CLINICAL RESEARCH

EVALUATING KNEE FUNCTION POST-ACL RECONSTRUCTION: CONVENTIONAL VERSUS ALL-INSIDE TECHNIQUE USING LYSHOLM SCORE

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Key words: anterior cruciate ligament, graft, operative treatment, Lysholm scale, functional result

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Abstract

Anterior cruciate ligament (ACL) reconstruction is a common surgical intervention. The aim of this paper was to make a comparison in terms of subjective symptoms that occur in a specific Lysholm scoring scale-in-progress before the operative period, 3 and 8 months after surgical treatment with two surgical methods. Materials and Methods: Eighty patients underwent primary ACL reconstruction at the Department of Orthopaedics and Traumatology in the City General Hospital "8th September" in Skopje in a period of two years. The first group (40 subjects) constituted the control group (CG), surgically treated with a standard method using a graft from ***m. semitendinosus*** and ***m. gracilis***. The second group (40 subjects) was the study group (SG) surgically treated with the ALL-INSIDE method using a ***m. semitendinosus*** graft. In all subjects preoperatively, at 3 and 8 months after surgical treatment, Lysholm scale was completed representing a designed questionnaire for evaluation of subjective symptoms. Results: Preoperatively, most patients from SG had a score lower than 65 to 55 % (22), while in CG between 65 and 83 – 50% (20). After 3 months of surgical treatment, SG patients had averagely a higher score than CG patients (88.60 ± 11.8 vs. 85.75 ± 17.8), but without statistical significance. Among SG and CG patients, 8 months after surgery (p = 0.043), SG patients had a significantly higher mean score than CG patients (97.62 ± 5.3 vs. 92.40 ± 15.1). Lysholm scale analysed qualitatively 8 months after surgical treatment showed no significant difference between them, i.e., the tested difference in the distribution of patients with a score of less than 65, from 65 to 83, from 84 to 90 and more than 90, and depending on the type of the surgical method was statistically insignificant (p = 0.123). Conclusion: The type of surgical technique used had no significant influence on the subjective complaints of patients after 3 months of surgical treatment. But after 8 months, a better functional result was obtained in SG patients.

КЛИНИЧКИ ИСТРАЖУВАЊА

ЕВАЛУАЦИЈА НА ФУНКЦИЈАТА НА КОЛЕНОТО СО LYSHOLM БОДОВНА СКАЛА ПО РЕКОНСТРУКЦИЈА НА ПВЛ:КОНВЕНЦИОНАЛНА НАСПРОТИ ALL- INSIDE ТЕХНИКА

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Цитирање: Зоран Несторовски, Зорица Вангеловска, Јасмин Циривири, Дарко Талевски, Ана- Марија Манева. Евалуација на функцијата на коленото со Lysholm бодовна скала по реконструкција на ПВЛ:конвенционална наспроти all- inside техника. Арх Ј Здравје 2024;16 (2) 5-17.

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Клучни зборови: преден вкрстен лигамент, графт, оперативен третман, Lysholm скала, функционален резултат.

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Печатарски права: ©2024. Зоран Несторовски, Зорица Вангеловска, Јасмин Циривири, Дарко Талевски, Ана- Марија Манева. Оваа статија е со отворен пристап дистрибуирана под условите на нелокализирана лиценца, која овозможува неограничена употреба, дистрибуција и репродукција на било кој медиум, доколку се цитираа торигиналниот(ите) автор(и) и изворот.

Конкурентски интереси: Авторот изјавува дека нема конкурентски интереси.

