

# SUBJECTIVE VS OBJECTIVE EVALUATION OF KNEE STABILITY IN PATIENTS BEFORE AND AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Aleksandra Wysota,<sup>1, 2, A, B, E</sup> Dawid Pawlak,<sup>1, 2, B</sup> Krzysztof Ficek,<sup>1, D</sup> Joanna Ficek,<sup>1, D</sup>  
Grzegorz Juras<sup>2, C, D</sup>

<sup>1</sup> Galen Orthopaedic Rehabilitation Centre, Bieruń, Poland

<sup>2</sup> Faculty of Human Motor Skills, The Jerzy Kukuczka Academy of Physical Education, Katowice, Poland

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## Address for correspondence:

Aleksandra Wysota

Galen Orthopaedic Rehabilitation Centre

Jerzego 6, 43-150 Bieruń, Poland

E-mail: ola\_wysota@wp.pl

**Abstract.** Every year, the number of anterior cruciate ligament ruptures increases considerably. The present analysis compares patients' subjective sensations after the ACL injury to an objective arthrometric examination. The subjective evaluation of the knee-joint condition was performed using the Lysholm score scale and IKDC 2000 scale, whereas the objective evaluation was performed using a GNRB device to obtain an arthrometric measurement. Both measurement methods were performed before ACL reconstruction and after the rehabilitation process of  $\pm 11.5$  months. The following research was conducted on a group of 8 patients who underwent anterior cruciate ligament reconstruction. Statistical analysis did not reveal any significant differences between the arthrometric examination and the subjective score scales. The test indicated the significant differences between the score scales questionnaires completed before and after the surgery. The conclusions that can be drawn from the present analysis show us the importance of using subjective evaluation devices. Despite the lack of significance in the examination performed with the objective device, the self-evaluation of knee-joint efficiency made by the patient indicated a significant improvement.

**Key words:** Anterior cruciate ligament (ACL), arthrometric measurement, Lysholm score scale, IKDC 2000 score

## Introduction

Due to the increasing number of reports about knee-joint injuries, in particular ACL ruptures, both orthopaedists and physiotherapists confront the task of improving the post-injury treatment process.

According to the epidemiological reports (Woo SL-Y et al. 2006), the estimated number of ACL ruptures in the USA exceeds 150,000 (Csintalan RP et al. 2008), leading to the necessity of performing approximately 100,000 ACL reconstruction interventions per year. Among numerous internal and external injury factors presented in the literature, we are able to observe an increasing disproportion between contact and non-contact injuries. The number of ACL injuries of the non-contact variety is increasing. The injuries relate more often to the right rather

than to the left lower limb (Rochcongar P. et al. 2009). Female athletes participating in team sports which involve pivoting, jumping and team sports such as football, basketball, volleyball are often claimed to have 4–6 times higher ACL injury risk than their male counterparts (Walden M. et al. 2011). Furthermore, in football, female players are 2–3 times more likely to suffer an ACL injury than their male counterparts (Walden M. et al. 2011). In many studies, authors are confronted with the task of creating a common approach for post ACL injury procedure, starting with the diagnostics, proceeding to the treatment, all the way through to the completion of the rehabilitation process.

The diagnostics of ACL injuries are based on clinical research and imaging tests such as X-Ray, Ultrasound or MRI. These clinical research and imaging tests can be included in the group of objective examinations. The subjective examinations evaluating the patient's sensations are of no less importance. Knowledge obtained by the patient's subjective sensations, his attitude towards the intervention and his expectations after the treatment process are the factors that make both the treatment and the rehabilitation process more effective. A subjective examination, in addition to allowing better communication with the patient, may become an indispensable part of diagnostics and treatment.

The present analysis compares the patient's subjective sensations after ACL injury to objective arthrometric examination. Both types of assessment were used comparatively before ACL reconstruction and after the rehabilitation process. The Lysholm score scale and the IKDC 2000 scale (International Knee Documentation Committee) were used in the subjective evaluation of the knee-joint condition. Objective evaluation was performed with a GNRB (Genorurob) arthrometric measurement device.

