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Return to Sports After Hamstring Injuries: Importance of the Criteria and Their Applicability in Clinical Practice

Hamstring Yaralanmaları Sonrasında Spora Dönüş: Kriterlerin Önemi ve Klinik Pratikte Uygulanabilirliği

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ABSTRACT

Purpose: Hamstring injuries are the most common sport-related muscle injuries. Several Return to Play (RTP) criteria have been described to prevent re-injury after hamstring injuries. Despite the criteria, re-injury rates have not been satisfactorily improved. The purpose of this study is to investigate the utilization of RTP criteria in clinical practice.

Materials and Methods: Forty-nine sports medicine specialists and twenty-six physiotherapists were included in the study. The study was conducted using a 5-point Likert-Scale questionnaire. This study is a cross-sectional study and Level of Evidence is IV. Participants were questioned about their sociodemographic characteristics, the importance of RTP criteria, the practical application of these criteria, and the factors that influence the RTP decision. The difference between importance referred to RTP criteria and practical application was analyzed with the Wilcoxon Signed Rank Test.

Results: Statistical analysis revealed a significant difference between referred importance and practical application of eight out of ten RTP criteria ($p<0.05$).

Conclusion: RTP criteria do not adequately reflect the practical application. The underlying causes of this contradictory situation should be analyzed, and a new perspective should be developed to prevent hamstring injuries and decrease the re-injury rates.

Keywords: hamstring injuries, RTP criteria, re-injury

ÖZ

Amaç: Hamstring yaralanmaları spor yaralanmaları arasında en sık görülen kas yaralanmalarıdır. Hamstring yaralanmalarından sonra yeniden yaralanmayı önlemek için birçok spora dönüş (RTP) kriteri tanımlanmıştır. Kriterlere rağmen, yeniden yaralanma oranları tatmin edici bir şekilde azalmadığı görülmektedir. Bu çalışmanın amacı spora dönüş kriterlerinin pratik uygulamalarını araştırmaktır.

Gereç ve Yötemler: Çalışmaya 49 spor hekimliği uzmanı ve 26 fizyoterapist dahil edilmiştir. 5'li Likert ölçeğinde bir anket kullanılarak yürütülmüştür. Bu çalışma kesitsel bir çalışma olup, Bilimsel Kanıt Düzeyi IV'tür. Katılımcıların sosyodemografik özellikleri, spora dönüş kriterlerinin önemi, bu kriterlerin klinik pratikte uygulanabilirliği ve spora dönüş kararını etkileyen faktörler sorgulanmıştır. Kriterlere verilen önem ile pratik uygulama arasındaki fark Wilcoxon İşaretli Sıralar Testi ile analiz edilmiştir.

Bulgular: İstatistiksel analiz, 10 spora dönüş kriterinden 8'inde kriterlere verilen önem ile pratik uygulama arasında anlamlı bir fark olduğunu ortaya koymuştur ($p<0.05$).

Sonuçlar: Spora dönüş kriterlerinin pratik uygulamaya yeterince yansımadığı görülmektedir. Bu çelişkili durumun altında yatan nedenlerin analiz edilmesi ve

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hamstring yaralanmalarını önlemek ve yeniden yaralanma oranlarını azaltmak için yeni bir bakış açısının geliştirilmesi gerektiği düşünülmektedir.

Anahtar Sözcükler: hamstring yaralanmaları, spora dönüş kriterleri, tekrar yaralanma

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INTRODUCTION

Muscle injuries are common sports injuries and constitute approximately 30% of elite football injuries (1-4). These injuries are also common in athletics, rugby, basketball and American football. The majority of muscle injuries occur in the lower extremity, most commonly in hamstring muscles (37%) (2). In other words, in a top level professional football team with an average of 25 players; 5 hamstring injuries and 80 training day loss per season are expected. (2). In addition, the high rates of re-injury and the longer time to RTP after re-injuries are also significant problems (5,6). Furthermore, from an economic point of view, these problems lead to a serious cost, as well (7).

The frequency and consequences of injuries motivated scientists to investigate this issue and many studies have been conducted. Some of these studies have attempted to establish measures to reduce the frequency of injury, and some have led to build up RTP criteria after injury (absence of pain, similar strength, and flexibility, sport specific functional exercises, neuromuscular studies, evaluation with imaging methods, etc.) (5, 8-12). The applicability of these criteria into practice are influenced by various factors (competition schedule, achievement goal, pressure from coach, lack of technical equipment, pressure from athlete to return early, etc.) (13-15). Despite many studies, the frequency of injury did not decrease significantly (2, 16-19).

The objective of this study was to figure out the utilization of RTP criteria following hamstring injuries and to put forward the causes of discrepancies in sports medicine practice.

