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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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COMPARISON OF THE CLINICAL RESULTS FROM THE RECONSTRUCTION OF ACL WITH AUTOGRAFT AND ALLOGRAFT TISSUE

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Abstract.

The ACL is the primary stabilizer of the knee joint. The injury leads to instability of the knee joint, which is a trigger for the subsequent destructive changes of the intra-articular structures such as menisci and cartilage of the joint surfaces. The most affected group is people of an active age, engaged in amateur sports. Also, this pathology is an occupational hazard in the military. In this community, ACL injuries have reached 3.24% in men and 3.51% in women, with increasing trends, especially among women. This data is derived from a study by Keller Army Hospital, West Point, New York.

In this study we selected 2 groups of patients – operated with autograft and operated with allograft. The groups included 25 patients followed for a period of 18 months. The tissues used for ACL reconstruction were: 1) for allograft – BTB donor tissue / allograft / 2) for autologous transplantation – mm. Semitendinosus et Gracillis / autograft /.

After the operation, the patients are placed in a rehabilitation program in five interconnected phases. The way they are performed allows the principle of gradual loading and constant feedback between the patient and the physiotherapist to be observed. Each of the phases has specific goals in the rehabilitation cycle, which has a certain approximate duration. After completion of the rehabilitation process, the clinical outcomes of both groups were compared using the International Documentation Committee (IKDC), Lysholm, and three in-house diagnostic methods. Our own diagnostic methods are Power test (a strength simulator is used, which directly examines the strength of the limb in flexion and extension in real life test. The results from IKDC were in favor of the autograft group (92.82) and from Lischolm of the allograft group (92.24). In terms of the power test the results were in favor of the allograft group. The result from the Power 1 test clearly shows statistically significant difference in symmetry of power in flexion and extension which is better in the allograft group compared to the autograft group. In our research we did not come across such a test in other studies.

In conclusion we proved that the development of a single strict rehabilitation protocol focusing on the principle of gradual increase in workloads achieves comparable results in the frequency of re-rupture in both the allograft and auto-graft groups.

Key words. Anterior cruciate ligament, autograft, allograft tissue.

Introduction.

The anterior cruciate ligament (ACL) is the primary stabilizer of the knee joint. The injury leads to instability of the knee joint, which is a trigger for the subsequent destructive changes of other intra-articular structures such as menisci and cartilage of the joint surfaces.

With regards to the gaining popularity of sports in the lives of people, the rate of in-juries to the ACL is also increasing. According to AAOS (2003 y.) one of 3000 patients in USA is suffering from anterior-medial instability. Every year 200,000 new cases of injury to the ACL are registered. After 1990, primary reconstructions increased from 100,000 to 350,000 per year. This makes ACL the most commonly restored ligament.

The most affected group is people of an active age, engaged in amateur sports. Also, this pathology is an occupational hazard in the military. In this community, ACL injuries have reached 3.24% in men and 3.51% in women, with increasing trends, especially among women. This data is derived from a study by Keller Army Hospital, West Point, New York [1,2].

Despite many years of experience in the reconstruction of ACL, there is still no consensus on the most appropriate methodology. Most often, autologous tissues such as: Fascia Lata; the middle 1/3 of the Lig. Patellae Proprium (BTB, Bone-Tendon-Bone); the ligaments of mm. Semitendinosus and Gracillis (St / G). The use of these tissues leads to the restoration of anterior-medial instability, but at the same time the donor structures undergo changes in the form of:

- Complete loss of the donor structure (when using the tendons of mm. Semitendinosus et Gracillis)
- Partial functional loss of the donor structure (lig. Patellae proprium (BTB)
- Violation of the proprioceptive mechanisms of the knee joint due to loss of donor structures
- Reduction of the adaptive functions of the knee joint

In order to avoid these complications, in the last 20 years, more and more attention has been paid to the alternative methods for replacement of ACL with allograft tissue, which avoids morbidity from the donor site.