It was assumed at the outset of the analysis that pre- and post- ACL reconstruction results conducted comparatively using both the subjective and the objective methods, would indicate statistically significant results showing increased stability of the knee-joint.

## Examination method

8 patients, including 2 women and 6 men, took part in the examination. The average age was  $\pm 29.4$  years old. The patients in the group were selected based on their active participation in sports. Initially, the examined patients were directed to perform the arthrometric measurement, after which they underwent ACL reconstruction within a period ranging from 5 days up to 7 months. Seven of the patients underwent autogenous ACL ST and GR grafts (semitendinosus and gracilis), while one of the examined patients underwent tibialis anterior muscle allograft, 7.0 mm thick double-bundle graft, fixed with the endobutton technique to femur by tibial INTERFIX MITEK fixation. On the day of the treatment the patients were asked to complete the Lysholm and IKDC 2000 subjective evaluation questionnaires regarding their knee-joint condition. The following stage was the rehabilitation process. Rehabilitation was homogeneously conducted according to the adopted procedural protocols after ACL reconstruction. The entire process of rehabilitation up to the final examination was conducted by a physiotherapist. Once the rehabilitation had been completed, the comparative arthrometric examination was conducted within 8–13 months' time (approx. 11.5 months). The patients also completed subjective evaluation questionnaires of IKDC 2000 and Lysholm's scales after concluding rehabilitation.

The criteria of classification for the comparative arthrometric measurement: to gain the quadriceps femoris muscle strength symmetry in both lower limbs, to gain full range of motion and no pain. Decision of the treatment completion was made by the orthopaedic technician and the physiotherapist.

The examinations were carried out in the framework of the project agreed to by the bioethical committee.

## Subjective evaluation

The Lysholm and IKDC 2000 (International Knee Documentation Committee) scales questionnaires were used in order to let the patient perform the subjective evaluation of the knee-joint's efficiency.

In the IKDC 2000 form, the patient was required to evaluate his/her symptoms, functionality and sport activities. Each subsection was evaluated on a scale from 0–10.

In the Lysholm questionnaire, the patient was asked to evaluate his basic physical activities on a scale from 0–25 points.

Higher numbers of points obtained by the patient corresponded with greater functionality and fewer symptoms. Fewer points indicated more limited knee-joint function and more symptoms accompanying the injury. The maximum possible score was 100 points on each scale.

## Objective evaluation

The arthrometric examination was conducted using a GNRB (Genorurob) device. The patient was prone, his/her lower limb placed in the neutral position in order to equalize external or internal rotations. Additionally, the crurotarsal joint was immobilized with specific protection support. The examination was conducted bilaterally. The healthy limb was examined first. The kneecap was protected with a patellar support, allowing equal distribution of controlled pressure while the test was being conducted.

The examiner set the limb so that the knee-joint space was settled between the bottom edge of the patellar support and the calf support. Movement control was set on the tibial tuberosity, at a right angle to the tibial bone. Each measurement was conducted with force of 134 N. The result of the anterior translation is presented in millimetres. The measurement of the femorotibial translation ranges from 3–11 mm and was different for every patient.

In accordance with the criteria, when the difference between the anterior translation of the healthy limb and the injured one is more than 2.8 mm, the probability of complete ACL damage is significant.



Figure 1. Arthrometric measurement with GNRB device

## Statistic analysis and its results

Due to the small size of the examined group, non-parametric tests were conducted in order to obtain statistical evaluation.

A Wilcoxon signed-rank test was used to analyse the statistic characteristics. By using the Wilcoxon test, it was possible to determine whether there were any significant differences between the arthrometric measurement result and the subjective evaluation questionnaires (Lysholm and IKDC 2000), evaluated before and after ACL reconstruction.

The test did not reveal any statistically significant differences between arthrometric examinations and the subjective scales (value was 0.49).

The same test showed statistically significant differences between the questionnaire results completed before and after the surgery (value for the Lysholm's scale was 0.02 whereas for the IKDC 2000 scale it was 0.03).

