

The prevalence and morphology of the palmaris longus muscle employed as flaps in reconstructive surgery

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Introduction

The desire to replace missing tissue in the human body has existed since the beginning of medicine (1). Flaps are defined as units of tissue that can be transferred from one site to another, keeping its own blood supply and may include skin, fascia, fat, bone or muscle (2,3). Flaps differ from grafts in the sense that the latter is harvested without its own blood supply and, consequently depend only on the blood supply of the recipient site (3). A donor tendon flap is usually selected for transfer because it is thought to be nonessential in its original location (4), meaning that the donor site can survive without the presence of this tendon and the functionality is not compromised.

This is the case with the palmaris longus muscle (PL), which is found to be frequently missing without any adverse effects. PL tendons can also be used for a wide variety of reconstructive applications including: lip augmentation (5), palm-to-fingertip grafts (6) and eyelid reconstruction (7). In the literature the PL is reported to be absent in between 4-30% of cases (4,6,7). It has also been suggested that if the muscle is absent on one side, that there is a one in three chance that it will be present on the contralateral side (6,8). To test for the palmaris longus muscle, the wrist should be flexed against resistance and the thumb and little finger should be opposed (4,8). Ultrasonography and magnetic resonance imaging can also be used to detect the PL tendon (8), although this is not recommended if the tendon is clearly visible on the forearm with examination. It has been suggested that if the tendon(s) are not detected, a 70-80% possibility exists that the tendon(s) are not present or useful for transfer (6,8).

There are however sparse information on the prevalence of this muscle in a South African population with even less information regarding the morphology of the muscle and whether it is viable for transfer.

Aims

The aims of this study are therefore to firstly determine the prevalence of the PL in a South African sample and secondly to describe the macroscopic structure of the PL.

Materials and Methods

A sample of 317, which included 79 cadavers and 238 living participants, were randomly selected from various age groups were used in the study. Informed consent was obtained from the participants older than 18 years old and consent was obtained from the parent(s)/ guardian(s) of individuals younger than 18 years old. The cadavers were dissected and examined under the regulations stipulated in the Human Tissues Act. The following was recorded from the participants: age, sex and whether the PL is present, absent on either the left or right side or absent on both sides (see Figure 1).

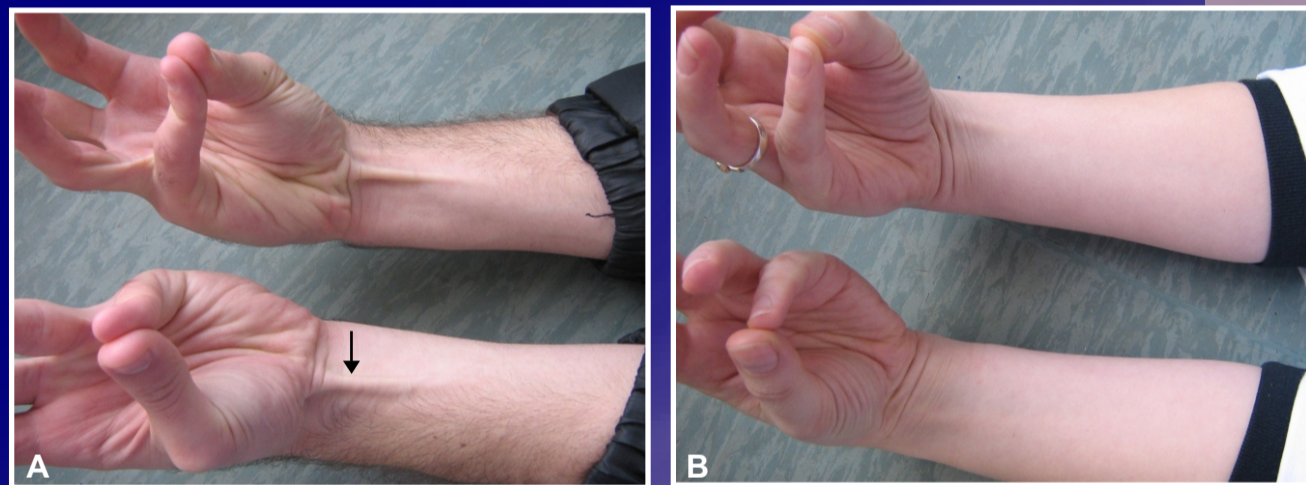


Figure 1. The presence (a) and absence (b) of the palmaris longus muscle

For the second aim, the PL was dissected out along its entire course on both the left and right sides of 79 adult cadavers. The length and width of the muscular belly and the tendon were measured. The demographic information was recorded for statistical analysis (see Figure 2).



