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The possible relationship between the palmaris longus and joint hypermobility

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Abstract. – OBJECTIVE: The palmaris longus (PL) contributes to the palmar fascia, wrist flexion, hand muscle balance, and pinch strength. Also, PL is used as a graft source. So, PL's presence is helpful for joint stability and grafting. On the other hand, joint hypermobility (JH) is associated with many complaints and disorders. Considering the adverse effects of JH and benefit-based evolution, the genesis rather than agenesis of PL can be expected in JH. Herein, it was hypothesized that PL might be together with JH, and individuals with PL may have higher scores of JH than those without.

PATIENTS AND METHODS: Between June 2023 and October 2023, 200 participants (F/M: 1/1) were included in the study. The Schaeffer's test and the Beighton scores were used to assess PL and JH, respectively. The participants were divided into two bilateral groups according to the presence or absence of PL. Then, the groups were compared for demographics and Beighton scores. Subgroup analyses were also done by considering gender.

RESULTS: No significant differences were found between PL (+) and PL (-) groups considering females+males in age (p=0.559), gender (p=0.517), weight (p=0.375), height (p=0.061), work status (p=0.229), Beighton score (p=0.893), and JH (p=1.0). No significant differences were found between PL (+) and PL (-) groups considering females only in age (p=0.871), weight (p=0.189), height (p=0.127), work status (p=0.200), Beighton score (p=0.727), and JH (p=1.0). No significant differences were found between PL (+) and PL (-) groups considering males only in age (p=0.370), weight (p=0.981), height (p=0.400), BMI (p=0.601), work status (p=0.145), Beighton score (p=0.757), and JH (p=1.0).

Conclusions: According to the results of this study, no relationship was found between PL and JH. However, this is the first study on the topic and has some limitations.

Key Words:
Palmaris longus, Schaeffer's test, Joint hypermobility, Beighton score.

Introduction

The palmaris longus (PL) is the most superficial muscle in the forearm's anterior compartment. It has high variability, and its absence rates range between 1.5% and 63.9%[1]. Although its function is less or is not known fully, the known role of PL contributes to the palmar fascia and wrist flexion, hand muscle balance[2], and pinch strength[3]. In addition, PL is widely preferred in plastic and reconstructive surgeries as a ready grafting source due to its long tendon with limited function and easy-to-detect superficial location[1,4]. Accordingly, PL treats some disorders requiring reconstruction, such as ptosis, urinary incontinence, and facial paralysis[5]. Therefore, PL assumes critical importance while planned as a graft. On the other hand, the presence of PL has been reported as a vital factor for carpal tunnel syndrome[6], and it has been found that PL is more prevalent in patients who underwent carpal tunnel release[7]. So, it is seen that both positive and negative interactions can be found between PL and human health.

The term hypermobility refers to joint laxity with excessive physiological range of motion. Joint hypermobility (JH) is associated with mechanical and functional instability, which is why it may present musculoskeletal, neurological, and other complaints, including joint clicking or subluxation, pain and instability, orthostatic intolerance, gastrointestinal and urogynecological discomfort, fatigue, mood disorders[8]. Moreover, there is a relationship between JH and various disorders such as scoliosis[9], pes planus and ankle sprain[10], skin changes, and recurrent hernias[11]. In addition, it has been found that JH exacerbates symptoms and limits functionality in patients with carpal tunnel syndrome[12].

These conditions may also be related because both PL[6,7] and JH[12] are associated with carpal tunnel syndrome. While the presence of PL is help-

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ful regarding joint stability and graft source[1,5], the presence of JH is associated with many complaints and disorders[8,11]. Since evolution in the human body progresses to obtain more economic functionality and applicable morphological changes, genesis may be more possible besides agenesis in the developmental process of PL. Accordingly, considering the susceptibility to many adverse effects mentioned above in JH[8-11], the presence of a muscle/tendon is more valuable and compatible regarding joint stability and graft source. Therefore, it is sensible that genesis rather than agenesis of PL in persons with JH can be expected according to the benefit-based evolution. This is the first study searching the relationship between the existence of PL and hypermobility of the joint.