There is still no definitive answer to the question which graft type is the better option. The ideal reconstruction graft must meet the following criteria: rapid integration, low complication rate, high safety, no morbidity from the donor site, wide availability, and low cost.

Our hypothesis is that the clinical results after the use of allograft are comparable, and even better than those in reconstruction with St / G autograft. For this purpose, we compared the clinical results and the complications that occurred during the reconstruction with allograft tissues and with autograft tissues.

Methods.

Our study involves 2 groups of patients – operated with autograft and operated with allograft. The groups included 25 patients followed for a period of 18 months.

All patients were duly informed about the advantages and disadvantages of ACL reconstruction with donor and autologous tissues. Their written consent was obtained. The tissues used for ACL reconstruction were: 1) for allograft – BTB donor tissue / allograft / 2) for autologous transplantation – mm. Semitendinosus et Gracillis / autograft /.

Source of the donor tissue (BTB – allograft) - Tissue Bank UMBALSM "Pirogov" Sofia, Bulgaria.

Patients with ACL reconstruction using allograft were between 16 and 45 years of age. Patients operated on with St / G autograph were aged between 17 and 45 years. The average age of patients using an autograft mm. Semitendinosus et Gracillis was 27.8 years. The mean age of patients operated on with BTB allograft was 32.3 years.

The distribution by gender is as follows for the two groups of patients 37 (74%) men and 13 (26%) women.

The age group with the highest number (17) for men is 20–29 years, followed by 30–39 years (12), and with the smallest (3) - 10–19 years. In women the age group with the largest number (5) is the age group 40–49 years, followed by 20–29 years (4), and with the smallest – 10–19 years with one (Figure 1).

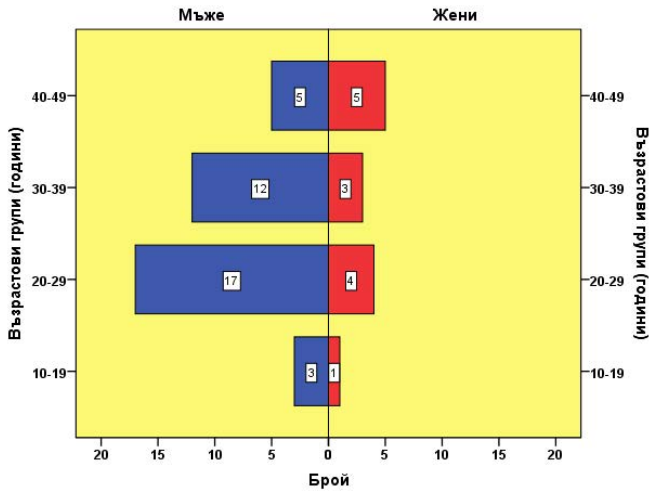

Figure 1. *Distribution of study participants by gender and age groups.*

The selection criteria for the study were subordinated to the idea of creating the most objective conditions for evaluating the results. The first group of criteria includes:

A. ACL injury without other concomitant injuries of the knee joint

B. No injuries to the contralateral knee

C. Without previous surgical interventions on the injured knee

D. Cartilage damage no more severe than grade 2 according to Outerbridge classification

E. No damage to the menisci

F. Lack of retro-patellar chondromalacia

G. Lack of Hoffa syndrome

H. Absence of systemic diseases

Basing on the thesis that ACL injury is a consequence of excessive load and impaired coordination of different muscle groups(8), we added additional criteria for selection of patients in the study:

A. Patient height up to 180 cm

B. Patients with BMI / Body Mass Index / up to 27-28

When selecting the allograft tissue transplant, we used the following criteria:

• Regarding the donor:

- Not older than 40 years.

• Regarding the transplant:

- To be obtained no more than 3 months earlier (thus we get a lower level of antigenicity).

