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Presentation of the bk21 (Kacprzak) test as a less traumatic alternative to the Lachman test and Drop Leg test in diagnosing anterior cruciate ligament tear

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ABSTRACT

Objective: despite the fact that anterior cruciate ligament injuries are the most common ligament injuries, the problem of making a quick and accurate diagnosis still exists. In our paper, we hypothesized that a modification of the Lachman test — BK21 (Kacprzak test), in comparison to the Lachman test and Drop Leg test will allow for a significant reduction of pain during the test, and thus for less muscular defense, more relaxation, and more reliable test results, whose sensitivity and specificity will be confirmed by magnetic resonance imaging

Materials and methods: using the patient's subjective pain rating scale, the Numerical Rating Scale (NRS), we were able to easily assess which way of performing the test was less traumatic for the patient. A physical examination in the form of a comparison of those two visits was performed at the private medical office Orto Med Sport in 203 patients with suspected anterior cruciate ligament tear.

Results: the BK21 modification (Kacprzak) test was on average 3 points less painful on the NRS scale than the classic Lachman test and 1 point less painful than the Drop Leg test, while the same principle of operation and analogous endpoints in both tests allow for high sensitivity and specificity of the test.

Conclusion: the BK21 test was a less traumatic and painful alternative to the Lachman test

Keywords: anterior cruciate ligament injuries, Lachman test, Drop Leg test

Conflict of interests: the authors declare no conflict of interest.

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Презентация теста BK21 (Кацпшак) как менее травматичной альтернативы тесту Лахмана и тесту Drop Leg при диагностике разрыва передней крестообразной связки

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РЕЗЮМЕ

Цель исследования: несмотря на то что травмы передней крестообразной связки являются наиболее частыми повреждениями связок, проблема постановки быстрого и точного диагноза все еще существует. В нашей статье мы выдвинули гипотезу о том, что модификация теста Лахмана — BK21 (тест Кацпшака), по сравнению с тестом Лахмана и Drop Leg test, позволит избежать возникновения боли во время исследования и, таким образом, уменьшить мышечную защиту, что может дать более надежные результаты тестирования, чувствительность и специфичность которых будет подтверждена магнитно-резонансной томографией.

Материалы и методы: используя цифровую рейтинговую шкалу (ЦРШ), мы смогли определить, какой из предложенных тестов является наиболее безболезненным для пациента. Оценка была проведена у 203 пациентов с подозрением на разрыв передней крестообразной связки в медицинском центре Orto Med Sport.

Результаты: тест BK21 (Кацпшак) был в среднем на 3 балла менее болезненным, согласно шкале ЦРШ, чем классический тест Лахмана, и на 1 балл менее болезненным, чем Drop Leg test, при этом данный тест также является чувствительным и специфичным.

Заключение: тест BK21 является менее травматичной и болезненной альтернативой тесту Лахмана.

Ключевые слова: травма передней крестообразной связки, тест Лахмана, Drop Leg test

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1. Introduction

Despite the fact that anterior cruciate ligament injuries are the most common ligament injuries, the problem of making a quick and accurate diagnosis still exists [1]. To illustrate the scale of the problem I quote statistics; in Poland, about 1 person per 1000 inhabitants is affected by a teard ACL. Use of magnetic resonance imaging, which can indicate not only damage to the ACL, but also the accompanying soft tissue damage, is the most common choices of professionals in those cases [2]. Immediately after the injury, if the patient's condition permits so, the knee should be evaluated for damage with a physical examination. Various studies have estimated that physical examination can specifically and sensitively diagnose anterior cruciate ligament tear in over 80 % [3].

The examination should begin with collecting the detailed history, and analysis of the patient's gait movement pattern. There are a number of clinical tests that allow an appropriate diagnosis to be made, including the most popular Lachman test (average sensitivity of 84 %) and the anterior drawer and pivot shift test (average sensitivity of ca. 62 %). It is a difficult test in patients immediately following injury, with high pain expectation and in those with naturally increased muscle tone [4, 5]. The Drop Leg test modification of the Lachman test has been suggested for those performing the test who have smaller hands [6].

