RELATION OF SELF-REPORTED KNEE FUNCTION AND PHYSICAL PERFORMANCE WITH PSYCHOLOGICAL RESPONSES IN ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTED INDIVIDUALS

RESEARCH ARTICLE

ABSTRACT

Purpose: The aim of this study was to investigate the correlation between anterior cruciate ligament return to sport index after injury (ACL-RSI) score and self-reported knee function, and physical performance in anterior cruciate ligament reconstructed individuals.

Methods: Ninety ACL reconstructed individuals at 6 months post-surgery were included in this study. To evaluate psychological responses, ACL-RSI score; and to assess self-reported knee function, International Knee Documentation Committee Subjective Knee Form (IKDC), Knee Injury and Osteoarthritis Outcome (KOOS) and Lysholm scores were selected. One leg hop test and anterior, posteromedial and posterolateral reach distances of star excursion balance test were used to measure physical performance. Pearson correlation test was used for statistical analysis.

Results: ACL-RSI score was positively correlated with IKDC, Lysholm and KOOS scores; one leg hop test; and posteromedial and posterolateral reach distances of the star excursion balance test (p<0.05).

Discussion: Psychological responses were correlated with self-reported knee function and physical performance in anterior cruciate ligament reconstructed individuals. Therefore, maximizing knee function and performance is important to overcome individuals' fear of re-injury which affects return to sport after surgery, negatively.

Key Words: Knee joint; return to sport; postural balance; athletic performance

ÖN ÇAPRAZ BAĞ CERRAHİSİ GEÇİRMİŞ BİREYLERDE HASTA BİLDİRİMLİ DİZ FONKSİYONU VE FİZİKSEL PERFORMANSIN PSİKOLOJİK YANITLARLA İLİŞKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı ön çapraz bağ cerrahisi geçirmiş bireylerde ön çapraz bağ spora dönüş indeksi (ACL-RSI) ile hasta bildirimli diz fonksiyonu ve fiziksel performans arasındaki ilişkiyi araştırmaktı.

Yöntemler: Çalışmaya 90 ön çapraz bağ cerrahisi geçirmiş ve cerrahi sonrası 6. aya gelmiş bireyler dahil edildi. Psikolojik yanıtı değerlendirmek için ACL-RSI skoru, hasta bazlı diz fonksiyonunu değerlendirmek içinse Uluslararası Diz Dokümantasyon Komitesi Subjektif Diz Formu (IKDC), Lysholm skoru ve Diz Yaralanma ve Osteoartrit Sonuç skoru (KOOS) seçildi. Tek bacak sıçrama testi ve 'star excursion balance' testin anterior, posteromedial ve posterolateral uzanma yönleri fiziksel performansı ölçmek için kullanıldı. İstatistiksel analiz Pearson korelasyon testi ile yapıldı.

Sonuçlar: ACL-RSI skoru, IKDC, Lysholm ve KOOS skorları ile tek bacak sıçrama mesafesi ve 'star excursion balance test'in posteromedial ve posterolateral uzanma yönleri ile pozitif ilişkili bulundu (p<0.05).

Tartışma: Ön çapraz bağ cerrahisi geçirmiş bireylerde psikolojik yanıt hasta bildirimli diz fonksiyonu ve fiziksel performansla ilişkili bulundu. Bu nedenle, ön çapraz bağ cerrahisi sonrası bireylerin spora dönüşünü olumsuz yönde etkileyen tekrar yaralanma korkusunu yenmeleri için diz fonksiyonunun ve performansın arttırılması önemlidir.