METHODS

Seventy-four sports medicine specialists who completed sports medicine residency in Turkey and fifty-one physiotherapists who were currently working on athletic injuries were invited to the study. An invitation letter, an informed consent, and a questionnaire were sent via e-mail to the participants. A reminder message was sent 15 days and 2 months after the first mail. Forty-nine of the sports medicine specialists and twenty-six of the physiotherapists participated in the study by responding to the e-mail. This study was designed according to the Declaration of Helsinki and approved by Ankara Yıldırım Beyazıt University School of Medicine Ethical Committee. All participants were fully informed about the study and they all signed written informed consent.

A 5-point Likert Scale questionnaire has been prepared for this investigation. This study is a cross-sectional study and Level of Evidence is IV. The participants were asked 29 questions in 4 sections. In the first section, age, gender, and occupational information were asked. In the second section, participants were asked to sort some of the RTP criteria mentioned in the literature from “1 = Not Important” to “5 = Very Important". In the third section, the practical use of these criteria has been asked to sort from "1 = never” to “5 = frequently". In the fourth section, the effectivity of factors that determine the utilization of these criteria is asked to be sorted as "1 = Not Effective” to “5 = Very Effective".

The sample size was calculated using an open-source web-based program. The effect size was estimated to be 0.10. Considering a power of 0.80, α level of 0.05, a minimum of 63 subjects would be required for the study. Descriptive statistics of the obtained data were performed. The hypothesis of the study was tested with the Wil-

coxon Signed Ranks Test. The level of significance was accepted as p <0,05. Statistical analyses were performed with SPSS software (version 23.0, SPSS Inc., Chicago, IL) for Mac (Free Trial) program.

RESULTS

49 sports medicine specialists (respond rate = %69) and 26 physiotherapists (respond rate = %51), a total of 75 participants (61 males, 14 females; 35,49 ± 8,55 years) were included in the study. 49 of the participants were working in health institutions and 12 of them were working in sports clubs. The remaining 14 participants were working in both health institutions and sports clubs.

The results of the questionnaire applied to depict the importance of the RTP criteria and the results of questionnaire applied to figure out the practical use of RTP criteria have been presented in Table 1.

Table 1. The referred importance and the practical application of the RTP criteria after hamstring injuries

	Referred Importance			**Practical Application**		
	N	Mean	SD	N	Mean	SD
Absence of Pain	75	4.75	0.548	75	4.83	0.381
Psychological Readiness	75	4.59	0.595	75	4.36	0.765
Sport-Specific Functional Evaluation	75	4.57	0.524	75	3.55	1.222
Flexibility	75	4.44	0.758	75	4.61	0.676
Nordic Eccentric Muscle Strength	75	4.25	0.871	75	2.87	1.398
Isokinetic Muscle Strength	75	4.13	0.905	75	2.37	1.271
Single Leg Balance	75	3.93	0.935	75	3.44	1.276
Aerobic-Anaerobic Capacity	75	3.84	0.129	75	2.83	1.369
Imaging with MRI-USG	75	3.00	1.040	75	2.73	1.298
Neuromuscular Evaluation with EMG	75	2.81	1.182	75	1.39	0.837

The results of the questionnaire applied to find out the effectiveness of factors that determine the utilization of these criteria are given in Table 2.

Table 2. The factors affecting the RTP decision

	N	**Mean**	**SD**
Competition Schedule- Achievement Goal	75	3.65	1.214
Pressure from coach	75	3.19	1.363
Pressure from athlete to return early	75	3.08	1.323
Lack of technical equipment	75	2.99	1.289
Fear of litigation	75	2.09	1.187

The significance of the difference between referred importance and practical application of the RTP criteria was calculated with the Wilcoxon Signed Rank Test. There were significant differences between referred importance and practical application of Psychological Readiness

(p=0,006), Sport-Specific Functional Evaluation (p<0,001), Flexibility (p=0,007), Nordic Eccentric Muscle Strength (p<0,001), Isokinetic Muscle Strength (p<0,001), Single Leg Balance (p<0,001), Aerobic-Anaerobic Capacity (p<0,001) and Neuromuscular Evaluation with EMG (p<0,001) (Table 3).