In this study, we hypothesized that the presence of PL may be together with the presence of JH, and individuals with PL may exhibit higher JH scores than those without.

Patients and Methods

The study included those who gave consent to participate. It was performed at the University Hospital, Department of Plastic and Reconstructive Surgery, between June 2023 and October 2023. In this observational study, 200 people were evaluated (F/M:1/1) for the presence or absence of PL and JH.

Assessment of Palmaris Longus

Schaeffer's test was used to evaluate the presence or absence of PL. It is the most powerful test for detecting PL accurately, with 94% sensitivity and specificity[13]. Schaeffer's test is the standard test for detecting PL and includes opposition of the first and fifth fingers and wrist flexion[13,14].

Assessment of Joint Hypermobility

The Beighton scoring system was used to assess the presence or absence of JH. This scoring system measures joint laxity on a nine-point scale, and accordingly, JH requires a cut-off ≥4 (Table I). It has been shown that the Beighton scoring system has a high level of inter- and intra-evaluator reliability and is commonly used to evaluate the presence or absence of JH[15].

The participants' characteristics were assessed using a structured interview. A physician asked the participants for their age, weight, height, and working status. They were also examined for the presence or absence of PL and JH.

The participants were divided into two bilateral groups according to the presence or absence of PL. Then, the groups were compared for demographics and Beighton scores. In addition, subgroup analyses were done considering gender.

Inclusion and Exclusion Criteria

The criteria for inclusion and exclusion were rigorously enforced. In order to establish a randomized sample, individuals eligible for inclusion were those of either gender, aged between 18 and 45, who were admitted to our hospital for reasons unrelated to significant extremity issues or joint hypermobility. This encompassed patients, their accompanying companions, visitors, and hospital staff who provided written informed consent to participate. On the other hand, exclusion criteria were as follows: the presence of the conditions can hinder the evaluation of the Schaeffer's test or the Beighton scores, such as structural abnormalities (e.g. extremity agenesis, amputation, fracture, contracture, infection), scoliosis, Marfan syndrome, Ehlers-Danlos syndrome, muscular dystrophies, spinal deformities, and inflammatory rheumatic disorders (e.g. rheumatoid arthritis, ankylosing spondylitis), pregnancy, extreme obesity (BMI≥40 kg/m²), and psychiatric disorders. In addition, since the range of motion values decrease with aging[16], and to provide homogeneity, individuals who were <18 or >45 years of age were excluded. Lastly, since their number was low, individuals with unilateral presence or absence of PL were excluded from analyses.

Ethical Consent

Ethics approval was granted on June 16th, 2023, with reference number 2023/06-08, by the Van Yuzuncuyıl University Local Ethics Committee.

Table I. The Beighton scores for the evaluation and diagnosis of joint hypermobility.

	Right	Left
Fifth metacarpophalangeal joint dorsiflexion >90°	1	1
Touching thumb to the inner surface of the forearm	1	1
Elbow extension >10°	1	1
Knee extension >10°	1	1
Touching the palms of hands to the ground with lumbar flexion	1	
Total score	9	

Table II. Comparisons between PL (+) and PL (-) groups.

	Palmaris Longus (+) (n=149)	Palmaris Longus (-) (n=51)	*p*-value
Age, years	33.60±7.92 (18-45)	34.33±7.24 (18-45)	0.559*
Gender Female, n (%) Male, n (%)	 72 (48.3%) 77 (51.68%)	 28 (54.9%) 23 (45.1%)	0.517****
Weight, kg	72.06±11.84 (40-98)	73.0±10.0 (53-100)	0.375**
Height, m	1.71±0.09 (1.50-1.90)	1.69±0.08 (1.56-1.90)	0.061*
BMI, kg/m^2	24.50±3.29 (16.44-31.89)	25.66±3.24 (18.42-35.16)	0.031*
Work status Housewife Worker No worker	 41 (27.52%) 84 (46.38%) 24 (16.10%)	 20 (39.22%) 26 (50.98%) 5 (9.80%)	0.229**
Beighton score	1.28±1.94 (0-9)	1.20±1.63 (0-5)	0.893**
Joint hypermobility (Beighton score ≥4)	23 (15.4%)	8 (15.7%)	1.0****