The average value of the difference in the anterior translation examination of both knee-joints in the arthrometric examination before the intervention was approx. 3.7 mm, which was above the standard value. In contrast, the average value of the difference in the anterior translation in both knee-joints after ACL reconstruction and its rehabilitation was about 2.5 mm, which is a standard result.

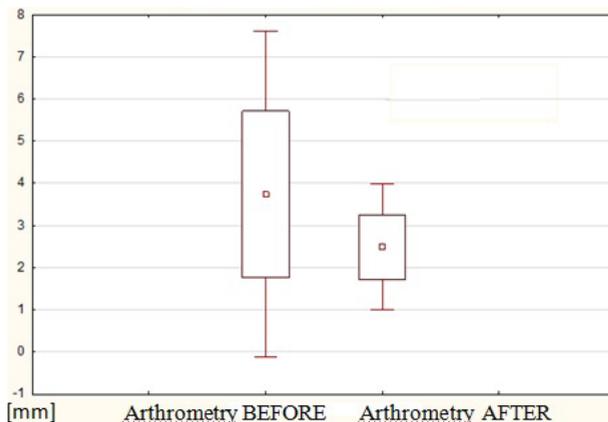


Figure 2. Arthrometry score

Figure 2 shows comparison results of the initial and final arthrometric examination. The values indicate the range of the anterior tibial translation measured arthrometrically.

Figure 3 shows the point range of values, obtained after the Lysholm's questionnaires had been completed by patients in the period before the intervention and approx.  $\pm 11.5$  months after the treatment.

Figure 4. The range of points obtained after having completed IKDC 2000 questionnaire before ACL reconstruction and approx.  $\pm 11.5$  months after the intervention

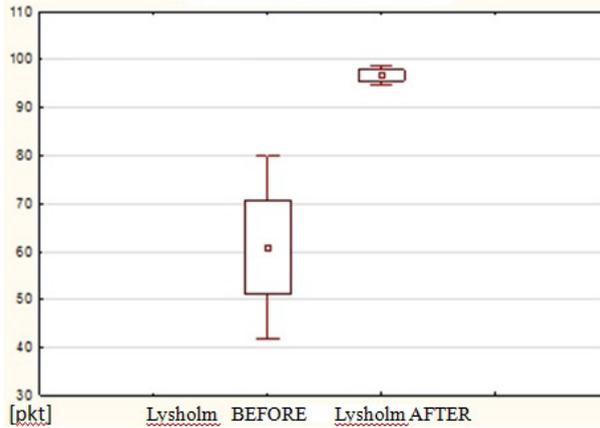


Figure 3. Lysholm score scale

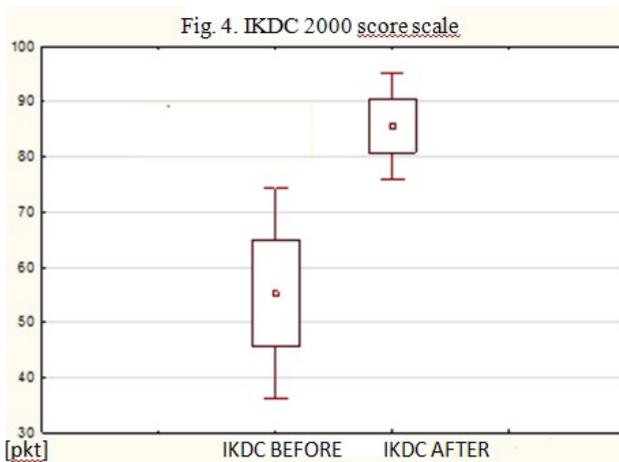


Figure 4. IKDC 2000 score scale

The comparative analysis of Spearman's ranks of arthrometry versus Lysholm score scales before ACL reconstruction equalled  $(-0.02)$  whereas the value in comparison of arthrometry and Lysholm score scales performed  $\pm 11.5$  months after the treatment and rehabilitation equalled  $(0.09)$ . The comparison of the arthrometric examination to the IKDC 2000 score before the treatment was  $(-0.21)$  whereas the one performed  $\pm 11.5$  months after the intervention and rehabilitation was  $(-0.42)$ . In both cases, the results were not statistically significant.