Anahtar Kelimeler: Diz eklemi; spora dönüş; postüral denge; sportif performans

Gülcan HARPUT, PT, PhD.[1]
Damla TOK, PT, MSc. [1]
Volga Bayrakcı TUNAY, PT, PhD, Prof. [1]

İletişim (Correspondence):

Gulcan Harput, PT, PhD. Hacettepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, 06100, Altındağ, Turkey

1   Hacettepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Turkey.

INTRODUCTION

Anterior cruciate ligament (ACL) injuries are the most common knee injuries occurring during sports including twisting, cutting and pivoting activities (1). Depending on the patient's desire to return to sport (RTS), ACL reconstruction (ACLR) is the first treatment choice recommended for the individuals whose physical activity level is high (2,3). The goal of the ACLR is to return patients to their pre-injury activity levels by restoring the knee joint function and stability (2). The patients attend a post-operative rehabilitation immediately following surgery and the rehabilitation typically lasts until the patients RTS which takes 6 to12 months after ACLR (4).

Demographic, physical and psychological factors have shown to affect RTS rate following ACL reconstruction (5). Previous studies suggested that only detecting side to side asymmetries by using physical performance tests is not adequate for RTS decision (6-10). A recent meta-analysis demonstrated that only 64% of patients returned to sports after ACLR, although approximately 90% of them had a good recovery of knee function following surgery (7). Therefore, psychological factors are thought to lead the mismatch between return to sport rate and physical performance outcomes after ACLR (10). Fear of re-injury is one of the most challenging psychological factors after ACL injuries (6,9) and up to 24% of ACLR patients do not return to sport due to fear of re-injury (9). Johnston et al. described fear of re-injury as hesitation, holding back, giving less than maximal effort, avoiding injury provoking situations and strapping the injured body part when participating in sport (11).

Although there are several questionnaires evaluating the psychological factors associated with return to sports (12,13), they are not specifically developed to evaluate the psychological impact of returning to sport after ACLR. Webster et al. developed the ACL Return to Sports after Injury (ACL-RSI) scale that evaluates emotions, confidence in performance, and risk appraisal of the athletes in relation to return to sport after ACL injury and/or surgery (10). The ACL-RSI was shown to help to identify patients who return to sport and who do not (10). Muller et al. showed that ACL-RSI scale

was the strongest predictive parameter of RTS at 6 months following ACLR (14). It was suggested that addressing the patients' fear of re-injury during early phase of the postoperative rehabilitation might decrease its impact on knee functions (15). However, there is limited information in the literature whether psychological responses related with knee functions in ACL reconstructed individuals. We postulated that lower knee function would be positively correlated with lower psychological responses. Therefore, the aim of this study was to investigate the correlation between ACL-RSI score and self-reported knee function, and physical performance in ACL reconstructed individuals.

METHODS

Ninety individuals (age: 28.5±8.2 years, body mass index: 25.1±4.1 kg/m2) who had undergone ACLR with hamstring tendon/patellar tendon autograft, and were at 6 months post-surgery were included in this study. Inclusion criteria of the study were; a) isolated ACL injuries, b) unilateral arthroscopic ACLR, c) age between 18 and 45, d) minimum 5 points of pre-injury Tegner score e) willing to return to sport after surgery. Participants who had undergone ACLR were excluded if they had an ACL revision, posterior cruciate ligament injury and/or reconstruction or had a previous injury or surgery to the contralateral limb.

Written informed consent was obtained from all participants, as approved by the Hacettepe University Ethical committee (GO 14/540).

Physical tests

One leg hop test (OLHT) and modified star excursion balance test (SEBT) were used to evaluate the physical performance of the participants.

For the OLHT, the participants stood on one leg with toes behind a mark on the floor. They were instructed to jump forward as far as possible with a controlled landing. The test was performed until three successful jumps were performed for each leg. The tests was performed with the uninvolved limb first and then, with the involved limb. The distance was measured in centimeters and the average of the three trials was recorded (16).

SEBT with the anterior (ANT), posteromedial (PM) and posterolateral (PL) directions was used to as-

sess the dynamic balance (17). Participants were instructed to stand in the middle of the grid with tapelines. The angle between ANT and PM or PL directions was set at 135˚, and between PM and PL was set at 90˚. The participants were instructed to reach as far as possible along each of the three lines, make a light toe-touch on the line without shifting weight on reaching foot, and return to the center of the grid while maintaining single-leg balance. Measurements were taken from the most distal aspect of the toes. Three practice trials were given for each limb for each direction. The participants then performed three trials in three directions for each limb. The average of the three reach distances was recorded.

