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Original article

Anterior Cruciate Ligament Reconstruction Under 18 Years-Old: Functional Level and Sports Activity

Catarina F. MARQUES [1], Pedro FIGUEIREDO *[1,2], João BRANCO [1,2], João PINHEIRO [1,2]

[1]Faculty of Medicine, University of Coimbra, Coimbra, Portugal.
[2]Physical Medicine and Rehabilitation Department, Hospitalar and University Center of Coimbra, Coimbra, Portugal.

*Corresponding author: Pedro FIGUEIREDO; *pedro.s.figueiredo@hotmail.com*

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Abstract

Introduction: Reconstruction of the anterior cruciate ligament (ACL) in patients under 18 years-old has grown in last decades. Knee ligament rehabilitation aims to normalize functionality and promote a safe return to exercise and sports. This study intends to evaluate the functional capacity, the perception of quality of life and the level of activity, between 18 and 72 months after reconstruction of the ACL, in a population under 18 years old. ***Methods:*** Cross-sectional observational study that included a sample of young patients submitted to surgical reconstruction of the ACL. Patients underwent a rehabilitation program and were evaluated between 18 and 72 months after reconstruction. Metric tools were the Knee Outcome Survey - Activities of Daily Living Scale (KOS-ADLS), Short Form (SF)-36 (SF-36) and Tegner Activity Scale (TAS). Descriptive and correlation statistics (Pearson's and Spearman's Correlation Coefficients) were used. ***Results:*** This sample included 30 participants, 15 males and 15 females with a mean age of 19.4 ± 2.0 years and a mean postoperative time of 43.0 ± 16.8 months. In 20 patients, meniscus and cartilage injuries were identified. They had a pre-injury TAS of 8.0 ± 1.2 and a current TAS of 4.6 ± 2.2. They currently present KOS-ADLS score of 87.6 ± 11.0 and in the SF-36 vitality, mental health, and general health domains respectively 66.3 ± 22.9, 75.9 ± 19.9 and 75.5 ± 20.0. ***Conclusion:*** Patients under 18 years old undergoing ACL reconstruction have a high perception of knee functionality and quality of life. However, after the rehabilitation program, they significantly lower the level of sports activity. Meniscus and cartilage injuries negatively may affect functional capacity.

Keywords: ***Anterior cruciate ligament, young patients, function, quality of life, activity level.***

Introduction

The incidence [1,2] and prevalence [3] of ACL injury in the adolescent and young adult have increased in recent years. This trend has been attributed to several factors, such as greater participation in highly demanding competitive sports, [4-6] as well as greater diagnostic accuracy particularly with imaging magnetic resonance [6,7].

ACL rupture is a serious injury in this population, [8] with short-term implications for knee function and medium and long-term risk of osteoarthritis [7]. In addition to the symptomatic and functional consequences, this injury interferes with physical well-being, mental health and the perception of quality of life. Associated injuries, meniscus and cartilage, should also be considered as a poor outcome, particularly in order of the of the knee functionality.

Some years ago, the initial approach to ACL rupture in skeletally immature patients was conservative, [9] but early reconstruction is now considered good practice in most young patients [10-12].

Along with the advances in the surgical management of ACL injuries in pediatric population, researchers have developed new tools for measuring the success of surgical interventions [14]. Moreover, the implementation of specific metric tools - Patient-Reported Outcome Measures (PROMs) - was also useful in terms of understanding patient's outcomes [14]. PROMs provide insight into patient's perception of recovery [5] and therefore these tools are important to evaluate the success of ACL reconstruction and rehabilitation.

The aim of this study is to evaluate the degree of function and quality of life after ACL reconstruction in the knee of adolescent and young adult athletes.

A second aim is to compare the level of sports activity at the time of the injury and that observed after rehabilitation, in this population of young patents.

A third outcome is to evaluate how meniscus and cartilage injury modify the functional performance.