- No more than 18 months have to have passed since the explanation

- To be without mechanical damage

- To not have any muscle tissue

When choosing the right graft, it is very important to calculate the required length of the intraarticular component as accurately as possible. It is determined by the formula of John Brown et al.: y = 1,17.x-41, 2 (inch); y = 0,4606.x-41,29 (cm) - y – intra-articular length of the ligament; 0.4606 – coefficient; x – height of the patient in centimeters; 41.29 – constant value.

The patients underwent reconstruction of their ACL not earlier than 1 week after the trauma. All patients underwent a program to achieve almost physiological range of motion of the injured knee joint preoperatively. In the group with auto-transplantation, an interfering bio-absorbable screw is used to lock the graft in the tibial canal, and an Endo Button is used for fixation in the area of the femoral tunnel. In the allograft transplantation group, an interference bio-absorbable screw was used in the area of both tunnels for fixation.

After the operation, the patients are placed in a rehabilitation program in five interconnected phases. The way they are performed allows the principle of gradual loading and constant feedback between the patient and the physiotherapist to be observed. Each of the phases has specific goals in the rehabilitation cycle, which has a certain approximate duration.

Phase 1. 0–4th week. Objective: Protection of graft by immobilization of the operated knee with brace and specific isotonic exercises. The latter aims to minimize the effects of immobilization. Control of inflammation and swelling. We strive to get a full active and passive extensions. Patient education in the sequence of the rehabilitation program.

Brace is used during this period. Its application follows the following principles: 0–1 postoperative week it is placed in a position locked in full extension in self-care and sleep. Upon reaching the 4th week, a gradual release of the brace is performed, and the patient controls the folding well. From week 4 to week 8, the patient should use a brace.

The loading during this period is gradual and is as follows: From 0 to 4 weeks, a partial load with 2 crutches is recommended. From the 4th to the 6th week the load is gradually increased to a full one (with a brace). From the 4th week the release of the flexion limiting device of the brace begins gradually at 15 degrees, as a criterion for its increase is the free movement at the reached volume and the lack of pain during movement.

The exercises that are allowed in the first phase of movement

are isotonic exercises for the thigh muscles, as well as exercises for the adjacent hip and ankle joints and exercises to restore the strength of the muscles of the thigh and lower leg.

Phase 2. 4–12 weeks. The following criteria for progression are monitored: 1) full extension (hyperextension); 2) seating 90˚; 3) flexion 90˚; 4) minimize swelling; 5) normal gait on a flat surface. Purpose: to restore normal gait and ability to climb stairs. Maintaining full extension. Progression of flexion in order to restore full range of motion. Graft protection and its fixation. Increase the strength of the musculature around the hip joint, quadriceps, and gluteal muscles. Exercises to improve proprioception. Regarding the immobilization brace – striving for absolute release of its limiters and gradual decrease of the usage of aids / crutches.

Exercises: The increase in flexion, as assessed for each patient, continues. Close Kinetic Chain exercises begin. Indoor cycling and exercises for proprioception have begun.

Phase 3. Week 12-18. Criteria for transition to phase 3 of the rehabilitation program: 1) no pain in the femur-patellar joint 2) minimum 120˚ flexion 3) sufficient strength 4) assessment of proprioception to start running exercises 5) minimal swelling.

Objectives: Achieving full range of motion. Development of strength and proprioception of the limb for active sports. Avoid stress on the transplant, enhance the hamstrings. Protection of the femoro-patellar joint. Normalization of the mechanism of running. The exercises recommended in this period are of the following type: Exercises to improve the volume of movement, tailored to the patient. Open Kinetic Chain exercises for limb extension (90-30˚) begin. Isokinetic exercises (with anti-shear device) are included in the regiment. progressively loading running exercises are included at 16 weeks. Swimming and swimming exercises are added, as well as exercises to increase the strength of the muscles of the hip joint and the abductors. Cardio exercises are also added, and the goal is to progress with exercises that improve proprioception.

