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Validity and reproducibility of the PPLP scoring scale in the follow-up of athletes after anterior cruciate ligament reconstruction

Validité et reproductibilité du score PPLP pour le suivi des ligamentoplasties du ligament croisé antérieur chez le sportif compétiteur

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Abstract

Objectives. – Validate the use of the PPLP scoring scale in the follow-up of athletes after anterior cruciate ligament (ACL) reconstruction.

Patient and method. – We conducted a prospective follow-up study on athletes with ACL reconstruction during several time periods between 2003 and 2009, we analyzed the score validity, its reproducibility, its responsiveness to change and its relevance in the follow-up and monitoring of ACL reconstructive surgeries.

Results. – The PPLP scoring scale was defined for the monitoring of ACL reconstruction in athletes. The PPLP tool is made of two parts: the first one (PPLP1) with a total of 100 points for postoperative follow-up and the second one also with a total of 100 points (PPLP2) adding up to the first score for determining a final post-op monitoring score of 200 points. The PPLP2 scoring scale is administered at a distance from the initial ACL reconstruction. For construct validity, we showed the differences in items' characteristics (coefficient r of 0.20 in 763 patients), and adequate correlation of the PPLP score to other scoring scales found in the literature (OAK, Lysholm, Tegner, Knee injury and Osteoarthritis Outcome Score [KOOS], Arpege, IKDC Subjective Knee Evaluation Form and Psychovitality Test). The intra/interexaminer reproducibility is excellent going from 0.92 to 1. The PPLP scoring scale shows a statistically significant responsiveness to change during the hospital stay, according to the postoperative delay but with great variations. Complicated clinical evolutions (among 3296 ACL reconstructions with postoperative follow-up) are well identified by a low PPLP score, mainly for complex regional pain syndrome Type 1 (CRPS1: 1.9%) with a mean PPLP1 score of 80.33 whereas uncomplicated clinical evolutions (80.8%) have a mean score of 94.28 with a significant difference ($p < 0.0001$). PPL2 scoring scale is significantly correlated to the possibility of getting back to competition ($p = 0.012$) and a high score is linked to a faster return to competition (follow-up of 258 patients). The optimal threshold score is 176, and not 170/200, as previously suggested. However, this score remains poorly discriminating in regards to sensitivity (79.7%), specificity (49.3%) and the percentage of athletes returning to competition 2.5 months after completing the PPL2 scoring tool (37.9%).

Conclusion. – The PPLP scoring scale was validated in the French language in terms of construct validity, reproducibility and sensitivity. This scoring scale is used for the follow-up and monitoring of ACL reconstruction in athletes, providing useful information on the quality of their recovery particularly during the postoperative phase and the possibilities of getting back to competition.

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Keywords: Knee; Anterior cruciate ligament; Score; PPLP; Validation; Reproducibility; Monitoring; Sport

Résumé

Objectifs. – Valider l'utilisation du score PPLP dans le suivi des ligamentoplasties du ligament croisé antérieur (LCA).

Patient et méthode. – Nous avons réalisé un suivi prospectif de reconstructions chirurgicales du LCA sur plusieurs phases entre 2003 et 2009, où nous avons analysé la validité du score, sa reproductibilité, sa sensibilité au changement et sa pertinence dans le suivi des ligamentoplasties.

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Résultats. – Le score PPLP a été précisé pour le suivi des ligamentoplasties chez le sportif. La grille est composée de deux parties : l'une (PPLP1) sur 100 points pour un suivi postopératoire et l'autre également sur 100 points (PPLP2) qui s'additionne au premier score pour un suivi à distance de la chirurgie déterminant un nouveau score de 200 points. Nous avons montré pour la validité de construit le caractère différencié des items (coefficient r de 0,20 chez 763 patients) et la corrélation du score PPLP avec d'autres scores de la littérature (OAK, Lysholm, Tegner, *Knee injury and Osteoarthritis Outcome Score* [KOOS], Arpège, *IKDC Subjective Knee Evaluation Form* subjectif et *Psychovitality Test*). La reproductibilité intra-examineur et extra-examineur est excellente, allant de 0,92 à 1. Le score PPLP évolue de façon statistiquement significative au cours de l'hospitalisation et en fonction du délai opératoire avec des phases de plus grandes variations. Les évolutions cliniques compliquées (parmi 3296 ligamentoplasties suivies en postopératoire) sont bien matérialisées par un score PPLP faible, notamment les neuro-aldodystrophies (syndrome douloureux régional complexe de type I [SDRC1] : 1,9 %) avec un PPLP1 moyen de 80,33 alors que les évolutions sans complications (80,8 %) ont un score moyen de 94,28 avec une différence significative ($p < 0,0001$). Le score PPLP2 est corrélé à la possibilité de reprendre la compétition de façon significative ($p = 0,012$) et un score élevé est lié à une reprise plus rapide (suivi de 258 patients). Le score barrière optimal est de 176 et non de 170/200, comme il l'avait été proposé auparavant. Cependant, ce score de 176 reste peu discriminant au vue de la sensibilité (79,7 %), de la spécificité (49,3 %) et du pourcentage de reprise de la compétition à 2,5 mois de la réalisation du score (37,9 %).