Unfortunately, the popularization of imaging techniques makes the art of examination disappear. However, it is worth paying attention to the simplest and cheapest of instruments, which are the hands of the doctor — orthopedist [7]. In our paper, we hypothesized that a modification of the Lachman test — BK21 (Kacprzak test), in comparison to the Lachman test and Drop Leg test will allow for a significant reduction of pain during the test, and thus for less muscular defense, more relaxation, and more reliable test results, whose sensitivity and specificity will be confirmed by magnetic resonance imaging.

2. Materials and methods

a. Characteristics of the tests

Classic Lachman test — examination technique. The patient lies on their back while the examined limb is bent at an angle of 15–20 degrees at the knee joint, the foot is supported on the ground. The examiner stands by the examined limb, with one hand immobilizing the distal part of the thigh with upward grip, with the other hand gripping the proximal part

of the shin. Pulling the shin towards oneself, the examiner tries to feel the displacement (translation) of the shin against the thigh with thumb. a slight forward movement with a firm end indicates a functional ACL. The possibility of significant forward movement of the shin with “soft,” smooth end of movement — indicates the damage of the anterior cruciate ligament [8].

Drop Leg test — examination technique. The patient lies on their back. The tested limb hangs off the examination table while the examiner stabilizes the tested limb between their legs. The examiner places their hand on the subject's thigh, then pulls the tibia towards themselves with their other hand [9].

BK21 — Kacprzak test — ca. 20 degrees of flexion at the knee, external rotation at the hip and abduction; one hand of the examiner is under the knee on the thigh, stabilizing the position. With the other hand, the examiner holds the shin. Next, pulling the shin towards themselves, the examiner tries to feel the displacement of the shin against the thigh. Here the results are treated similarly to the basic Lachman test — displacement and translation of the thigh indicates ACL damage.

The test modification results from my own observations — patients, protecting themselves from pain after the injury, adopt a position that gives them relief, thus they invert their leg at the hip and rotate it outwards, keeping the injured knee slightly bent. The basic Lachman test requires that the leg is straightened at the hip, and only then is the knee bent to 20–30 degrees. This causes additional discomfort and pain for the patient, and results in muscular stiffness and defense, therefore the test becomes unreliable. Similarly,



Fig. 1. Intraoperative performance of the BK21 version of the test
Рис. 1. Выполнение теста BK21 во время операции



Fig. 2. Classic version of the test — quadriceps flexion, muscular defense

Рис. 2. Классический вариант теста — сгибание четырехглавой мышцы, мышечная защита



Fig. 3. BK21 version of the test — eliminated quadriceps flexion

Рис. 3. Тест BK21 — исключение сгибания четырехглавой мышцы

in the Drop Leg test, the examiner simply takes the limb and places it outside of the couch, causing pain to the freshly injured patient.

Using the patient's subjective pain rating scale, the Numerical Rating Scale (NRS), we were able to easily assess which way of performing the test was less traumatic for the patient. The scale is a 10cm-long ruler. Patients

indicated the severity of pain from 0 — no pain at all to 10 — the most severe pain imaginable. There are also modified scales in use; at the extreme poles, there are VAS (visual analogue scale) faces — a smiling (no pain) face and a grimacing (strongest pain) face, or additionally accompanied by verbal descriptions of pain under the graphic axis (graphic descriptive scale)[10].

After the examiner performed the Lachman, Drop Leg, and Kacprzak tests in random order, the patients were asked to rate the pain they had experienced during each test.

b. Patient characteristics

A physical examination in the form of a comparison of those two visits was performed at the private medical office OrtoMedSport in 203 patients with suspected anterior cruciate ligament tear. Both tests were a piece of the entire physical examination according to the art. Subsequently, patients were asked to indicate on a printed VAS scale how they rated pain during both tests. All patients also underwent magnetic resonance imaging tests.

3. Results

The BK21 modification (Kacprzak) test was on average 3 points less painful on the NRS scale than the classic Lachman test and 1 point less painful than the Drop Leg test, while the same principle of operation and analogous endpoints in both tests allow for high sensitivity and specificity of the test.

Magnetic resonance imaging confirmed the injury in all patients initially diagnosed with anterior cruciate ligament tear.

