



# Prevalence of Absence of Palmaris Longus Tendon in a Population Sample from a Multiethnic Brazilian City\*

## *Prevalência de ausência de tendão palmaris longus em uma amostra populacional de uma cidade brasileira multiétnica*

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### Abstract

**Objective** The objective of the study was to determine the prevalence of absence of palmaris longus tendon in a population sample from a multiethnic Brazilian city.

**Methods** A cross-sectional observational study was carried out between October 2017 and April 2018. We included male and female volunteers aged 18 years or older. The absence of palmaris longus tendon was determined by asking the volunteers to perform the Schaeffer test bilaterally.

**Results** We prospectively collected data on 1,008 volunteers, 531 male and 477 female, with age between 18 and 74 years (mean 38.4 years). The absence of palmaris longus tendon was observed in 264 (26.2%) volunteers. Bilateral absence was detected in 123 volunteers (12.2%), 60 female (48.8%) and 63 male (51.2%). Unilateral absence was found in 141 patients (14.0%), 54 female (38.2%) and 87 male (61.8%) ( $p < 0.05$ ).

**Conclusion** The prevalence of absence of palmaris longus tendon in our study was 26.2%. There was no statistically significant difference between gender and bilaterally. The absence of palmaris longus tendon was predominant on unilateral right side in males.

### Keywords

- ▶ prevalence
- ▶ tendons
- ▶ hand deformities, congenital

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**Resumo**

**Objetivo** O objetivo do presente estudo foi determinar a prevalência de ausência de tendão palmaris longus em uma amostra populacional de uma cidade multiétnica brasileira.

**Métodos** Um estudo observacional transversal foi realizado entre outubro de 2017 e abril de 2018. Incluímos voluntários dos sexos masculino e feminino com 18 anos ou mais. A ausência do tendão palmaris longus foi determinada pedindo aos voluntários que realizassem o teste de Schaeffer bilateralmente.

**Resultados** Foram coletados prospectivamente dados de 1.008 voluntários, 531 homens e 477 mulheres, com idade entre 18 e 74 anos (média de 38,4 anos). A ausência do tendão palmaris longus foi observada em 264 (26,2%) voluntários. A ausência bilateral foi detectada em 123 voluntários (12,2%), 60 mulheres (48,8%) e 63 homens (51,2%). A ausência unilateral foi encontrada em 141 pacientes (14,0%), 54 mulheres (38,2%) e 87 homens (61,8%) ( $p < 0,05$ ).

**Conclusão** A prevalência de ausência do tendão palmaris longus em nosso estudo foi de 26,2%. Não houve diferença estatisticamente significativa bilateralmente e entre gêneros. A ausência do tendão palmaris longus foi predominante no lado direito unilateral no sexo masculino.

**Palavras-chave**

- ▶ prevalência
- ▶ tendões
- ▶ deformidades congênitas da mão

**Introduction**

The palmaris longus (PL) muscle is one of the four superficial muscles of the anterior compartment of the forearm. It has a fusiform muscular belly that originates from the medial humeral epicondyle, and its long tendon inserts distally in the volar aspect of the palmaris.<sup>1</sup> This anatomic configuration creates an axis of action along the flexor-pronator mass, allowing the PL to act as wrist flexor and palmaris aponeurosis tensor. Its power, however, is classically described in anatomical textbooks as much weaker than that of the other muscles of this compartment, the flexor carpi radialis, the flexor carpi ulnaris, and the pronator teres, making it a replaceable muscle in the hand surgery practice.<sup>1-4</sup> Because of this coadjutant action, the palmaris longus tendon (PLT) is a very important graft donor site in reconstructive surgery, ligament repair, and muscle transfers.<sup>5-7</sup> The PLT presents a great anatomical variation in presence, position, duplication, and slips.<sup>3-5,8-23</sup> Its variation has importance in clinical, surgical, and radiological and rehabilitation analysis. The worldwide absence is highly variable. A Chinese study has shown 4.6% of PLT absence in the population studied.<sup>15</sup> In the north of Iran, the overall PLT absence was recorded in 13.2% of individuals;<sup>3</sup> 16.3%<sup>12</sup> in the USA, 24.4% in South Africa,<sup>14</sup> and 37.5% in Serbia.<sup>16</sup>

Because of the surgical importance of this anatomical structure in the field of hand and orthopedic surgery and rehabilitation, we decided to conduct the present study to evaluate the prevalence of absence of PLT in a population sample from a multiethnic Brazilian city.