Извадок

Реконструкција на предниот вкрстен лигамент (ПВЛ) претставува честа хируршка интервенција. Целта на овој труд беше да се направи компарација во однос на субјективните симптоми кои се јавуваат кај пациентите преку специфична Lysholm бодовна скала во тек на предоперативниот период, 3 и 8 месеци по оперативниот третман со два оперативни метода. Материјали и методи: Осумдест пациенти беа подложени на примарна реконструкција на ПВЛ на Одделот за ортопедија и трауматологија во ГОБ „8-ми Септември" во период од две години. Првата група (40 испитаници) ја сочинуваа контролната група (КГ), оперативно третирана со стандарден метод со користење графт од *m. semitendinosus* и *m. gracilis.* Втората група (40 испитаници) ја сочинуваа испитуваната група (ИГ) оперативно третирана со методот ALL-INSIDE и користење графт од *m. semitendinosus.* Кај сите испитаници предоперативно, на 3 и на 8 месеци по оперативниот третман беше исполнета Lysholm скалата, која претставува дизајниран прашалник за евалуација на субјективни симптоми. Резултати: Предоперативно најголем дел пациенти од ИГ имаа скор понизок од 65 до 55 % (22), додека во КГ скорот беше помеѓу 65 и 83 – 50 % (20). По 3 месеци од оперативниот третман пациентите од ИГ имаа во просек повисок скор од пациентите од КГ (88,60 ± 11,8 vs, 85,75 ± 17,8), но без статистичка значајност. Осум месеци по оперативната интервенција (p = 0,043), пациентите од ИГ имаа значајно повисок просечен скор од пациентите од КГ (97,62 ± 5,3 vs 92,40 ± 15,1) Lysholm скалата анализирана квалитативно 8 месеци по оперативниот третман не покажа значајна разлика помеѓу групите, односно тестираната разлика во дистрибуцијата на пациенти со скор помал од 65, од 65 до 83, од 84 до 90 и повеќе од 90, а во зависност од типот на хируршкиот метод, беше статистички незначајна (p = 0,123). Заклучок: Типот на користена хируршка техника немаше значајно влијание врз субјективните тегоби на пациентите по 3 месеци од оперативниот третман. Но, по 8 месеци се доби подобар функционален резултат кај пациентите од ИГ.

Introduction

The knee joint intricately designed biomechanically, is susceptible to injuries, particularly the anterior cruciate ligament (ACL), a critical component coordinating knee joint motion. Despite its importance, the ACL is prone to injuries, necessitating surgical interventions for restoration[1]. The data confirm that ACL reconstruction can be recommended to patients older than 40 years who wish to maintain an active lifestyle or have symptomatic instability with daily activities. Patient-based outcomes scores were better in the operative studies compared to the single nonoperative study in this patient population[2]. Therefore, several previous studies have comprehensively evaluated the all-inside ACLR technique, analysing the clinical outcomes, graft rupture rates and rehabilitation protocols. While these studies have made significant contributions, there is for advancing new instrumentation and refined techniques to optimize this surgical approach and provide additional clinical advantages[3]. Many options are available for anterior cruciate ligament (ACL) reconstruction, including an autologous bone–patellar tendon–bone graft, a hamstring tendon graft and an allograft. The bone–patellar tendon–bone graft is more likely to result in normal knee joint laxity and less incidence of significant flexion loss. In contrast, hamstring grafts reduce the incidence of patellofemoral crepitus, kneeling pain and extension loss[4]. Surgeon experience, correct graft position, choice of graft fixation and postoperative rehabilitation confound the results of comparisons of ACL reconstruction[5]. Hamstring tendon grafts are the most common choice for anterior cruciate ligament (ACL) reconstruction (ACLR). Previous studies have provided evidence that offers conflicting opinions concerning the most favourable graft choice[6]. A disadvantage of using hamstring tendon autograft consisting of the semitendinosus and gracilis tendons for anterior cruciate ligament reconstruction is pain from tendon harvesting and persistent hamstring weakness. In the tendon-sparing all-inside technique, a quadrupled semitendinosus graft and adjustable-loop cortical fixation are suggested to give less postoperative flexion deficits while displaying overall similar clinical results to the traditional hamstring technique. Patients often expect to return to their preinjury functional status when they consent for ACLR surgery[7]. However, there are a limited number of high-quality studies comparing these techniques with inconsistent results[8]. In recent years, there has been considerable emphasis on the use of patient-reported outcomes to evaluate health care interventions. The Lysholm Knee Scale is an 8-item questionnaire scored on a 0-100 weighted scale measuring pain (25 points), instability (25 points), locking (15 points), swelling (10 points), limp (5 points), stair-climbing (10 points), squatting (5 points) and use of support (5 points). The scale was originally designed to assess ligament injuries of the knee[9].

The aim of this paper was to make a comparison in terms of subjective symptoms that occur in a specific

Lysholm scoring scale-in-progress before the operative period, 3 and 8 months after surgical treatment with two surgical methods.