Psychological response

The ACL-RSI scale was developed into three RTS subscales: emotions, confidence in one's performance, and evaluation of risk appraisal. It consists of 12 questions evaluated by visual analogical scales (VAS) from 0 to 100 with 10 point increments (10). The total score was calculated by taking a percentage of the total scores for the 12 questions. High score indicates positive psychological response (10,18). Turkish version of ACL-RSI scale was used in this study (18).

Self-reported knee function

The knee injury and osteoarthritis outcome (KOOS) score has five subscales evaluating symptoms; pain; function in daily life; function during sport and recreational activities; and knee-related quality of life. The score for each subscale range from 0 to 100; where higher scores indicate good knee function (19).

International knee documentation committee (IKDC) subjective knee form is developed to measure symptoms, function, and sports activity for people with knee disorders, including ligamentous and meniscal injuries, osteoarthritis, and patellofe-

moral dysfunction. The form contains 18 selected items designed to assess pain; stiffness; swelling; joint locking; and joint instability, while other items designed to measure knee function assess the ability to perform activities of daily living. The total score ranges from 0 to 100, with 100 indicating higher levels of knee function (20).

The Lysholm score is an eight-item questionnaire designed to evaluate knee function after knee ligament injury. It is scored on a 100-point scale from 0 to 100 (worst to best symptoms, respectively), with 25 points attributed to pain, 15 to locking, 10 to swelling, 25 to instability, 10 to stair climbing, and 5 points each to limping, use of a support, and squatting (21).

Statistical analysis

IBM SPSS 21.0 (SPSS Inc, Chicago, IL) was used for statistical analysis. Kolmogorov Smirnov test was used to test the normal distribution of the data. Data were expressed as means and standard deviations (SD) for descriptive data. Pearson's correlation test was performed to analyze the correlation between ACL-RSI score and functional performance (OLHT, SEBT) outcomes and self-reported knee function (KOOS, IKDC and Lysholm). The correlation was expressed to be 'strong' (r > 0.5), 'medium' (r=0.3-0.5) or 'small' (r < 0.3) (22). Statistical significance level was set at $p<0.05$.

RESULTS

Table 1 and Table 2 provide descriptive statistics for self-reported knee function and functional performance outcomes and correlations between psychological responses and self-reported knee function and physical test outcomes.

ACL-RSI score was significantly correlated with IKDC score ($p<0.001$, r=0.54), Lysholm score ($p<0.001$, r=0.45) and KOOS 5 subscales such as other symptoms (p=0.001, r=0.35), pain ($p<0.001$, r=0.48), function in daily living ($p<0.001$, r=0.41),

Table 1: Correlation between ACL-RSI score and self-reported knee functions

	ACL-RSI	IKDC	KOOS Symtoms	KOOS Pain	KOOS ADL	KOOS Sport	KOOS QoL	Lysholm
Mean±SD	52.7±22.5	77.2±15.2	80.2±14.4	86.5±13.3	92.9±12.4	74.4±21.5	60.9±22.1	94.3±8.3
r value	-	0.540	0.349	0.484	0.412	0.440	0.577	0.449
p value	-	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*

Table 2: Correlation between ACL-RSI score and one leg hop test and star excursion balance tests.

	ACL-RSI	OLHT	SEBT Anterior	SEBT Posteromedial	SEBT Posterolateral
Mean±SD	52.7±22.5	90.2±13.7	99.1±8.8	98.1±6.3	99.4±7.9
r value	-	0.26	0.09	0.27	0.28
p value	-	0.02*	0.41	0.02*	0.01*

Abbreviations: OLHT, One leg hop test; SEBT, star excursion balance test

function in sport and recreation (p<0.001, r=0.44) and knee-related quality of life (p<0.001, r=0.58) subscales. The participants whose ACL-RSI score was higher had a better knee function. While the correlation between ACL-RSI score and IKDC and KOOS quality of life subscale were strong, the other correlations were found medium.