**Materials and Methods**

This study was approved by our institutional review board (CAAE: 81215917.7.0000.5505). Informed consent was

obtained from all individual participants included in the study.

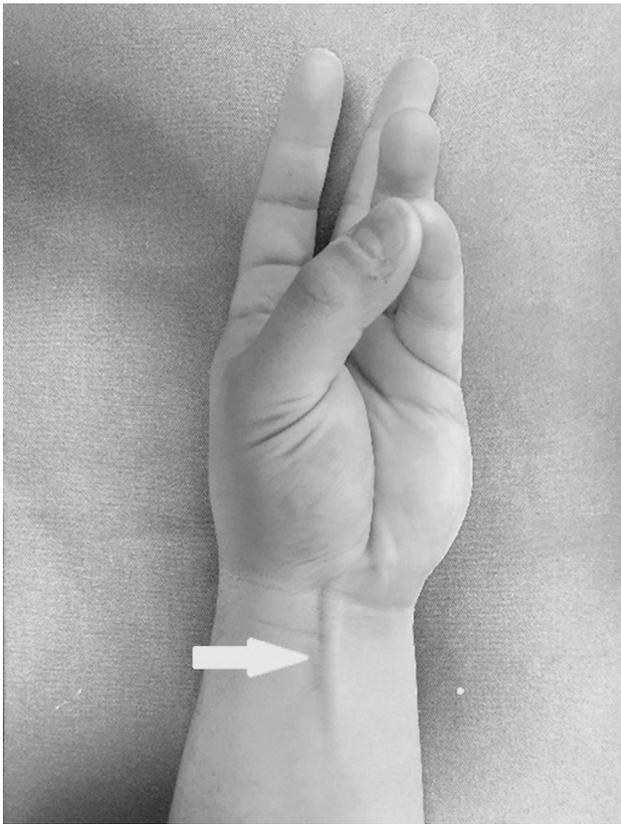
We performed an observational cross-sectional study that included 1,008 volunteers prospectively evaluated from October 2017 to April 2018 in the University Hospital. Any patient or patient companion with no complaint about the upper limbs, aged equal or over 18 years old from both genders was considered as volunteer. After signing the informed consent, these volunteers were clinically assessed for the presence of PLT by undergoing the Schaeffer test bilaterally (▶ Fig. 1). The Schaeffer test consists of a painless active flexion of the wrist with the thumb and little finger touching each other in opposite fashion.<sup>11,12</sup> The PLT was considered absent if it could not be visualized by the Schaeffer test or palpated during examination by the finger of the examiner (▶ Fig. 2). All volunteers were evaluated by means of the test involving three independent examiners and confirmed by a senior author if necessary.

We excluded candidates who had prior surgeries, traumatic lesions, congenital anomalies in the upper limb or candidates who declined to sign the informed consent form.

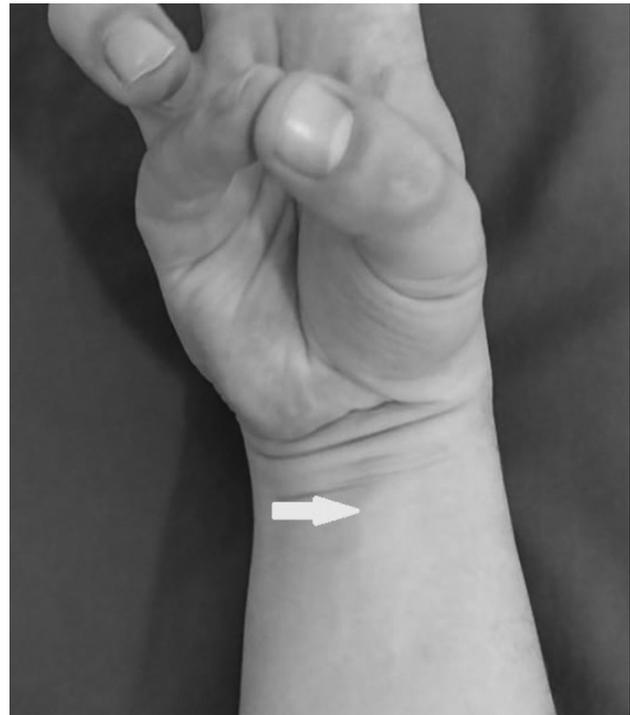
Data was analyzed considering the variables: age, laterality, and gender. The differences were mathematically evaluated with the Chi-squared test using the IBM SPSS Statistics for Windows, Version 23.0 software (IBM Corp., Armonk, NY, USA) and considered statistically significant if the  $p$ -value was less than 0.05 ( $p < 0.05$ ).