Materials and Methods

A total of 80 patients who underwent primary ACL reconstruction using HS autograft (*m. semitendinosus - m. gracilis*) or HS autograft (m. semitendinosus) were included in this study. This study shows the results of patients treated in the City General Hospital "8th September" inSkopje at the Department of Orthopaedics and Traumatology. The first group (40 subjects) made up the control group (CG), surgically treated with a standard method using a graft in the form of duplication from the semitendinosus and gracilis muscles. The second group (40 subjects) consisted the study group (SG) surgically treated with a method in which only the semitendinosus muscle was used as a graft in the form of a quadruplication. The Lysholm scale was completed in all subjects preoperatively, three and eight months after surgical treatment, that is, it evaluated patients' subjective symptoms. The Lysholm scale is a designed questionnaire that gives data to the examiner about the impact of the change on the performance of daily activities: bending, support, pain, instability, blocking, swelling, climbing stairs, kneeling. The interpretation of the Lysholm scale is that if the score is less than 65 points, it indicates a poor functional result; from 65 to 3 points is considered enough. A score of 84 to 90 points is a good result. More than 90 indicates an excellent functional score.

Results

Patients from the study and control groups had preoperatively significantly different scores on the Lysholm scale, which expressed patients' subjective perception of the impact of the change on the performance of daily activities (p = 0.039) (Table 1). A significantly lower mean score on this scale was registered in SG (60.85 ± 15.1 vs. 69.0 ± 19.4) (Figure 1).

Table. 1 Preoperative Lysholm scale – SG and CG

Preoperative clinical examinations			
Group	Descriptive Statistics (Lysholm scale)		p-level
	mean ± SD	min – max	
SG	60.85 ± 15.1	22 – 91	t = 2.09
CG	69.0 ± 19.4	22 – 100	p = 0.039 sig

t (Student t-test for independent samples); SG (autograph m. *semitendinosus*); CG (autograph *m. semitendinosus* and *m. gracilis*)

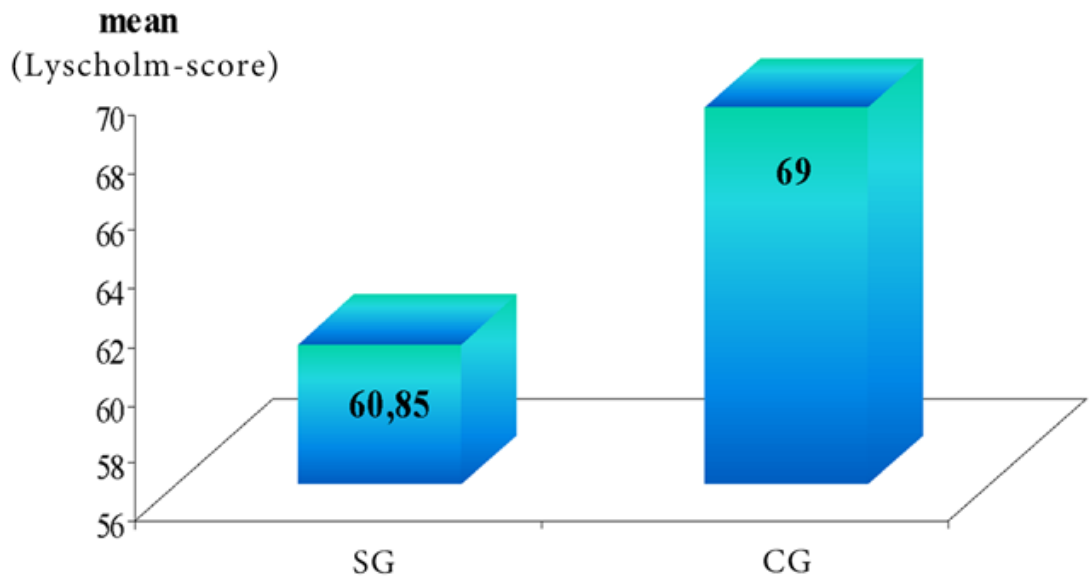


Figure. 1 Graphic representation of preoperative Lysholm scale – SG and CG

The results of the Lysholm scale were analyzed and qualitatively divided in 4 groups: score less than 65, from 65 to 83, from 84 to 90 and 90 and more (Table 2). According to the results displayed in Table 2, preoperatively most patients from SG had a scale score lower than 65 to 55 % (22), in CG most patients had a Lysholm score between 65 and 83 – 50 % (20).

