MEDICINE, BIOLOGY, REHABILITATION AND SPORTS

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Palmaris longus, a muscle that lost its function, or not? A pilot study

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Abstract. The palmaris longus muscle is one of the most variable muscles in human body. Its most common anatomic variation is the complete agenesis of the muscle. The palmaris longus is considered to be a phylogenetically redundant muscle which lost its function. This led to great importance of the muscle in plastic and reconstructive surgery, since the palmaris longus can be extracted from the forearm without any complications, and can be used as a donor muscle. The general point of view is that the presence or absence palmaris longus has no effect on the functioning of the forearm. This pilot study aims to assess the grip strength in people who have unilateral agenesis of the muscle, thus establish whether it has any influence on the grip strength. According to the results there is a great deviation from the expected results in patients who had unilateral agenesis of the muscle.

Keywords: *palmaris longus muscle, agenesis, grip strength, Hungarian population*

Introduction

The palmaris longus muscle (PLM) is often described as a phylogenetically degenerate muscle, which lost its function and is no longer needed for human hand since it can perform its functions properly with or without the muscle alike [7]. The function loss of the muscle is considered to be the main reason behind the development of a number of different variations of palmaris longus that are described in the literature, such as: agenesis of PLM, the most frequent anatomical variation [15], reversed PLM [Salgado], double PLM [11], variation in location [15], and many others. As the human hand functions are usually not affected by the variations of the muscle, they usually remain unnoticed.

According to the anatomical descriptions PLM is as a slender, fusiform muscle, with a short muscular belly which is positioned proximally and a long tendon (10-12 cm) which passes anterior (superficial) and distally in forearm of the upper limb of humans and disposed medial to flexor carpi radialis. It is innervated by median nerve and irrigated by branches from anterior ulnar recurrent arteria. This muscle has its origin in the medial epicondyle of the humerus [13] palmaris longus has largely abandoned a direct bony attachment by attaching instead to the palmar fascia [5]. Usually the anatomy books describe the most frequent anomaly of PLM, its complete agenesis, and state that the frequency of the agenesis is usually about 15%, but from the relevant literature we may know that the frequency of the agenesis may wary in a great way depending on the population in which it was examined. [3, 6, 7, 9, 15] This study was done in Hungarian population in which the agenesis rate may wary between 33 and 53% [1, 2, 3, 4, 5].

The general point of view is that PLM lost its function and the muscle is no longer needed for proper functioning of the hand. Yet some studies suggest that the muscle could retain some of its original functions and may still play some role in certain moves of hand and fingers. [6]. This made the PLM one of the main donor muscles of the human body for tendon grafts and flaps used in plastic and reconstructive surgery, orthopaedics and hand surgery. The generally accepted point of view is that if we remove the tendon of the PLM, it won't affect the functioning of the hand in any way. [10, 20]. Yet there are only a few studies which could confirm this opinion [8, 10, 18]. This paper presents the results of a pilot study done to assess the influence of the absence or presence of palmaris longus muscle on the grip strength, and to establish whether further studies would be expedient.

Materials and methods

From overall 500 patients examined by conventional tests for establishing the absence or presence of PLM 140 individuals were selected whose grip strength was measured by dynamometer. The group of selected 140 individuals consisted of 3 subgroups: first subgroup was assembled of 20 patients who had unilateral agenesis of PLM in their right hand. The second subgroup was assembled of 20 patients who had unilateral agenesis of PLM in their left hand. The third subgroup was a control group consisting of 100 people who had PLM in their both hands. There were several studies examining the effect of the absence or presence of PLM on the grip strength. Yet to state certainly that the PLM has or don have effect on grip strength we would have to examine patients that have the same muscles except for the presence or absence of the PLM. This could be done only if we examine patients that have the muscle, then surgically remove the PLM and after complete recovery of hand and forearm muscles to the state before surgery, assess the grip strength again. Obviously we can't do this. It was established that the best way to maximally near the conditions mentioned above is to examine the grip strength of people who had agenesis only in one hand. According to 10% rule the grip strength of the dominant hand is 10% stronger than the grip strength on non-dominant hand. Yet from previous studies we know that this rule is not always true. We may assume that the difference in grip strength may vary between different populations and different groups depending on genetic background, lifestyle, occupation and many other factors. To establish the difference in grip strength of dominant and non-dominant hands in the examined population a control group of 100 patients also was examined during the study.

During the examination all people who were doing any sports or activities that could lead to development on increased grip strength in one of the hands were excluded from the study. All the patients who had any medical issues that could influence the proper functioning of the hand or grip strength were also excluded from the study.

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For the assessment of the presence or absence of the palmaris longus muscle six different tests were used. Namely: Thompson's [19], Schaeffer's [17], Pushpakumar's [14], Mishra's 1, Mishra's 2 [12] and Hiz-Ediz [9].

The grip strength was measured by a calibrated dynamometer.

Results

In the control group the general difference in the grip strength between dominant and non-dominant hands was 10.71%. This result makes the 10% rule in the Hungarian population a quite reliable orientation point.