**Results**

We prospectively collected data on 1,008 volunteers, 531 males (52.7%) and 477 females (47.3%), with age between 18 and 74 years (mean 38.4 years). Of this total, 264 volunteers showed some absence of PLT, which represents an overall prevalence of absence of 26.2%.



**Fig. 1** Schaeffer's test: presence of palmaris longus tendon (white arrow).



**Fig. 2** Schaeffer's test: absence of palmaris longus tendon (white arrow).

Bilateral absence was detected in 123 volunteers (12.2%), 60 female (48.8%) and 63 males (51.2%). The gender-related prevalence of bilateral absence in females was 12.6% and 11.9% in males,  $p = 0.729$  (► **Table 1**).

Unilateral absence was found in 141 volunteers (14.0%), 54 women (38.2%) and 87 men (61.8%),  $p = 0.021$ . Based on

laterality, the unilateral absence of the PLT in the right side was detected in 57 volunteers (5.6%): 18 women (31.6%) and 39 men (68.4%),  $p = 0.014$ . On the left side, 84 volunteers (8.3%): 36 women (42.8%) and 48 men (57.2%),  $p = 0.392$  (► **Table 2**).

**Discussion**

Anatomical variations of the volar muscles and tendons unit of the forearm are frequently reported by anatomists and clinicians. Such variations may or may not have clinical implications. The most common anatomical variations are in the flexor digitorum superficialis, flexor digitorum profundus, flexor pollicis longus, and palmaris longus.<sup>11,24-26</sup>

Reimann et al.<sup>10</sup> in a study of 1,600 extremities considered the palmaris longus muscle and tendon as an accessory muscle. In humans, the PL can present with anatomical variations regarding the insertion site, tendon length, muscular belly shape, number of muscular bellies or its complete absence.<sup>10,27</sup> In the present study, our focus was to evaluate

**Table 1** Gender-related prevalence of bilateral absence

		BILATERAL ABSENCE		P
		NO	YES	
GENDER	FEMALE	417	60	0.729
	MALE	468	63	
TOTAL		885	123	

**Table 2** Unilateral absence regarding gender and side

TABLE 2 - UNILATERAL PL ABSENCE (DETAIL)							
		LEFT ABSENCE		P	RIGHT ABSENCE		P
		NO	YES		NO	YES	
GENDER	FEMALE	441	36	0.392	459	18	0.014
	MALE	483	48		492	39	
TOTAL		924	84	TOTAL	951	57	

the absence of PLT by clinical examination. The presence or absence of PL has been determined by multiple tendon examination techniques. Different tests were described, Schaeffer's test,<sup>11,12</sup> Thompson's fist,<sup>12</sup> Mishra's 1<sup>st</sup> & 2<sup>nd</sup> test,<sup>28</sup> Pushpa kumar's two finger test.<sup>13</sup> In our study we used the standard Schaeffer test associated to finger examiner's palpation of PLT. Holzgrefe et al.<sup>29</sup> observed an absence of the PL tendon in 14% of wrists by physical examination and 10% of wrists by sonography. All PL tendons missed on physical examination were small and none were considered to be suitable for tendon grafting. The intraclass correlation coefficient between PLT length measurement on examination and ultrasound was 0.54. The Schaeffer test accurately detected this tendon with > 90% sensitivity and specificity.<sup>30</sup>

The studies to determinate the prevalence of absence of PLT present different amount of subjects evaluated. Alves et al.,<sup>17</sup> in 2011, evaluated 200 Chileans, Kapoor et al.<sup>15</sup> evaluated 500 Indians in 2008, Soltani et al.<sup>19</sup> evaluated 516 Americans in 2012, Sankar et al.<sup>22</sup> evaluated 942 Indians in 2011, and Kose et al.<sup>31</sup> evaluated 1,350 Turks in 2009. In our study, we included 1,008 Brazilians volunteers.