Table. 2 Qualitative presentation of preoperative Lysholm scale – SG and CG

Lysholm scale	Groups		
	N	SG	CG
> 65 weak	34	22 (55)	12 (30)
65 - 83 good	35	15 (37.5)	20 (50)
84 - 90 very good	6	2 (5)	4 (10)
> 90 excellent	5	1 (2.5)	4 (10)

In accordance with the results obtained, patients from the study and control groups did not differ significantly in terms of Lysholm scale scores in a period of 3 months after surgical intervention (p = 0.4) (Table 3, Figure 2). SG patients had on average a higher score on this scale than CG patients (88.60 ± 11.8 vs. 85.75 ± 17.8), but without statistical significance. The type of surgical technique used had no significant influence on the subjective complaints of patients regarding the performance of daily activities after 3 months of surgical treatment.

Table. 3 Lysholm scale of the injured limb after 3 months postoperatively – SG and CG

After 3 months of postoperative treatment			
Group	Descriptive Statistics (Lysholm scale)		p-level
	mean ± SD	min – max	
SG	88.60 ± 11.8	44 – 100	t = 0.84
CG	85.75 ± 17.8	22 – 100	p = 0.4 ns

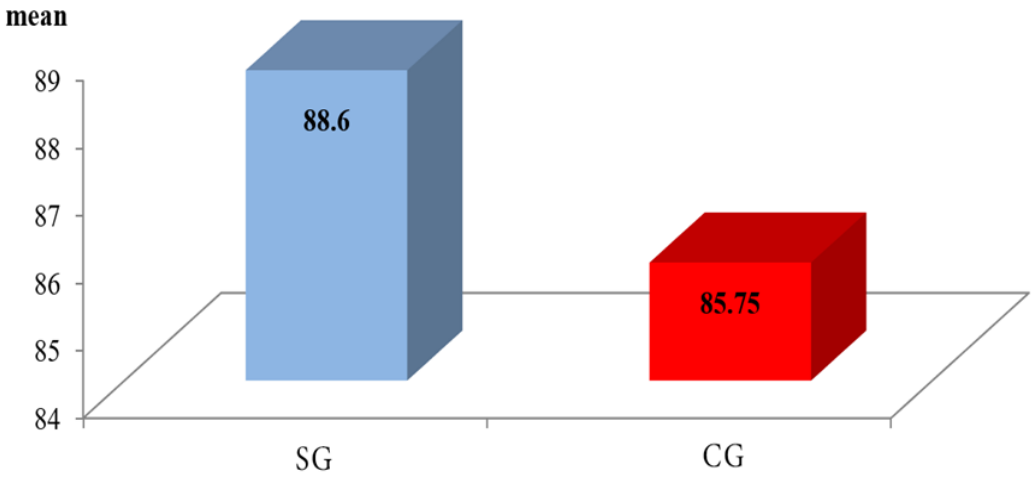


Figure. 2 Graphic representation of mean Lysholm score of the injured limb after 3 months postoperatively – SG and CG

A significant statistical difference was identified 3 months after surgical treatment, when the two groups were compared in terms of qualitatively expressed Lysholm scale scores (p = 0.02) (Table 4). SG patients more often than CG patients had a score from 65 to 83, indicating a sufficient functional result – 27.5% (11) vs. 5% (2), while SG patients more often had a Lysholm scale score from 84 to 90 – 32.5 % (13) vs. 12.5 % (5), which indicated a good functional result of the surgical intervention (Figure 3).

Table. 4 Qualitative representation of Lysholm scale of the injured limb after 3 months postoperatively – SG и CG

Lysholm scale after 3-months-postoperatively	Groups			p-level
	N	SG n (%)	CG n (%)	
Weak functional Result	6	3 (7.5)	3 (7.5)	X^2 = 9.81
Good	13	2 (5)	11 (27.5)	p = 0.0203 sig
Very good	18	13 (32.5)	5 (12.5)	
Excellent	43	22 (55)	21 (52.5)	

p(Pearson Chi-square)

