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Sonographic Assessment of Finger Flexor Tendons in Olympic Archers

Olimpik Okçularda Parmak Fleksör Tendonlarının Sonografik Değerlendirmesi

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Summary

Objective: The aim of this study was to demonstrate the possible hypertrophy of the finger flexor tendons in archers.
Materials and Methods: Thirteen Olympic archery athletes without any symptoms of overuse injury were enrolled in the study. The second, third and fourth flexor digitorum profundus (FDP) tendons of the string and bow hands were evaluated both axially and longitudinally using sonography. Width, thickness and cross-sectional area (CSA) of FDP tendons of the string and bow hands were compared.
Results: Thickness, width and CSA values of the fourth fingers were all increased in the string hands compared to the bow hands, however, those differences pertaining to tendon thickness and CSA reached statistical significance ($p<0.05$). The values of the second and third fingers were similar between the hands ($p>0.05$).
Conclusion: FDP tendons of archers tend to hypertrophy on their string hands probably due to overloading during shooting. *Turk J Phys Med Rehab 2012;58:85-7.*
Key Words: Archery, flexor tendon, overloading, sonography

Özet

Amaç: Bu çalışmanın amacı, okçuların parmak fleksör tendonlarındaki muhtemel hipertrofiyi belirlemekti.
Gereç ve Yöntem: Aşırı kullanma yaralanması hikayesi olmayan 13 olimpik okçu çalışmaya dahil edildi. Kiriş ve yay elinin ikinci, üçüncü ve dördüncü fleksör digitorum profundus (FDP) tendonları sonografi ile longitudinal ve aksillar olarak değerlendirildi. Kiriş ve yay elinin FDP tendonlarının genişliği, kalınlığı ve kesitsel alanı karşılaştırıldı.
Bulgular: Kiriş elinde dördüncü parmakların kalınlık, genişlik ve kesitsel alan değerlerinin hepsi yay eliyle karşılaştırıldığında daha yüksekti. Fakat tendon kalınlığı ve kesitsel alana ait değerler istatistiksel olarak anlamlılık gösterdi ($p<0,05$). İkinci ve üçüncü parmaklara ait değerler eller arasında benzerdi ($p>0,05$).
Sonuç: Okçuların kiriş ellerindeki FDP tendonları, muhtemelen atış sırasındaki aşırı yüklenmeye bağlı olarak hipertrofiye gitmektedir. *Türk Fiz Tıp Rehab Derg 2012;58:85-7.*
Anahtar Kelimeler: Okçuluk, fleksör tendon, aşırı yüklenme, sonografi

Introduction

Tendons exposed to chronic overloading are injured and/or undergo adaptation via biomechanical, biochemical or structural changes. Overuse type of tendon injuries are among the most common musculoskeletal pathologies in recreational and competitive athletes; and the structural changes have been widely reported (1). Load-induced structural changes, especially hypertrophy, have been also studied in tendons of animals and healthy subjects (2-11). On the other hand, relevant data regarding asymptomatic athletes are scarce (6,10,12). Likewise, in archery, finger flexor tendons undergo considerable loading during shooting, however, to our best knowledge, possible structural changes in the finger flexor tendons of archers have not been assessed. Therefore, in this study, we aimed to demonstrate the possible hypertrophy of the finger flexor tendons of archers by using sonography.

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Material and Methods

Thirteen Olympic archery athletes (9 M; 4 F) were enrolled in the study. None of the participants had any symptom of overuse injury in their hands at the time of the study. Sonographic measurements, which is an acceptable method for evaluating the tendons (13), were performed by a single physiatrist experienced in musculoskeletal sonography, using a lineer array probe of 8-16 MHz (Diasus Dynamic Imaging Ltd., Scotland, UK). The second, third and fourth flexor digitorum profundus (FDP) tendons of the string and bow hands were visualized both axially and longitudinally. During the examination, the patients were seated in a comfortable position with their hands and fingers supported so as to keep a position of slight wrist extension with the metacarpophalangeal, proximal interphalangeal and the distal interphalangeal joints in full extension. The angle of the ultrasound beam was kept perpendicular to the surfaces of the tendons to have the highest echogenic view. Measurements of the FDP tendons were performed axially at the midportion of the middle phalanx. Mediolateral (width) and anteroposterior (thickness) diameters were noted. Cross-sectional area (CSA) was measured using continuous boundary trace of the tendons excluding the surrounding hypoechoic fat (Figure 1). The tendons were evaluated longitudinally for any pathological finding suggesting tendonitis, tendinosis or rupture.

SPSS 15.0 was used for statistical analysis. Tendon thickness, width and CSA of the FDP tendons of the string and bow hands were compared using nonparametric Wilcoxon test. Statistical significance was set at $p<0.05$.