During the evaluation of the results the first subgroup – people who had agenesis in their right hand – had to be divided further in two smaller groups: right-handers – 16 people, and lefthanders – 4 people. The difference in grip strength in right-handers who had agenesis in their right hand was -1.88%. This means that in these people the grip strength in non-dominant hand was 1.88% higher than in dominant. In the lefthanders who had agenesis in their right hand the dominant hand was stronger by 18.11%.

The second subgroup – people who had agenesis in their left hand didn't have any lefthanders. In this group the dominant hand was stronger by 23.93%.

Unfortunately the numbers obtained during the pilot study are not enough for a convincing statistical analysis. Yet as it can be seen in fig. 1. there is a great deviation from both 10 % rule and control group in all the cases when the patients had agenesis only in one of their hands.

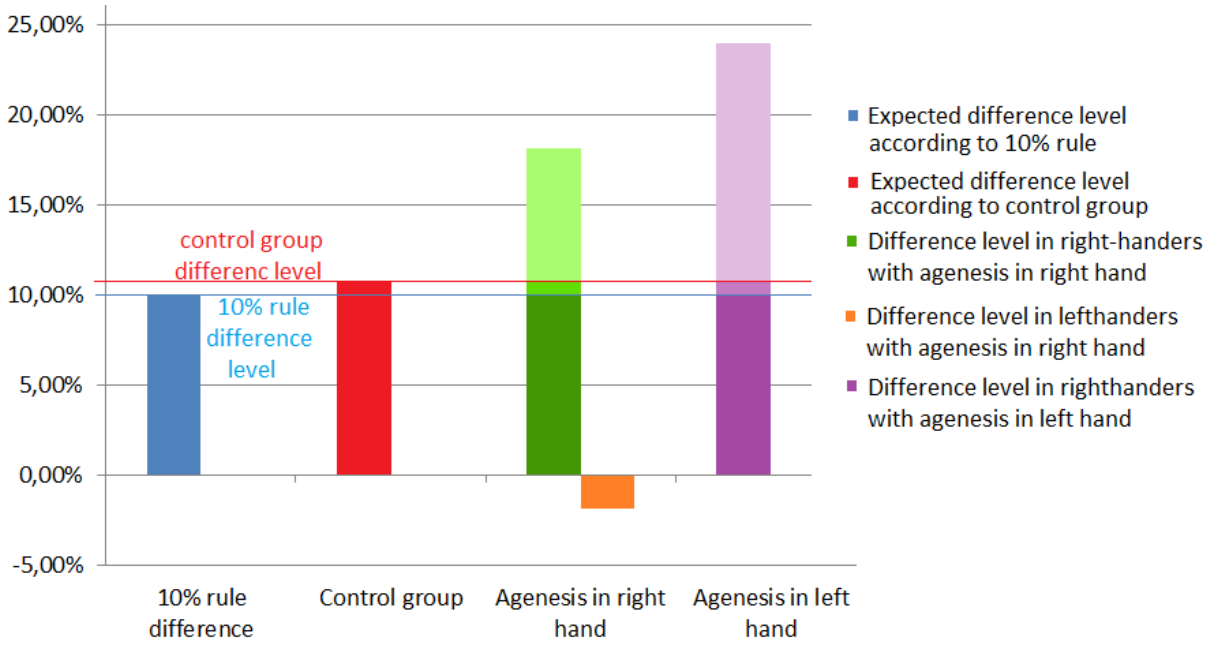

Fig. 1. Differences between grip strength of dominant and non-dominant hands in examined sample

Discussion

Currently the general opinion is that the palmaris longus muscle has no influence on grip strength or functionality of hand, and its surgical removal would not affect the grip strength of patient. The present study shows that the PLM may still have some role in the functioning of the hand and there could be negative effects on grip strength after the surgical removal of PLM during plastic or reconstructive surgeries. Unfortunately this pilot study did not provided enough data for proper statistical evaluation thus we can't exclude the possibility that the present results are only a product of accidental coincidence caused by low sample size. Yet the differences found between control group and groups with unilateral agenesis give us a good starting point for further studies.

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Боркач Н. Длинный ладонный мускул утратил свою функцию или все же нет? Пилотное исследование

Аннотация. Длинная ладонная мышца является одной из наиболее вариабельных мышц в организме человека. Наиболее распространенной анатомической вариацией является полная агенезия мышцы. Palmaris longus считается филогенетически излишней мышцей, которая утеряла свою функцию. Это сделало мышцу очень важной в пластической и реконструктивной хирургии, так как долгая ладонная мышца может быть извлечена из предплечья без каких-либо осложнений, и использована в качестве мышцы-донора. Общепринятой является точка зрения, что наличие или отсутствие большой ладонной мышцы не имеет никакого влияния на функционирование предплечья. Это пилотное исследование ставит своей целью оценить прочность сцепления в людей, у которых обнаружена односторонняя агенезия мышцы, тем самым установить, имеет ли она какое-либо влияние на прочность захвата. Обнаружено существенное отклонение от ожидаемых результатов у пациентов с односторонней агенезией длинной ладонной мышцы.

Ключевые слова: *длинная ладонная мышца, недоразвитие, прочность сцепления, венгерского населения*