In our study we obtained a PLT absence rate of 26.2%. Palmaris longus absence appears to be associated with ethnicity/ancestry.<sup>15,18</sup> In the last population census, the multiethnic population of city of São Paulo is composed with Caucasians (63.9%), Blacks (34.6%), Asian (2.2%) and Indigenous (0.1%).<sup>32</sup> The ethnic characteristics of our population, seems to favor the occurrence of intermediate prevalence values. It is possible to identify in our results a considerable difference in relation to Asian or Indian populations, and a similarity in values of African, South American and European subjects.<sup>8,12,15-17</sup> Ranking it by prevalence, we could see groups of low frequency of absence, like Asian population (4.08–4.5%) and high frequency of absence like in Serbians or Arabs (31.1–37.5%).<sup>20,21</sup> Between these extremes, there is a large intermediate group formed by Caucasians, South Africans and Chileans (20.0–26.5%).<sup>13,16,17</sup>

Our study found a bilateral PL absence rate of 12.2%: 12.6% of women and 11.9% of men. Venter et al.<sup>16</sup> in South African population and Alves et al.<sup>17</sup> in a Chilean subjects found similar rates. Morais et al.<sup>33</sup> studying a local population in Brazil, observed that bilateral absence was in 12.2% of subjects.<sup>33</sup>

The unilateral PL absence rate, in our study was of 14.0%, 5.3% women and 8.6% men. This numbers closely resemble those found by Venter et al.<sup>16</sup> in South African population and Alves et al.<sup>17</sup> in a Chilean subject. Regarding laterality, 5.6% of our volunteers presented exclusive unilateral absence on the right side and 8.3% exclusively on the left side. Similar rates were observed by Eric et al. in Serbians.<sup>20</sup>

The importance of this type of study is related with the frequent use of the PLT in surgical procedures in upper extremity. During a surgical procedure for harvest graft, the size of tendon can be evaluate because there is a significant relationship between the length of the tendon and the length of the forearm.<sup>34</sup> Safe harvesting of the PLT mandates knowledge of the anatomy, in particular the proper differentiation between median nerve and PLT

and when occurs it absence.<sup>35</sup> Cetin et al.<sup>36</sup> had determined that grip strength of the hand wrist was not affected in the absence of PLM.

The PLT is used frequently as graft in upper extremity surgical procedures to restore function and improve the quality of life of many patients with a variety of disease etiologies. Postoperative care is a team effort by the surgeon, therapist, and patient. Restrictions are initially placed for the patient, and these are then reduced as they begin to incorporate the new motion into daily activity.<sup>36</sup> Although extremely important, during the organization of this manuscript, we had the opportunity to observe that the number of scientific publications on rehabilitation protocols is still small. There is consensus that the active rehabilitation protocol is only possible with thick connections used, the strength of the thick-medium thin connection is at the limit of indications for the active rehabilitation protocol, and the coarse-thin connection strength is sufficient only for the passive rehabilitation protocol.

Our study presents some weaknesses, namely: it was designed based on the clinical examination of the volunteers, being, therefore, examiner-dependent. No image exam has been done to confirm the diagnostic, which could have raised the evidence of our study. We believe that this limitation is inherent in the noninvasive method for diagnosis and will be present in clinical practice. The population of the city of São Paulo may not represent the real ethnicity of Brazil. The strength of our study is to provide information on the rate of absence of the PLT that can be used as a reference for future studies in patients in Brazil.

## Conclusion

The prevalence of absence of PLT in our study was 26.2%. There was no statistically significant difference between gender and bilaterally. The absence of PLT was predominant in males unilaterally on the right side.

### Authors' Contributions:

Each author contributed individually and significantly to the development of this article: D. P. K., L. M. M. and C. H. F. researched the literature and conceived the study. D. P. K., L. M. M. and F. F. were involved in protocol development and gaining ethical approval. D. P. K., J. B. G. S. and F. F. did the data analysis. C. H. F., D. P. K. and L. R. N. wrote the first draft of the manuscript. All authors reviewed and edited the manuscript and approved the final version of the manuscript

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### Conflict of Interests

The authors have no conflict of interests to declare.

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