Methods

Study Design and Participants - This was an observational and cross-sectional study that included consecutive patients (N=30) who underwent arthroscopic ACL reconstruction in the Orthopedic department of the Pediatric Hospital - Centro Hospitalar e Universitário de Coimbra (CHUC). All patients between 16 and 18 years-old were included. All patients underwent the same rehabilitation program and were observed between 18 and 72 months after ligament reconstruction.

The rehabilitation program lasted between 6 and 9 months and promoted nociceptive control, joint mobility, muscle strength, proprioceptive training, and aerobic performance.

All participants understand Portuguese language and had adequate cognitive function. Patients with other orthopedic impairments. neurologic or rheumatologic morbidities or other health conditions that compromised health status were excluded.

All participants, as well as the legal representatives provided written informed consent.

Metric tools

The KOS-ADLs contains 17 items that assess the algo functional level of the knee through a final global score ranging from 0 (lowest level of function) to 100 (highest level of function) [16]. The scale assesses 7 symptoms (pain, crepitation, stiffness, edema, instability, muscle weakness) and functional disabilities with activities of daily living, namely walking, climbing stairs, standing, squatting, sitting, and kneeling [15].

The SF-36 contains 36 items [16,17] that cover eight sub-dimensions that assess different areas of health status: physical function, physical performance, physical pain, general health, mental health, emotional performance, social function, and vitality [16-18]. The eight sub-dimensions can be grouped into two general dimensions of health status: the physical dimension, which includes physical function, physical performance, physical pain, and general health; and the mental dimension, which includes mental health, emotional performance, social function, and vitality [18]. Each sub-dimension is translated into a scoring score from 0 to 100, where 0 means the worst possible health status and 100 indicates the best possible state [18].

The Tegner activity scale is a tool applied in patients with ACL injury [14] to stratify the characteristics and demands of sports practice. Tegner Activity Scale values range from 0 to 10. A value of 10 corresponds to the practice of competitive sports (including soccer, rugby, and others) at a professional level [15]. A value of 6 corresponds to recreational sports practice (at least 5 times a week). A value of 4 corresponds to moderately heavy work activity or recreational sports practice (at least 2 times a week), and a value of 0 is given to sedentary individuals (with pathology or disability due to knee problems) [15].

Ethical approval - The study was approved by the ethical commission of Faculty of Medicine and Hospitalar and University Center of Coimbra

Statistics

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 27.0 for Microsoft Windows.

Descriptive statistics were used to characterize the sample, with the presentation of variables with mean and standard deviation for age, post-surgery time, rehabilitation time, pre-injury TAS, current TAS, KOS-ADLS, and SF-36 scores.

Correlation analysis used the Pearson's coefficient and Spearman's coefficient.

The Pearson Correlation Coefficient and Spearman Correlation Coefficient were used.

Results

Thirty (30) patients were included, according inclusion criteria. Main demographic characteristics are described in Table 1.

Table 1: Sample characteristics.

Demographic Characteristics	*N / Mean ± SD*
Gender (F/M)	15/15
Age (years)	19.4 ± 2.0
Assocated injury (meniscus; cartilage)	20 /30
Postoperative Time (months)	43.0 ± 16.8
Rehabilitation (weeks)	35.2 ± 10.4
TAS pre-injury (weeks)	8,0 ± 1.2

Table 2 presents the mean values and standard deviation of PROMs.

Table 2: Mean values and standard deviation of PROMs

Patient-Reported Outcome Measures - PROMs	*Mean ± SD*
TAS after reconstrution	4.6 ± 2.2
Variation	3.4 ± 2.2
KOS-ADLS after reconstrution	
Overall	87.6 ± 11.0
SF-36 after reconstrution	
physical functioning	90.5 ± 10.5
role limitations(physical)	76.7 ± 28.6
bodily pain	80.3 ± 20.3
general health perceptions	75.5 ± 20.0
vitality	63.3 ± 22.9
social functioning	83.4 ± 21.5
role limitations(emotional)	73.1 ± 20.8
mental health	75.9 ± 19.9

KOS-ADLS - Knee Outcome Survey-Activities of Daily Living Scale; SF-36 – Short Form (SF)-36

Table 3 present the results of the studied correlations, using Pearson coefficient for continuous variables and Spearman coefficient for nominal variables.