## Discussion

The most important finding of the present study was to compare two criteria for ACL deficiency using objective and subjective evaluations before and after ACL reconstruction. Our results indicated that the objective anterior translation examination of both knee-joints in the arthrometric examination before intervention was 3.7 mm, which was above the standard, whereas the average value after ACL reconstruction was about 2.5 mm which is a standard result. Furthermore, the subjective results improved more significantly after ACL reconstruction than before surgery.

In the present study we use GNRB arthrometer to measure anterior translation of tibialis bone. There are few objective devices to test anterior translation of tibialis bone like KT-1000, Telos and GNRB. The studies reported the accuracy and reproducibility between KT-1000 and GNRB (Collete et al. 2011). Results proved that GNRB provides more accuracy and reproducibility during measuring and that GNRB is not examiner dependent (Collete et al. 2011). Authors also show that KT-1000 is a good screening tool with chronic and complete ACL tears, but not for partial ACL ruptures. The studies comparing the reliability of knee laxity using GNRB and Telos in partial ACL tears show that diagnostic value of GNRB is better than Telos for partial ACL tears, yet the correlation rate between using both devices was very high with 250 N force (Lefevre et al. 2014). The Genourob GNRB is a device that measures only sagittal translation of the tibia; it is difficult to measure rotational instability of the tibialis bone (Lorbach et al. 2011). For measure anterior knee laxity 134 N force was applied. The force leading to ACL rupture might be higher than 134 N, the laxity characteristics beyond 134 N had similar linear relationships with those just below 134 N (Lin et al 2011). In this study, there were some limitations to be addressed regarding the selection of the patients. The group consisted of 8 patients and the control group 5; the results could be more precise with higher number of participants.

The Lysholm and IKDC 2000 scales questionnaires were used in order to let the patient perform the subjective evaluation of the knee-joint's efficiency. According to studies, both scales have become ISAKOS/ESSKA-compliant instrument for subjective knee function evaluation to be used on Polish groups of patients following ACL reconstruction (Piontek et al. 2012). Authors believe that Polish version of IKDC 2000 questionnaire is more reliable and more useful in clinical evaluation than the Polish rendition of Lysholm scale (Piontek et al. 2012). The objective methods should be supported with subjective evaluation. A subjective examination, in addition to allowing better communication with the patient, may become an indispensable part of diagnostics and treatment. Lysholm and IKDC 2000 questionnaires are precious for diagnostic process, giving us information about patients feelings in relation to everyday activities requirements. GNRB device can be used by physiotherapists despite of other diagnostics tools for example MRI which is time saver. Using both subjective and objective devices is a good step of improving diagnostic and treatment process after anterior cruciate ligament reconstruction.

## Conclusions

In the face of an increasing number of anterior cruciate ligament injuries, modern orthopaedics faces the task of improving the diagnostic and preparatory procedural protocol of ACL reconstruction. The objective of this study was to make a comparison between subjective and objective evaluation methods, by using pre – and post – ACL reconstruction examination results of both types.

The lack of statistically significant results in the objective device examination should only encourage further comparative analysis in larger groups. It is also worth noticing that the average value of anterior tibial translation decreased by 0.7 mm after reconstruction and rehabilitation yielding a standard result.

The conclusions that can be drawn from the above analysis indicate the importance of using some forms of subjective evaluation. Despite the lack of significance in the examination conducted with the objective device, the self-evaluation of knee-joint efficiency made by the patient indicated a significant improvement. That may lead us to the conclusion that the insignificant values obtained in our objective evaluation did not necessarily influence the subjective sensations which indicated significant improvement.

The objective methods should be supported with subjective evaluation. The results of Lysholm and IKDC 2000 subjective evaluation scales in the above research underlined the importance of patients' sensations and attitude towards the existing injury. Examinations conducted before and after rehabilitation process can enrich our knowledge concerning how to improve whole convalescence process.

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