Results

The mean age of the participants, age of sports, draw weight, maximum FITA (from the French, Fédération Internationale de Tir à l'Arc) scores, the number of training per week and total number of arrows shot per training were 26.3±3.9 years, 11.9±2.8 years, 19.8±2.3 kg, 1293±36.5, 4.9±1.4 and 207.3±87.2, respectively. Tendon thickness, width and CSA of the FDP tendons of the string and bow hands are given in Table-1. Thickness, width and CSA values of the fourth fingers were all increased in the string hands compared to the bow hands; however, those differences pertaining to tendon thickness and CSA reached statistical significance ($p<0.05$). The values of the second and third fingers were similar ($p>0.05$). Any pathological finding of tendinopathy was not observed.

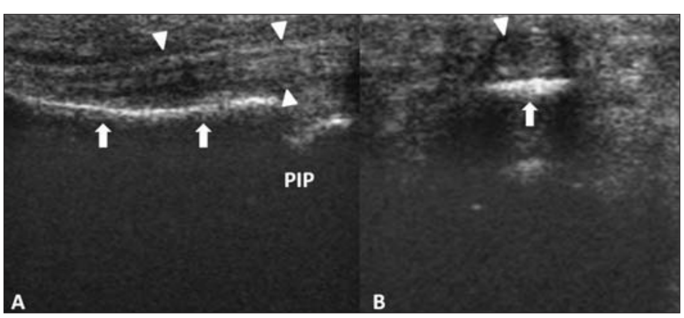

Figure 1. Sonographic imaging of the second finger at the level of the midphalanx (white arrows) **(A)** Longitudinal and **(B)** Axial views demonstrate the hyperechoic flexor tendon (white arrow heads). PIP: Proximal interphalangeal joint.

Discussion

In this study, we have assessed the possible structural changes of the FDP tendons in asymptomatic Olympic archery athletes, for the first time in the literature, by using sonographic imaging. Our main finding was hypertrophy of the FDP in the fourth finger on the string hands of the archers. Since during shooting the third and fourth fingers of the string hand undergo considerable loading (especially the fourth finger just before shooting), we considered our results worthy of discussion.

Tendons are able to adapt their mechanical and morphological properties in response to mechanical loading. In the literature, the effect of exercise training on tendon structure was evaluated in human (healthy subjects and athletes) and animal studies, however, results were controversial. Patellar tendon CSA was found to be regionally increased in healthy subjects who underwent 9-12 weeks of knee extension resistance training and on the lead extremity of elite athletes (fencers and badminton players) (2-4). Moreover, Achilles tendon hypertrophy was detected with mechanical loading of the tendon in healthy subjects and athletes (5,6,12). In animal studies, larger superficial digital flexor and common digital extensor tendon CSAs were found in exercise training group of horses (7). In accordance with these results, we have found increased CSA of the FDP in Olympic archery athletes, possibly due to repetitive overloading during shooting. Although in some human and animal studies exercise and sport-induced tendon hypertrophy has been observed, the results were not statistically significant when compared with the non-exercised subjects (10,11). In other studies, no significant tendon hypertrophy was

Table 1. Sonographic measurements of flexor digitorum profundus tendons of the second, third and fourth fingers of the archers.

Fingers	String hand	Bow hand	p
Second			
Thickness (mm)	2.05 (0.35)	2.01 (0.16)	1.00
Width (mm)	3.85 (0.68)	3.88 (0.46)	0.25
CSA (mm^2)	6.19 (1.54)	6.12 (0.88)	0.92
Third			
Thickness	2.05 (0.22)	2.11 (0.22)	0.16
Width	3.88 (0.61)	3.81 (0.45)	0.51
CSA	6.21 (1.06)	6.3 (1.98)	0.81
Fourth			
Thickness	1.99 (0.23)	1.84 (0.19)	0.01
Width	3.78 (0.41)	3.52 (0.51)	0.07
CSA	5.91 (0.99)	5.13 (1.17)	0.03

CSA: Cross sectional area.

detected with resistance training in elderly human (8,9). This discrepancy may be explained by the differences between mode and duration of training exercises (endurance vs. resistance) and the features of participants (age, sex etc.) enrolled in these studies. Likewise, Magnusson et al. (14) observed that habitual training results in patellar tendon hypertrophy in men but not in women.

It is still of debate whether tendon hypertrophy induced by chronic training results from a physiological response to reduce tissue stress or from a tissue repair response to damage induced by repeated loading. Since histopathological assessment could not be performed in our study, we cannot definitely say that tendon hypertrophy was due to physiologic response to overloading.

Conclusions

In the light of our first and preliminary results, we imply that the FDP tendons of archers tend to hypertrophy on their string hands. Further studies with larger samples are needed to also assess the mechanical properties of these tendons both with regard to their functional properties and injured risk.

Conflict of Interest:
Authors reported no conflicts of interest.

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