BMI: body mass index. Values were given as mean±SD (min. - max.) or number (percentage). *Student's *t*-test. **Mann-Whitney U test. ***Pearson's Chi-squared test. ****Fisher's Exact test.

The Declaration of Helsinki Principles were applied in this study, and the participants gave their written consent.

Statistical Analysis

The statistical analyses were done using SPSS 20.0 for Windows (IBM Corp., Armonk, NY, USA). The Kolmogorov-Smirnov test was applied to continuous variables to address the normality assumption. The Student's *t*-test and the Mann-Whitney U test were used to compare normally and non-normally distributed variables, respectively. Continuous data were presented as mean±SD (min.-max.). Categorical variables were evaluated using Pearson's Chi-squared and Fisher's exact tests and presented as numbers (percentages). Statistically, the significance level was considered as $p<0.05$.

Results

Table II compares PL (+) and PL (-) groups. No statistically significant differences were found in terms of age ($p=0.559$), gender ($p=0.517$), weight ($p=0.375$), height ($p=0.061$), work status ($p=0.229$), Beighton score ($p=0.893$), and JH ($p=1.0$). The groups were statistically different for BMI ($p=0.031$) (Table II).

Table III presents the comparisons between female and male groups. No statistically significant differences were found in terms of age ($p=0.081$),

Table III. Comparisons between females and males groups.

	Female (n=100)	Male (n=100)	*p*-value
Age, years	34.74±7.78 (18-45)	32.83±7.62 (18-45)	0.081*
Weight, kg	67.56±9.85 (40-90)	77.0±10.86 (56-100)	<0.001*
Height, m	1.66±0.07 (1.50-1.83)	1.76±0.07 (1.55-1.90)	<0.001**
BMI, kg/m^2	24.60±3.32 (16.44-35.16)	25.00±3.30 (17.48-31.89)	0.389*
Work status Housewife Worker Not working	 61 (61%) 31 (31%) 8 (8%)	 0 (0%) 79 (79%) 21 (21%)	<0.001***
Beighton score	1.39±1.72 (0-7)	1.13±1.98 (0-9)	0.051**
Joint hypermobility (Beighton score≥4)	14 (14%)	17 (17%)	0.696****

BMI: body mass index. Values were given as mean±SD (min.-max.) or number (percentage). *Student's *t*-test. **Mann-Whitney U test. ***Pearson's Chi-squared test. ****Fisher's Exact test.

Table IV. Comparisons between PL (+) and PL (-) groups considering females.

	Palmaris Longus (+) (n=72)	Palmaris Longus (-) (n=28)	*p*-value
Age, years	34.82±8.01 (18-45)	34.54±7.29 (22-45)	0.871*
Weight, kg	66.75±9.80 (40-90)	69.64±9.86 (53-90)	0.189*
Height, m	1.66±0.08 (1.50-1.83)	1.64±0.06 (1.56-1.75)	0.127*
BMI, kg/m^2	24.07±3.02 (16.44-31.22)	25.94±3.73 (20.70-35.16)	0.011*
Work status Housewife Worker Not working	 41 (56.94%) 26 (36.11%) 5 (6.95%)	 20 (71.43%) 5 (17.86%) 3 (10.71%)	0.200***
Beighton score	1.46±1.81 (0-7)	1.21±1.50 (0-4)	0.727**
Joint hypermobility (Beighton score≥4)	10 (13.89%)	4 (14.29%)	1.0****

BMI: body mass index. Values were given as mean±SD (min.-max.) or number (percentage). *Student's *t*-test. **The Mann-Whitney U test. ***The Pearson's Chi-squared test. ****The Fisher's Exact test.