A weak correlation was observed between ACL-RSI score and OLHT (p=0.02, r=0.26), SEBT_PM (p=0.02, r=0.27) and SEBT_PL reach distances (p=0.01, r=0.28). There was no correlation between ACL-RSI score and SEBT_ANT reach distance (p=0.41, r=0.09).

DISCUSSION

The main findings of this study was that, psychological response evaluated by ACL-RSI score was positively correlated with self-reported knee function and physical performance in ACL reconstructed individuals. Strong correlations were observed between psychological responses and self-reported knee functions while the correlations were small between psychological responses and physical performance.

Previous studies indicate that there is a significant emotional response to athletic injury (6-9). The individuals felt that they were at risk of re-injuring their knee if they returned to sport. This could explain low rate of return to sport ratio in athletes even they had achieved successful outcomes in physical examinations. ACL-RSI scale specifically evaluates the psychological responses of the ACL injured population in terms of return to sport after ACL injury and/or surgery. Webster et al. indicated that the primary aim of the ACL-RSI scale was to be able to predict the individuals who require psychological interventions after ACL reconstruction (10). This scale was shown to discriminate between athletes who returned to sport and who did not return to

sport due to fear of re-injury after ACL reconstruction (7,10). Ardern et al. suggested that a score of less than 56 points on the ACL-RSI may indicate an increased risk of not returning to the preinjury level and may help clinicians to identify at-risk athletes (7). In the present study, ACL-RSI score of the participants was 52.7 points which show that the participants may not psychologically be ready to return to sport at 6 months post-surgery.

Strong correlation between ACL-RSI score and IKDC score, and KOOS "quality of life" subscale score in the present study indicated that lower knee function had an impact on psychological responses of the ACL reconstructed individuals. Therefore, we may say that individuals whose knee functional score was lower had more fear of re-injury after surgery. Consistent with our findings, previous studies found positive correlations between ACL-RSI score and patient reported outcomes (23-25). Bohu et al. and Kvist et al. found that ACL-RSI was more likely to be correlated with KOOS "quality of life" subscale (9,23), while Slagers et al. reported higher correlation between ACL-RSI and KOOS "sport and recreation" subscale (25). The conflicting findings of different studies might be due to elapsed time after ACL surgery, attendance of a rehabilitation program, physical activity level of the participants. Researchers have found that patients who scored poorly on the IKDC were 4 times more likely to fail the return to sport tests. Lentz et al. showed that IKDC score was one of the factors most strongly associated with self-reported return-to-sport status (5). Therefore, the ACL reconstructed individuals who scored poorly on IKDC and KOOS might be more likely to fail to return to sport due to psychological factors.

Ardern et al. demonstrated that having poor hop test symmetry and self-reported knee function, and more negative psychological responses were

associated with not playing at the preinjury level sport at 2 years (26). However, there was no study in the literature which investigated the correlation between psychological responses and physical performance test in ACL reconstructed individuals. In this study, it was hypothesized that the participants who had lower ACL-RSI score would also get lower scores in hop and balance tests. Although the correlations between ACL-RSI and physical tests were significant, they were small. The tests were chosen for the present study might not be challenging enough for the participants, so they had no difficulty during performing the tests due to psychological factors. We chose OLHT and SEBT since the test battery for return to sport after ACL reconstruction includes these tests. Sport specific tests might be more informative to document the relationship between psychological responses and physical performance tests.

The limitation of this study is that we included only male ACL reconstructed individuals in the study, so the result of this study might not reflect female ACL reconstructed and ACL injured individuals.

CONCLUSION

The results of this study showed that psychological responses were positively correlated with self-reported knee function and physical performance in ACL reconstructed individuals. Therefore, maximizing knee function and performance of the patients could help them to overcome the fear of re-injury which affects return to sport after surgery, negatively.

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