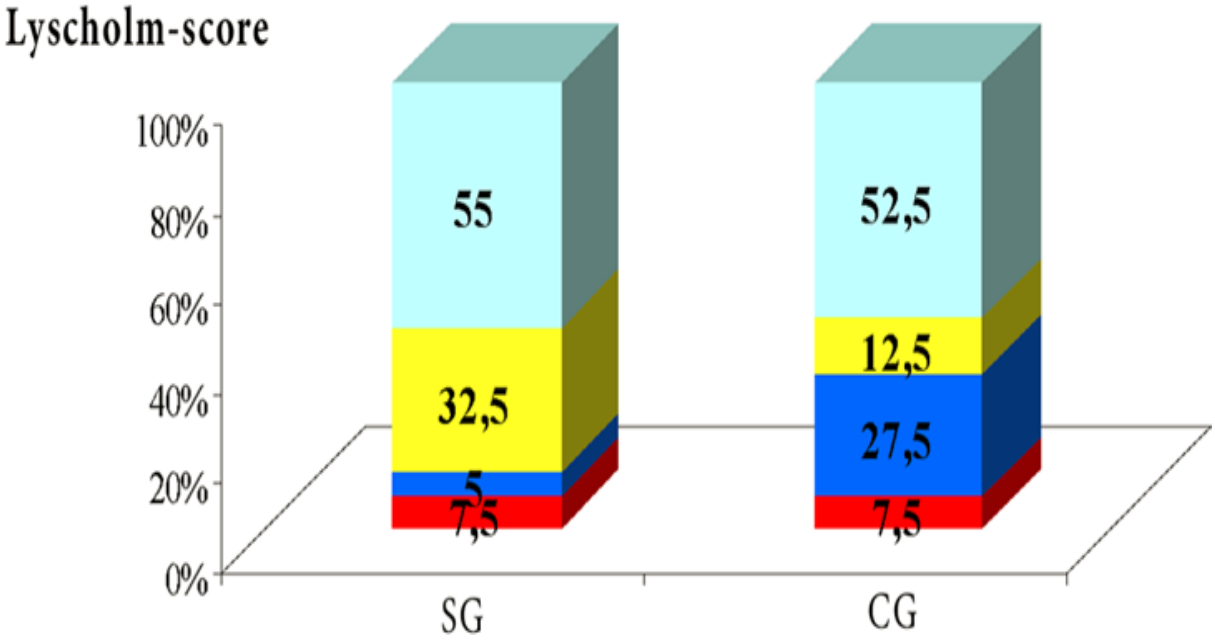


Figure. 3 Graphic representation of Lysholm scale of the injured limb after 3 months postoperatively– SG and CG

A statistically significant difference was identified between patients from the study and control groups regarding the Lysholm scale scores 8 months after surgical intervention (p = 0.043) (Table 5). SG patients had a significantly higher mean score than CG patients (97.62 ± 5.3 vs. 92.40 ± 15.1) (Figure 4). The type of surgical technique used had a significant impact on patients' subjective complaints regarding the performance of daily activities after 8 months of surgical treatment. According to the completed Lysholm scale, patients with a *m. semitendinosus* graft had a significantly better functional result after the intervention than patients with a *m. semitendinosus* and *m. gracilis graft*.

Table. 5 Lysholm scale after 8 months postoperatively – SG and CG

Eight months after postoperative treatment			
Group	Descriptive Statistics (Lysholm scale)		p-level
	mean ± SD	min – max	
SG	97.62 ± 5.3	73 – 100	t = 2.06
CG	92.40 ± 15.1	22 – 100	p=0.043 sig

t(Student t-tests for independent samples); SG (autograph *m. semitendinosus*); CG (autograph *m. semitendinosus* and *m. gracilis*)