BMI (p=0.389), Beighton score (p=0.051), and JH (p=0.696). However, the groups were statistically different for weight (p<0.001), height (p<0.001), and work status (p<0.001) (Table III).

Table IV compares PL (+) and PL (-) groups considering females. No statistically significant differences were found in terms of age (p=0.871), weight (p=0.189), height (p=0.127), work status (p=0.200), Beighton score (p=0.727), and JH (p=1.0). The groups differed statistically for BMI (p=0.011) (Table IV).

Table V compares PL (+) and PL (-) groups considering males. No statistically significant differences were found in terms of age (p=0.370), weight (p=0.981), height (p=0.400), BMI (p=0.601), work status (p=0.145), Beighton score (p=0.757), and JH (p=1.0) (Table V).

Discussion

This study evaluated the possible relationship between PL and JH. It tested the hypothesis that PL may be associated with higher rates and JH scores. As a result, no association was found between PL and JH. However, this is the first study addressing the topic. Thus, future studies from other geographic regions and ethnic groups must confirm the results.

The results of this study did not support the hypothesis tested. This reveals that the study's thesis needs to be corrected. In addition, previous studies[17,18] have demonstrated that females have higher rates than males regarding the presence of JH and the absence of PL[4,19,20]. This suggests a possible association between the presence of JH and the lack

Table V. Comparisons between PL (+) and PL (-) groups considering males.

	Palmaris Longus (+) (n=77)	Palmaris Longus (-) (n=23)	*p*-value
Age, years	32.45±7.71 (20-45)	34.08±7.32 (18-45)	0.370*
Weight, kg	77.03±11.47 (56-98)	77.09±8.73 (61-100)	0.981*
Height, m	1.76±0.06 (1.55-1.90)	1.75±0.07 (1.60-1.90)	0.400*
BMI, kg/m^2	24.91±3.50 (17.48-31.89)	25.32±2.56 (18.42-29.39)	0.601*
Work status Housewife Worker Not working	 0 (0%) 58 (75.32%) 19 (24.68%)	 0 (0%) 21 (91.30%) 2 (8.70%)	0.145***
Beighton score	1.12±2.05 (0-9)	1.17±1.80 (0-5)	0.757**
Joint hypermobility (Beighton score≥4)	13 (16.88%)	4 (17.39%)	1.0***

BMI: body mass index. Values were given as mean±SD (min.-max.) or number (percentage). *Student's *t*-test, **Mann-Whitney U test, ***Fisher's Exact test.

of PL when taking females only into account. However, our results revealed no difference between females with and without PL regarding JH scores. So, all these results demonstrate that PL and JH are independent clinical-anatomical entities that are separate from each other. On the other hand, since there is no study on the topic in the literature, any comparison or in-depth analysis was impossible.

The present study has some limitations, especially regarding generalizability. The study included only individuals who had bilateral presence or absence of PL. The study included only individuals who had bilateral presence oSo, the results must be more generalizable to those with unilaterally PL. Likewise, since the presence or absence of PL may vary by geographic region and ethnic group, the results may not be generalizable to other countries. Also, since the age range in the study was limited to 18-45 years, the results may be generalizable to only some ages. Another possible area for improvement, despite being a standard method used worldwide with high sensitivity and passivity rates, is that Schaeffer's test may provide unsatisfactory results when considering the high anatomic variations of PL[21,22]. Therefore, determining PL using ultrasonography can present more satisfactory outcomes[23].

Conclusions

No relationship was found between PL and JH, according to this study's results. However, this is the first study on the topic and has some limitations.

Conflict of Interest
The author declares no conflict of interest.

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Ethics Approval
Ethics approval was granted on June 16th, 2023, with reference number 2023/06-08, by the Van Yuzuncuyıl University Local Ethics Committee.

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Informed Consent
Informed consent was obtained from all participants before the study started.

Availability of Data and Materials
All data for this study are presented in this paper.

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