Table 3. The difference between referred importance and practical application of RTP criteria

	T	p	z	r
Absence of Pain	16,5	p=0,109	z= -1,604	r= -0,19
Psychological Readiness	69	p=0,006*	z=-2,746	r=-0,32
Sport-Specific Functional Evaluation	56	p<0,001*	z= -5,663	r= -0,65
Flexibility	40	p=0,007*	z= -2,711	r= -0,31
Nordic Eccentric Muscle Strength	19	p<0,001*	z= -6,105	r= -0,70
Isokinetic Muscle Strength	16	p<0,001*	z= -6,753	r= -0,78
Single Leg Balance	104	p<0,001*	z= -3,696	r= -0,43
Aerobic-Anaerobic Capacity	25,5	p<0,001*	z= -5,405	r= -0,62
Imaging with MRI-USG	351	p=0,053	z=-1,934	r=-0,22
Neuromuscular Evaluation with EMG	33	p<0,001*	z= -6,464	r= -0,75

**Significant differences between referred importance and practical application of RTP criteria*

DISCUSSION

Although hamstring injuries are the most common football-related muscle injuries (2), it has been understood that the accepted theoretical knowledge in the treatment approach has been ignored in practice. When the reasons for this implementation are discussed; it is seen that the RTP decision is not given according to the clinical status.

The absence of pain was determined to be the most important and most frequently used RTP criterium. This result is consistent with several studies in the literature (6, 9-12, 20). The similarity between the referred importance and practical application is probably due to the subjective evaluation of the athlete. The psychological readiness of the athlete, which is a subjective criterion like pain, is also considered as an important criterion (21-23). In our study, this has also been considered to be an important criterion, but there was a significant difference between practical application and referred importance. This difference might probably be resulted from other factors affecting RTP decision.

Flexibility is known to be another frequently used RTP criterion. There are different opinions in the literature on flexibility. Although equality of range of motion (ROM) on both limbs are noted to be utterly important in some studies (6, 10, 24), there is another study suggesting that a 10% difference in ROM is an acceptable level for permission to RTP (11). It is thought that this discrepancy may be one of the reasons leading to the significant difference between referred importance and practical application.

Another RTP criterion that is propounded for hamstring injuries is the comparison of muscle strength between the limbs (6, 10, 11, 24-27). In this study, the preference of participants was asked about two different methods of muscle strength evaluation. Nordic eccentric muscle strength evaluation was found to be more important than isokinetic muscle strength measurement. This result is consistent with the study of van der Horst et al. (12). There was a significant difference between the referred importance and the practical application of both measurement methods. Although the participants had remarked the importance of strength measurements in making the decision of RTP, the utilization of this criterion was found to be quite low, possibly due to lack of easy access to

technical equipment used for strength measurement.

Sport specific functional evaluations, aerobic and anaerobic capacity measurements are accepted as RTP criteria (6, 8, 10, 12, 28), as well. The ability to completion of the required sport-specific functional exercises was another RTP criterion that was stated by the participants. There was also a significant difference between the importance and practical application of this criterion. Again, the difference between theory and practice may be due to lack of technical equipment (GPS systems, oxygen analyzers, etc.).

In the present study, the two less important RTP criteria were depicted as MRI-USG imaging and EMG and neuromuscular evaluation. There are some studies stating that these two criteria are not very important in RTP decisions and may be excluded from the criteria list (10, 12). We noted that there was no significant difference between the referred importance and practical application of MR-USG imaging. On the other hand, EMG evaluation was stated as an important RTP criterion in theory, whereas less attention has been attributed to that in practice. The need for special training and technical equipment for the EMG application were possible factors in this difference.

It is known that the RTP decision is also influenced by factors other than health and performance parameters (14, 15, 29, 30). Creighton et al. have developed a 3-step decision-based RTP model (29). In the third step of this model, non-medical factors were mentioned. In our study, the effect of these factors on the RTP decision was questioned, as well. The competition schedule and the achievement goals were the factors that the participants gave the highest score. The effect of these factors on the RTP decision has been mentioned before (12, 29, 30). Another high scored factor is pressure from the coach, and this factor has also been mentioned in the literature (14, 15, 21). In addition, it has been shown that the coaches' perception of communications and behaviors had an impact on the frequency of injury (31). We detected that the pressure of athletes to return to competition was another important factor that could influence RTP decisions.

The results of the present study should be considered with several limitations. Although non-medical factors were effective in RTP decisions, more comprehensive evaluations about these factors are required. Participants have different occupations and employers, however, sample size hindered the analysis of these differences. Further studies that take these differences into consideration will be more useful in practice. Besides, the answers to Likert scale questions could be affected by factors such as social desirability bias and acquiescence bias.

CONCLUSION

In conclusion, referred importance is not parallel to practical applications in terms of RTP criteria following hamstring injuries. The higher rates of hamstring re-injuries could be attributed to inconsistency between well-established RTP criteria and practical applications of these criteria. This discrepancy could be resulted from the non-medical constraints that sports physicians faced in daily practice, mainly coming from coaches and athletes. Comprehensive studies are needed to put forward the factors influencing the decision making in RTP following hamstring injuries, especially based on sports specific models. Eliminating the factors leading to failure of following the RTP criteria in hamstring injuries will result not only in lowering re-injuries, but also decreasing the overall injury rates.

Conflict of Interest and Funding Statement

There is no conflict of interest of funding in this article.

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