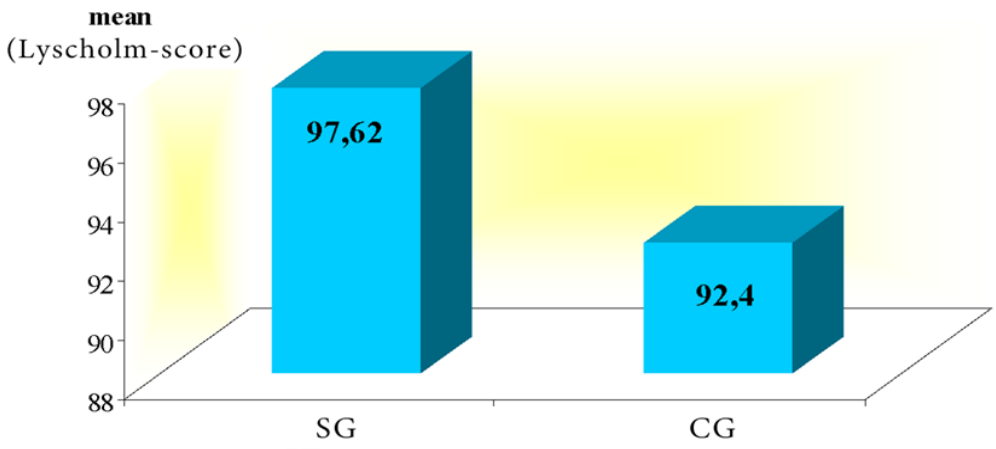


Figure. 4 Graphic representation of mean Lysholm score after 8 months of postoperative treatment – SG and CG

On the other hand, the comparison of the two groups of patients 8 months after surgical treatment in relation to the qualitatively analyzed Lysholm scale did not show a significant difference between them, i.e., the tested difference in the distribution of patients with a score on the Lysholm scale lower than 65, from 65 to 83, from 84 to 90 and more than 90, depending on the type of surgical method, was statistically insignificant (p = 0.123) (Table 6).

At the end of the observation, the majority of patients from both groups had a score greater than 90, which is equivalent to an excellent functional result in terms of performing daily activities, but insignificantly more often patients from SG had this result - 92.5% (37) vs. 72.5 % (29).

Table. 6 Qualitative presentation of Lysholm scale after 8 months postoperatively– SG and CG

Lysholm scale after 8-months-postoperatively	Groups			p-level
	N	SG n (%)	CG n (%)	
Unsatisfactory functional results	1	0	1 (2.5)	$X^2 = 5.77$
Sufficient	8	2 (5)	6 (15)	p = 0.123 ns
Good	5	1 (2.5)	4 (10)	
Excellent	66	37 (92.5)	29 (72.5)	

p(Pearson Chi-square)

The mean Lysholm score preoperatively was 60.85 ± 15.1, which is equivalent to a poor functional result, while in the control group the mean preoperative score was 69.0 ± 19.4, which indicates a good functional result (Table 7, Figure 5).

After the third and eighth months of surgical treatment, the mean Lysholm score was 88.60 ± 11.8 in SG and 97.62 ± 5.3 in CG; the mean Lysholm score was 85.75 ± 17.8 and 92.40 ± 15.1, respectively. Patients from both groups had an excellent functional result at the second control with the functional result being better in SG (Table 7, Figure 5).

For $p < 0.0001$, a significant increase in the Lysholm score was confirmed in both, the study and control groups (Table 7).

Table. 7 Lysholm scale – SG and CG

Group	Groups	
	SG mean ± SD	CG mean ± SD
Preoperative	60.85 ± 15.1	69.0 ± 19.4
After 3 months	88.60 ± 11.8	85.75 ± 17.8
After 8 months	97.62 ± 5.3	92.40 ± 15.1
p-level	X=78.6 p = 0.0000 sig	X = 53.6 p = 0.0000 sig

p (Friedman ANOVA and Kendall)

