The contribution of the palmaris longus muscle to the grip strength

Palmaris longus kasının el kavrama gücüne katkısı

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Introduction

Palmaris longus (PL) is the first choice as a donor tendon used in hand and reconstructive surgery, because it usually fulfills the necessary requirements of length, diameter and availability.¹ Patients in whom PL is to be harvested as a donor tendon usually asks about the impact of the removal of PL muscle on their hand functions. The classical answer to this question is an obvious no. Because, it is believed that PL is a dispensable muscle that can be harvested without producing any functional loss at the donor hand. On the other hand, there seems to be little evidence based knowledge to support this proposition in relevant literature.²⁻³

In this current study, we compared grip strength between healthy subjects having the tendon and lacking.

Abstract

Objectives: Palmaris longus (PL) is frequently used as a donor tendon in various wrist, hand and reconstructive surgery. It is believed that PL is a dispensable muscle that can be harvested without producing any functional loss at the donor hand. The purpose of this study is to compare the grip strength between normal subjects having the tendon and lacking it.

Methods: Three hundred thirty three male subjects between 18 and 25 years of age were assessed for the presence of the PL tendon and grip strength was measured with a calibrated hydraulic hand dynamometer. Both dominant and non-dominant hands were divided into two groups according to the absence of PL tendon and grip strength was compared between groups.

Results: The mean grip strength in dominant extremities lacking PL was 45.27±6.21 kg and having PL was 45.40±7.07 kg (p=0.899). The mean grip strength in non-dominant extremities lacking PL was 41.04±6.39 kg and having PL was 40.79±6.33 kg (p=0.782).

Conclusion: Results of this study showed that grip strength is similar whether the subject has or does not have a PL. Patients may be informed that harvesting their PL tendon would not affect the functions of their hands.

Key words: Grip strength, palmaris longus.
We aimed to determine the contribution of PL muscle to the grip strength.

**Materials and Methods**

Three hundred thirty three consecutive male subjects between 18 and 25 years of age who were admitted to our outpatient clinic were included in this study. The research was carried out according to the principles of the Declaration of Helsinki and verbal informed consent was obtained from each volunteer after explaining the objectives and methods of the study. Subjects were excluded if they had a history of upper-limb injury, congenital or neuromuscular disease or abnormality of the upper limb that may affect the grip strength and preclude examination for the presence of the PL tendon. A calibrated hydraulic hand dynamometer (Baseline®, Fabrication Enterprises Incorporated Inc., Irvington, USA) was used for the grip strength measurements. The device handle was adjusted for each subject, to fit onto the palm with the fingers in flexion at the proximal and distal interphalangeal joints with the thumb in 90º abduction. Subjects were seated upright with shoulder in adducted and neutrally rotated; the elbow flexed at 90º; forearm in neutral position, and the wrist between 0º and 30º dorsiflexion and 0º and 15º ulnar deviation. Grip strength was measured in kilograms. Subjects were instructed to grasp handle for five seconds and three readings were taken alternatively for each hand, starting with the dominant hand. The mean value of the three tests was used as the resultant value for analysis.

Standard test (Schaeffer's test, oppose the thumb to the little finger while flexing the wrist) was used to assess the presence of the PL tendon both with inspection and palpation (Fig. 1). Age, dexterity, the absence of the PL tendon on both sides and grip strength measurements were recorded. Both dominant and non-dominant hands were divided into two groups according to the absence of PL tendon. Resultant grip strength was compared between groups. Student t-test was used for statistical analysis and a p value less than 0.05 was considered as significant in 95% confidence interval.

**Results**

The mean age of the subjects was 21.29 (range: 18-25) years. PL was absent in 60 dominant extremities and 57 non-dominant extremities. The mean grip strength in dominant extremities lacking PL was 45.27±6.21 kg and having PL was 45.40±7.07 kg. The mean grip strength in non-dominant extremities lacking PL was 41.04±6.39 kg and having PL was 40.79±6.33 kg. The grip strength values were statistically similar between groups (p=0.899, p=0.782). The summary of results is shown in **Table 1**.

![Schaeffer’s test showing unilateral presence of palmaris longus (black arrow) on the right hand.](image)

**Table 1.** Summary of results

|                      | Dominant hand | Non-dominant hand |
|----------------------|---------------|-------------------|
| Mean grip strength with PL | 45.40±7.07 kg, n= 271 | 40.79±6.33 kg, n=274 |
| Mean grip strength without PL | 45.27±6.21 kg, n= 60 | 41.04±6.39 kg, n=57 |
| Significance (p value) | 0.899 | 0.782 |

**Discussion**

PL is one of the most variable muscles in the musculoskeletal system. The most common variation is the agenesis of the entire muscle. The overall prevalence of absence of PL (unilateral or bilateral) in Turkish population has been reported 26.6%. PL is proposed to be a metacarpophalangeal flexor that lost its function with the erection of the human. In vertebrates it is found only in mammals and is best developed in those where the forelimb is used for ambulation. PL is always present in the Orangutan but is variably absent in higher apes such as Chimpanzees, Gorillas and Humans.

The palmaris longus is inserted into the palmar aponeurosis and fans out at its insertion. It functions as a weak flexor of the wrist. In addition, it plays a role in stabilization of the palmar fascia and contributes to anteposi-
tion and pronation of the thumb. Theoretically, harvesting PL tendon may cause grip strength loss at the donor hand.

In current literature, there are two studies which specifically investigated the contribution of PL muscle to the hand functions. Sebastian et al. compared hand functions between normal subjects having the tendon and lacking it. The authors claimed that absence of the palmaris longus is not correlated with decreased grip or pinch strength measurements. However, this study was conducted on a heterogeneous sample of subjects in whom the age ranged between 7 to 85 years. Furthermore, it included subjects from various ethnic groups with different occupations. It is well known that there is a wide variation in grip strength according to age, sex, race, dexterity. Therefore, the result of this study is questionable, although they tried correcting this bias using statistical regression models. In the second study, Gangata et al. compared the strength of thumb abduction using a specially designed dynamometer between normal subjects having the tendon and lacking it. In contrast to the findings in previous study, they found that the force of thumb abduction was significantly greater on the hand with a PL than the one without it. They proposed that harvesting PL would decrease the thumb abduction strength.

Results of our study showed that grip strength is similar in subjects having PL and lacking it. In other words, absence of PL does not affect the grip strength in normal hands. People who congenitally lack PL tendon do not notice any functional disability during their daily activities. Therefore, an indirect proposition can be made that harvesting PL would not lead any functional disability. Although, Gangata et al. showed that thumb abduction strength decreased after removal of PL, they stated that removal of the tendon does not compromise hand function unduly, as there are few everyday activities that involve thumb abduction such as opening a scissors.

Grip strength does not truly reflect the independent functions of PL muscle but it is a widely used objective outcome measure that provides a quantitative evidence of hand function after various surgical procedures in the upper extremity. Our study population was healthy subjects whom their PL is congenitally absent. Indeed, the ideal study design to test the consequences of harvesting PL would be the comparison of grip strength before and after harvesting PL in otherwise normal hands.

In conclusion, absence of PL tendon does not affect the grip strength, thus patients may be informed that harvesting their PL tendon would not affect their grip strength.

Conflicts of Interest: No conflicts declared.

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