4. Discussion

Despite the ever-increasing computerization and digitization of medicine, and improvements in imaging techniques, many papers suggest the superiority of carefully performed physical (clinical) tests even over MRI. This makes unacceptable the reports of Shelbourne's 2010 paper in which he reports that of 202 orthopedists, only 63 % of them had patients expose the knee joint for examination, 89 % of them physically touched the injured knee, and 37 % of them touched the other knee. of the 22 orthopedists who did not touch the patient/conduct a physical exam, 16 ordered an MRI. of the 75 orthopedists who did not discover the involved joint for examination, as many as 79 % of them examined the involved knee through clothing. This study supported the hypothesis presented by the author of the paper — the disappearance of the art of the physical examination. It is very disturbing that as many as 37 % of the physicians did not examine the other uninvolved knee for comparison, etc. [6].

A clinical examination of the knee joint may not only detect damage, but also control the treatment process.

Research supports the use of clinical testing for diagnostic purposes in suspected ACL tears. Van Eck et al.

Table 1

Patient demographic distribution

Таблица 1

Демографическое распределение пациентов

	Survey group (n = 203) / Испытуемые (n = 203)
Age, mean, SD / Возраст, значение, SD	28.3 ± 11.44
Gender F/M / Пол ж/м	98/105
Location of changes / Локализация изменений	
L / Слева	123
R / Справа	80
Test type / Тип теста	
Post-traumatic / После травмы	156
>4 weeks after injury / >4 недель после операции	47

Table 2

NRS scale scores

Таблица 2

Значения по шкале ЦРШ

	Lachman test	BK21 (Kacprzak) test	Drop Leg test
NRS / ЦРШ			
Average / Значение	5.55	2.83	3.74
Median / Медиана	6	3	4
Standard deviation (SD) / Стандартное отклонение (SD)	1.83	0.98	1.05
Confidence level (95 %) / Уровень доказательности (95 %)	0.253	0.135	0.18
MIN-MAX (мин-макс)	1–8.5	1–6	2–8
MR diagnosis confirmation / Подтверждение на МРТ	100 %		



Fig. 4. MRI confirmation of ACL tear

Рис. 4. Подтверждение разрыва ПКЛ на МРТ

demonstrated that when diagnosing a complete, acute ACL tear, the Lachman test has the highest sensitivity. The authors also found that the anterior drawer test, Lachman test, and pivot shift test have comparable specificity [11].

The ability to diagnose an anterior cruciate ligament tear has major clinical implications for patients. An initial diagnosis made in the office should immediately mean educating

the patient about restrictions (no rotation, no team games), initially considering a treatment regimen (conservative vs. operative) and suggesting starting immediate rehabilitation that will allow for better functional results in the future, and a quicker return to sports. Thirdly, MRI testing involves an expensive examination and also patients often have to wait in line for it to be performed. A well performed physical examination has similar sensitivity to an MR examination [12].

The leg position in the Drop Leg test and BK21 test modification of the Lachman test, in which the leg is abducted, results in greater relaxation of the quadriceps as well as the gluteal and biceps muscles compared to the classic Lachman test, in which the limb remains in slight flexion. This allows for a greater posterior-anterior displacement, which affects the reliability of the test. The BK21 test was a less traumatic and painful alternative to the Lachman test, so we encourage the use of this test [13].

Fresh trauma is associated with severe pain and swelling, so there is muscular defense during joint examination that we may cleverly bypass and make the patient more comfortable if we follow the suggested test performance pattern [14].

We encourage performance of the clinical examination in the manner suggested by the author, in order to evaluate its long-term usefulness and effectiveness, all the more so if we may improve patient comfort with the modification performed, and thus obtain a more certain diagnosis.



Fig. 5. MRI confirmation of ACL tear

Рис. 5. Подтверждение разрыва ПКЛ на МРТ

Authors' contributions:

Bartłomiej Kacprzak — study conception and design, acquisition and interpretation of data, drafting of manuscript, critical revision.

Natalia Siuba-Jarosz — interpretation of data, acquisition of data, drafting of manuscript.

All authors have read and agreed with the published version of the manuscript.



Вклад авторов:

Кацпшак Бартомеј — концепция и дизайн, сбор и интерпретация данных, написание текста статьи, редактирование.

Сиуба-Ярош Наталия — интерпретация данных, сбор данных, написание текста статьи.

Все авторы прочитали и согласились с опубликованной версией рукописи.

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