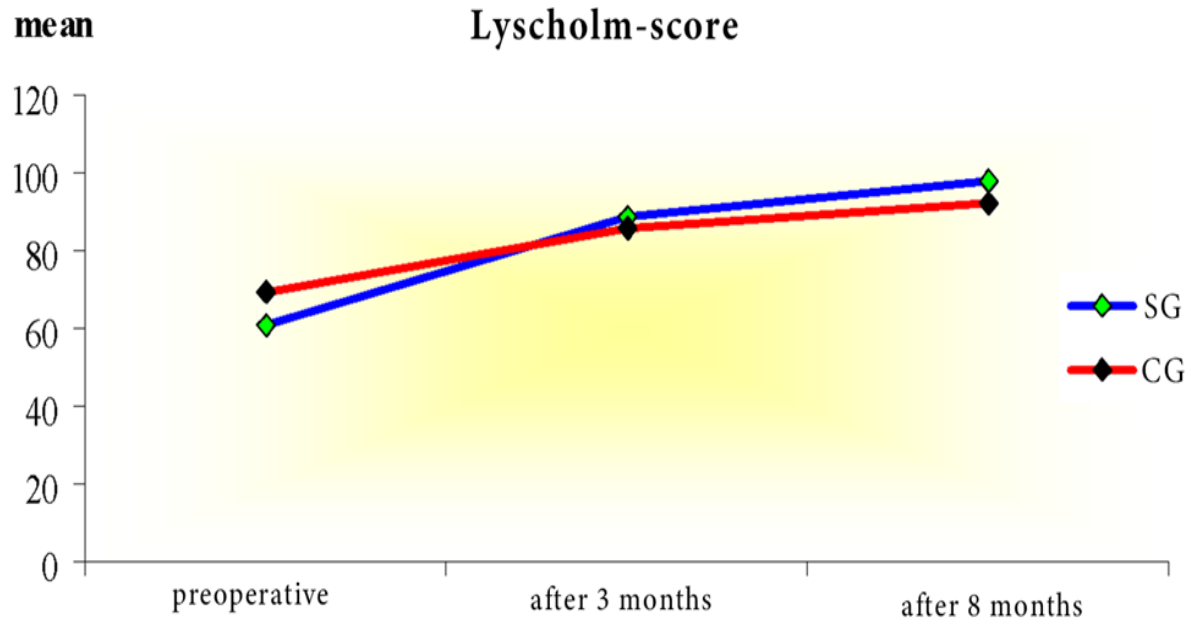


Figure. 5 Linear diagram for Lysholm scale in the examined period – SG and CG

Discussion

The Lysholm knee scoring scale is a commonly used subjective tool for evaluating outcome after anterior cruciate ligament reconstruction. The scoring scale evaluates the function and symptoms of patients, higher scores indicate a better result. The Lysholm knee scoring scale indicates knee function and symptoms on a scale of 0 to 100, with 100 indicating normal knee function, while 0 - complete knee dysfunction. Several studies indicate that the results obtained from the Lysholm knee scoring scale in patients in whom the all-inside technique was used were similar or better compared to patients in whom the standard technique was used. Vishal S Desai did a comparative study of 82 patients (mean ± SD age, 25.8 ± 10.2 years) who underwent all-inside reconstruction and 54 patients (mean ± SD age, 21.1 ± 7.3 years) who underwent complete tibial tunnel reconstruction. Patients were divided into 2 groups monitored over a period of 30 months. On the technique used, they received a score of 94.4 vs. 93.8 for patients in whom the all-inside technique was used 10. Anil Kumar Mishra and Girish S also conducted a study in which 120 patients were included (arthroscopy-assisted anterior cruciate ligament reconstruction with quadrupled semitendinosus tendon graft) in the period from March 2015 to March 2018. Lysholm score was recorded at 6 months, at the 1st year and 2nd year postoperatively. At the 2nd year of follow-up postoperatively, the mean postoperative Lysholm score improved from preoperative score of 66±5.2 to 88.70±5.54. The improvement in the mean preoperative and postoperative Lysholm scores was statistically significant. At the 2nd year of follow-up, 54 cases (45%) had excellent score (>90). Good score (84-90) was seen in 60 cases (50%). The overall satisfactory result (excellent + good) at 2 year-follow up was 95%. As a result of this, 111 patients (92.5%) were able to achieve preinjury activity level 11. Hee-Soo Kyung *et al.* evaluated 144 cases of single-bundle ACL reconstruction using an autologous hamstring tendon. The ST group included 85 cases and the ST/G group included 59 cases of reconstruction using a ST tendon and *a. gracilis* tendon. No significant differences were found between the ST and ST/G groups with respect to Lysholm scale[4]. George Kyriakopoulos *et al.* showed a similar result when examining 44 patients in two groups in a 3-year period. The first group was the all-inside group and the second was the classic with S-G graft. The Lysholm knee scores showed a significant improvement compared to the preoperative values in both groups. The preoperative values were almost identical in both groups with a mean of 57.6 and 57.2 points in the classic and the all-inside groups, respectively. The 24-month postoperative scores for the classic group increased significantly to an average of 87 ($p < 0.001$) and similar results were found in the all-inside groups, with a mean Lysholm score of 86.13 ($p < 0.001$). There was no significant difference between groups either in terms of postoperative values or percentile change[12]. Piero Volpi *et al.* conducted a pilot study between 2007

