon of the palmaris longus muscle.

general mean was 275.4mm; separately for the male sex the mean value was 277.5mm, while for the female group it was 270.8mm. (Table 1)

According to the test for equality of means of the measurements between both sexes a significant difference was demonstrated in the tendon length between them. (Table 2)

A correlation was observed between tendon length, width and forearm length in men and women. (Table 3)

## DISCUSSION

The absence of the palmaris longus muscle was described for the first time in Columbus' book, entitled *De Re Anatomica*, and published soon after his death, in 1559, without illustrations, except for those contained on the cover sheet<sup>11</sup>. Machado and DioDio<sup>12</sup>, Alves et al.<sup>13</sup> and Thompson et al.<sup>14</sup> have been the subject of studies on cadavers and also of clinical studies.<sup>2,8</sup>

**Table 1. Measurements of tendon length, forearm width and length between the sexes.**

	Tendon Length (mm)	Tendon Width (mm)	Forearm Length (mm)	Ratio of the Lengths 100%
Men	123.6+/-10.4	3.9+/-1.4	277.5+/-17.8	44.6+/-3.3
Women	111.4+/-20.5	4.7+/-1.7	270.8+/-17.8	41.1+/-6.9
Total	119.9+/-15.2	4.1+/-1.5	275.4+/-17.9	43.5+/-4.9

**Table 2. Test for equality of means of the measurements between the male and female sexes.**

	Statistic t	p-value
Tendon Length (mm)	2.3898	0.0263
Tendon Width (mm)	-1.8855	0.0646
Forearm Length (mm)	1.3416	0.1851

**Table 3. Correlation between tendon length, forearm width and length.**

Men						
(mm)	Correlation (c)			p-value (p)		
	Tendon Length (mm)	Tendon Width (mm)	Forearm Length	Tendon Length (mm)	Tendon Width (mm)	Forearm Length
Tendon Length (mm)	1.00					
Tendon Width (mm)	0.11	1.00		0.4882		
Forearm Length (mm)	0.53	0.12	1.00	0.0004	0.4778	
Women						
(mm)	Correlation (c)			p-value (p)		
	Tendon Length (mm)	Tendon Width (mm)	Forearm Length	Tendon Length (mm)	Tendon Width (mm)	Forearm Length
Tendon Length (mm)	1.00					
Tendon Width (mm)	-0.43	1.00		0.0786		
Forearm Length (mm)	0.49	0.42	1.00	0.0374	0.0844	

It is known that a wide variation is described with prevalence<sup>9,10</sup> of absence in different ethnic groups.<sup>12-20</sup> In the hand surgery books its absence can range from 11.2 to 15%, it is more common in bilateral than unilateral in women and the left side is more affected by absence than the right side.<sup>17</sup> It has a high prevalence in Caucasians (22.4%) and Turks (63.9%), and a low prevalence in blacks (3%), Asians (4.8%), and Koreans (0.6%).<sup>8</sup> Clinical studies can check the presence of the palmaris longus for preoperative evaluation for the harvesting of grafts, yet these studies can be poorly interpreted.<sup>2,16</sup> In his study, Milford<sup>19</sup> mentions that the palmaris longus offers a length of approximately 15cm for grafts, but did not mention the width. Other authors carried out the same study on black or Japanese cadavers;<sup>16-20</sup> where they verified the absence of the palmaris longus muscle as seen in the literature. The unilateral presence of this muscle at right was recorded in two female cadavers of the black race, while unilateral and bilateral absence were observed in two cadavers of Japanese and Chinese nationality, without sex specification<sup>18-20</sup>. With this study one can suggest that the tendon be presumed before, of its retreat to be used in grafts.

### CONCLUSION

The measurement of the tendon of the palmaris longus muscle has the advantage of allowing the estimation of its length and width before removing it for surgical graft procedures, besides favoring the possibility of making only two excisions to remove it.

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