Table 3: Pearson and Spearman correlation coefficients.

Correlations	*Correlation Coefficients*	*p*
KOS-ADLS / Current TAS	.402*	.014
KOS-ADLS / Variation TAS	-.502**	.002
Concomitant Injury / KOS-ADLS	-.393*	.016
KOS-ADLS / Bodily Pain (SF-36)	.684**	<.001
KOS-ADLS / Mental Health (SF-36)	.444**	.007
Gender / Pre-injury Tegner Index	-.390*	.017
Variation TAS / Age	.742	.112
Variation TAS / Postoperative period	.495	.224

p-p-Value.

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Discussion

Return to exercise and sports in young athletes after ACL reconstruction should be based on objective assessment of pain, muscle strength, proprioception, functionality. PROMs should also be used to gather information about the patient's perception of their recovery in terms of knee function, confidence and quality of life.

This population consists of active adolescents with regular recreational or competitive sports practice, with a preinjury TAS of 8, and with males generally presenting significantly higher levels of activity.

The KOS-ADLS questionnaire and physical dimensions of the SF-36 can provide insights into the patient's perception of knee function, particularly related to daily activities and quality of life relative to physical health. The positive and statistically significant correlation between the KOS-ADLS score and the Mental Health dimension of the SF-36 suggests that knee functional status has a relevant impact on the overall perception of emotional well-being. This reinforces the importance of clinicians considering psychological factors throughout the rehabilitation, as previously noted by others researches [5,16].

The study also found that patients with associated meniscus or cartilage injury had lower functional levels, highlighting the importance of adapting rehabilitation programs to each patient's specific needs. Furthermore, the perception of pain levels (physical pain dimension of the SF-36) presented a significant correlation with the reported functional levels, emphasizing the importance of assessing and managing the nociceptive context in the medium term, even in very patients.

Despite high knee function values found in the KOS-ADLS evaluation, there was a significant reduction in sports activity levels as reflected in the current TAS (4.6). This variation was not influenced by age, suggesting that knee function alone does not determine a return to the same type and intensity of exercise and/or sport.

This can be explained by the possible psychological impact of this major knee injury, which affects motivation levels for returning to sports, especially for competitive sports demands. These results reinforce those found by Kuenze *et al.* [17] and suggested by Vutescu *et al.* [19] about the existence of psychological and other factors that affect the resumption of sports practice in young athletes after ACL reconstruction, such as fear of reinjury, psychological readiness, and desire to return to sport [19]. Medical and family counseling can also play a relevant role in post-injury sports options.

Regarding future research, more studies should be conducted for a better understanding why did TAS decrease so much in these patients. It is important to understand the objective role of mental components of SF-36 and the reduction of activity levels in pediatric intervention populations. In future research, it will also be important to use a larger sample size and a control group of adolescents and young adults to compare activity levels.

Conclusions

Patients under 18, undergoing ACL reconstruction have a high perception of knee activity in ADL as well as perception of quality of life. However, after ACL reconstruction it is verified a significant reduction in the level of sports activity. Meniscal and cartilage associated injuries negatively affect the funcional perception.

Study limitations

The sample size limits the extrapolation of results to large adolescents or young adults populations. Moreover, the heterogeneity of the population regarding time after surgery may imply more significant variations in the studied indices. The high percentage of associated injuries may misrepresent the impact of isolated ACL injury.

Contribution

All authors contributes to conception of study, statistic analysis, discussion and revision. Author Catarina F. Marques collected patient information and applied the metric tools.

Conflict of interest

The authors declare no conflict of interest.

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