Figure 2. Measuring the Palmaris longus muscle. Blue pins were inserted into the origin and insertion of the muscle

Digital photographs were taken of the dissected PL and imported into UTHSCSA Image Tool version 3, in order to measure the length and width of the belly and tendon, using the Spatial Measurement function. All data was entered into a Microsoft Excel worksheet after which statistical analysis was done.

Results

The ages of the participants ranged from 5 to 99 years and the prevalence of the PL is illustrated in Table 1.

Table 1. Results of studies conducted on the prevalence of PL

Author	Total sample	Present bilaterally		Absent bilaterally		Absent left		Absent right	
		n	%	n	%	n	%	n	%
Reimann <i>et al.</i> , (1944)	362	302	83.4	30	8.3	13	3.6	17	4.7
Vanderhooft, (1996)	186	156	83.9	18	9.7	0	0	4	2.2
Sebastin <i>et al.</i> , (2005)	418	394	94.3	7	2	12	2.9	5	1.2
Current study by Venter <i>et al.</i> , (2008)	317	248	78.2	32	10.1	20	6.3	17	5.4
Total	921	798	86.6	57	6.2	32	3.5	26	2.8

Of the 79 cadavers that were dissected, the PL was exposed, photographed and measured in 59 left arms and 59 right arms. The measurements of PL are summarised in Table 2. A paired t-test was used to compare the data obtained from the left and right sides and there was found to be no statistically significant difference between the two sides. The data for the left and right sides was therefore combined for a total sample.

Table 2. Results of the morphology measurements of PL on both the left and right arms

	Left Mean (mm)	Standard Deviation (mm)	Right Mean (mm)	Standard Deviation (mm)	Significant difference (p-value)
Tendon length	153.65	32.70	149.63	25.17	-
Tendon width	4.87	0.88	4.62	1.00	-
Belly length	125.12	28.72	127.93	28.79	-
Belly width	15.02	20.82	12.04	3.51	-
Total length	278.42	48.41	277.12	45.05	-

The sample of 79 cadavers contained 19 females and 60 males. The morphology of PL between males and females was compared using a paired t-test. It was found that a statistically significant difference existed in the measurements of the PL between females and males (see Table 3).

Table 3. Results of the morphology measurements of PL in males and females (Note the statistically significant differences)

	Female Mean (mm)	Standard Deviation (mm)	Male Mean (mm)	Standard Deviation (mm)	Significant difference (p-value)
Tendon length	164.19	20.42	150.67	6.01	0.0002
Tendon width	4.75	0.35	4.85	0.58	0.0092
Belly length	125.80	3.63	125.41	0.21	0.0033
Belly width	16.74	9.32	12.57	1.56	0.0010
Total length	289.99	24.04	275.43	5.95	0.0000

Discussion

Upon investigation of the prevalence of PL it was found that the percentage values obtained in this study were higher than that reported in the literature. The literature or textbooks, where the prevalence is reported, often doesn't distinguish between unilateral absence of the muscle. As can be seen in Table 1, previous studies show that the PL is bilaterally present in 83.4% - 94.3% of the population as opposed to 78.2% found in this study. It appears that although the data correlates well with that obtained in previous studies, there is a higher prevalence in the South African population to have either a bilateral or unilateral (on either the left or right sides) absence of PL. It is important to remember however that the presence of the PL does not necessarily guarantee the usefulness of PL for reconstructive surgery (6), but rather on the morphology of the muscle.

Only two previous studies mentioned the tendon width and length of the PL. Vanderhooft (9) and Ito and co-workers (10) reported an average tendon width for PL to be 4.5 mm which is in close range compared to our study (4.87 mm on the left and 4.62 mm on the right). Tendons with a width of less than 2 mm are unsuitable for use as a flap (8). This means that all the tendons measured in this study will be suitable for use as a flap for reconstructive surgery. Ito reported that the average tendon length is 108.3 mm (± 16.4) in females and 124.6 mm (± 17) in males. This is not the case in the current study. The tendon length was found to be 164.2mm (± 20.4) in females and 150.67 mm (± 6.0) in males. In table 3 it is noted that there is a statistical significant difference of the tendon width between males and females (0.0092). According to Ito and co-workers (10) there is no statistical significant difference of the tendon width between males and females.

Conclusion

In a South African population the prevalence of the PL differs slightly from studies done in the past, as the muscle appears to be more absent when compared to previous studies. It is also clear that the morphology of the muscle is significantly different between males and females and although all the muscles dissected where morphologically viable for transfer, there is a definite variation in the structure of the muscle between individuals, which should taken into account when planning a reconstructive procedure.

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