Conclusion. – Le score PPLP a été validé en termes de construction, de reproductibilité et de sensibilité en langue française. C'est un score de suivi de la ligamentoplastie du LCA, qui permet de donner des indications sur la qualité de la récupération, notamment en postopératoire, et sur les possibilités de reprise de la compétition.

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Mots clés : Genou ; Ligament croisé antérieur ; Score ; PPLP ; Validation ; Reproductibilité ; Suivi ; Sport

1. English version

1.1. Introduction

There are several tools used for the follow-up of anterior cruciate ligament (ACL) reconstruction surgery [9,10,12,14,23,27], yet very few of them were assessed with an adequate and complete methodology [3,22,29]. Most times, authors limit their analysis to only one validity parameter, resulting in several different studies that are difficult to compare for determining if one scoring tool is better than the other [2,8,11–13,15,19,32]. Furthermore, even though isokinetic assessments are frequently included as part of the clinical monitoring of ligament reconstructive surgeries [5,24,25], they were never before integrated as part of a follow-up scoring scale. The PPLP score has rarely been described in the literature [20,33], and had not been validated to this day. This scoring scale is used for a proper monitoring and follow-up of ACL reconstruction in athletes and can evaluate their chances of getting back to competition (Appendix A). It is based on subjective, clinical and functional data as well as a complete evaluation of the patients' muscular strength. This tool is made of two parts: the first one (PPLP1) for a postoperative follow-up and the second one (PPLP2) adding up to the first score for a long-term follow-up (several weeks after the initial surgery), thus making up a new score. Our objective was to evaluate its reproducibility, its validity, its responsiveness to change and its relevance in the follow-up of ACL reconstruction surgeries.

1.2. Material and method

1.2.1. PPLP scoring scale

PPLP1 grid (Appendix A) is defined by subjective parameters (pain, apprehension and patient's sensations) associated to clinical examination parameters (patella perimeter, joint laxity tests, joint range of movement, pain in the graft area, and amyotrophy). It also takes into account simple

functional parameters such as walking with or without technical aids (canes, braces), and also the various medications taken by the patient. PPLP1 allows the monitoring of ACL reconstruction patients during the postoperative period, with a possible maximal score of 100 points.

PPLP2 (Appendix A) is defined by a functional assessment (running, cardiovascular training on a bike) and an isokinetic evaluation. This score adds up to the PPLP1 score to make up a new score with a maximum of 200 points. The postoperative delay is defined by the time period between the initial surgery and the test completion. Isokinetic tests are done on the quadriceps and hamstrings in a concentric mode at 90°/s (repeated six times) and 240°/s (repeated 15 times), then in an eccentric mode at 90°/s (repeated six times) on a Biodex-type isokinetic equipment, after an initial warm-up session that includes cycling, leg-press and hamstring training for about 15 minutes completed by two to three warm-up movements on the isokinetic equipment. The patient sits down on the equipment, with a dynamic knee range of motion (ROM) going from 0 to 90°. The arms are positioned on the lateral handles. One highly competent examiner performed the entire test. The test's total duration varies from 30 to 40 minutes. Quantifying the peak torque (PT) between the operated side and the healthy side permits the calculation of the PPLP2 score.

1.2.2. Method

Our study was conducted in several prospective stages between 2003 and 2009, in order to encompass the various parameters needed to validate this scoring scale. The numerous validation criteria and measurement methods (clinical follow-up and monitoring, questionnaire) required several distinct studies according to the validation requirements of each criterion.

Short follow-up periods on small populations enabled us to compare the PPLP scoring scales with other rating tools found in the literature and we were able to analyze its reproducibility and responsiveness to change during the patients' hospital stay.

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