and 2008. Twenty patients were consecutively treated with ACL reconstruction using the all-inside transtibial technique with ST autograft and another 20 patients were consecutively treated with reconstruction with the traditional transtibial single-bundle procedure using ST-G autograft. This study suggests that in respect to return to sports and adequate articular function, there are no differences between the all-inside transtibial ACL reconstruction technique and the traditional transtibial ACL reconstruction using ST-G. Lysholm scale for traditional ACL technique showed a result of 94.9± 5.1 while for All Inside technique it showed 90.9 ± 8.8 (p value 0.09)[13]. In the study of Ignacio Manchado and Luci M. Motta, twenty-six patients underwent ACLR with a single bundle semitendinosus four-strand (ST group) arthroscopic all-inside reconstruction. The remaining 26 patients underwent arthroscopic ACLR with a single bundle combined doubled semitendinosus and double gracilis graft through a complete tibial tunnel (ST group). The Lysholm knee score at 5 years was similar between the ST-G and ST groups and the results were within the range of normative values for a population of this age. The preoperative vs. postoperative median values for the ST-G group were 58.5 (47.2–63) and 95 (94.2–100), respectively (p < 0.001). The preoperative vs. postoperative median values for the ST group were 52 (38.7–64.5) and 97.5 (95–99), respectively (p < 0.001).14 It is important to note that the results of these studies should not be generalized to all patients and that the difference between the all-inside technique and standard anterior cruciate ligament reconstruction should be based on individual patient needs and conditions. Research has shown that both reconstruction techniques can result in improving knee stability and function measured by this tool, i.e. scoring scale. In our study the results of the Lysholm scale were analysed qualitatively and divided into 4 groups (score less than 65, 65-83, 84-90 and more than 90). Patients completed the Lysholm scoring scale preoperatively, 3 and 8 months postoperatively. Preoperatively most of the patients in SG had a score lower than 65, while in CG most of them had a score between 65 and 83. Three months after the operation, the CG patients in relation to the SG had a score of 65 to 83, indicating a sufficient functional result, while the patients from SG had a score of 84 to 90, indicating a good functional result of the surgical intervention. Eight months after the operation the patients from SG had a significantly higher score than patients of CG (97.62 + 5.3 vs. 92.40 + 15.1) which represents a statistically significant difference between the examined and the control group in terms of Lysholm-scale values. Therefore, patients who were surgically treated only with a semitendinosus graft in the form of a quadruplication had a significantly better functional result compared to patients surgically treated with semitendinosus and gracilis grafts. The average preoperative Lysholm score was 60.85 ± 15.1, while in the control group the average preoperative score was 69.0 ± 19.4. On the third and

eighth month postoperatively, the average Lysholm score in SG was 88.60 ± 11.8 and 97.62 ± 5.3, respectively; in CG the average Lysholm score was 85.75 ± 17.8 and 92.40 ± 15.1, respectively. Patients from both groups had an excellent functional result at the second control, but the functional score was better in SG. For $p< 0.0001$ a significant increase in the Lysholm score was confirmed in the study and control groups. All-inside and standard techniques for ACL reconstruction are effective techniques, and which of these methods will be implemented depend on various individual factors, and mostly on the characteristics of the case. As doctors, it is important to give advice and guidance to patients, taking into account their individual needs and circumstances, supporting them throughout the entire process from preoperative evaluation to postoperative rehabilitation.

Conclusion

The type of surgical technique used had no significant influence on the subjective complaints of patients regarding the performance of daily activities after 3 months of surgical treatment. However, the type of surgical technique used had a significant impact on the subjective complaints of patients regarding the performance of daily activities after 8 months of surgical treatment. According to the completed Lysholm scale, patients with a *m. semitendinosus* graft had a significantly better functional result after the intervention than patients with a *m. semitendinosus* and *m. gracilis* graft. At the end of the follow-up, most patients from both groups had a score greater than 90, which is the equivalent of an excellent functional result in terms of performing daily activities, but patients from SG had this result insignificantly more often - 92.5% (37) vs. 72.5 % (29). The choice of technique may depend on patient-specific factors, recovery priorities and surgeon expertise.

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