Phase 4. 5th-7th month. Criteria for progression to phase 4 are: 1) complete painless range of motion 2) no significant oedema 3) no symptoms of the femur-patellar joint 4) strength is about 70% of the unaffected lower limb for isokinetic exercise 5) sufficient strength and proprioceptive function to initiate activity 6) normal gait when running.

The goals to achieve in the 4th phase are: Symmetrical readiness for basic work with specific sports strokes. Jumps, aiming to reach 85% of the strength of the uninvolved limb. Reaching 85% of the strength of the uninvolved limb in isokinetic exercises.

The exercises in this phase are Continuation of the flexibility and strength program based on individual needs and deficits. Initiation of a plyometric program, assessing the patient's sports goals. Exercises for agility, including side walking and jumping, running in Figure 8 and others.

Phase 5. 7th month and onwards. The criteria for entering the last phase of the rehabilitation program are: 1) no pain in the femur-patellar joint or soft tissue swelling 2) it is necessary to link the range of motion, strength, skill, and proprioceptive skills for a safe return to work or sport 3) as-assessment of partial or full activity.

The goals in the last phase are a safe return to sports or work. Maintaining strength, endurance and proprioception and educating the patient in view of certain limitations.

The exercises included in this phase are of the following type: partial return to sports and continuation of the strength and endurance program. Wearing a brace in this phase is not mandatory, and a functional one can be worn in specific cases.

After completion of the rehabilitation process, the clinical outcomes of both groups were compared using the International Documentation Committee (IKDC), Lysholm, and three in-house diagnostic methods. Our own diagnostic methods are:

- **Power-test (A strength simulator is used, which directly examines the strength of the limb in flexion and extension. The effort is measured in Lbs./Kg).** It is performed preoperatively and 18 months after the operation.
- **Time to reduce 1/2 of the postoperative oedema.** Preoperatively, the circumference of the knee is measured 6 cm above the base of the patella. The same procedure is followed in the following postoperative days.
- **Rate of swelling subsidence.** After taking initial data preoperatively, the amount of swelling is monitored daily after reconstruction.

Statistical analysis.

The survey included all the patients that came to our practice in the time frame of the study, and as every patient was informed about the difference between the two techniques, each one was placed in the group they chose.

The survey data were entered and processed with the IBM SPSS Statistics 23.0 statistical package. For a significance level at which the null hypothesis was rejected, $p < 0.05$ was assumed.

The following methods were applied:

1. Descriptive analysis – in table form is presented the frequency distribution of the considered signs, broken down by groups of research.

2. Variation analysis – to assess the characteristics of the main trend and statistical scattering.

3. Graphic analysis – to visualize the results.

4. Fisher's exact test – to test hypotheses for the existence of a relationship between categories of variables.

5. Non-parametric Shapiro-Wilk test – to check the normality distribution.

6. Student's T-test – to test hypotheses for the difference between two independent samples.

7. Non-parametric Mann-Whitney test – to test hypotheses for the difference between two independent samples.

8. Non-parametric Friedman test - to test hypotheses for differences between several de-pendent samples.

9. Non-parametric Wilcoxon test - to test hypotheses for the difference between two de-pendent samples.

Results.

The patients included in the study were followed for more than 18 months (18-24 months). In both groups, no infections were diagnosed, both early and late.

The self-assessment tests performed by IKDC and Lischolm

show the following mean values by groups: IKDC (allograft – 91.63 / autograph – 92.82) and Lischolm (allograft – 92.24 / auto-graph – 89.28). From the results obtained, no significant differences were observed between the two groups of patients (Table 1) (Figures 2-5).

From our own assessment methods including analysis of muscle strength, rate of reduction of postoperative oedema and reduction of 1/2 of the oedema, we obtained the following results.

In our study of the symmetry of the strength of the two limbs of patients in whom the reconstruction of ACL was performed at the expense of allograft, compared with patients in which it was performed by autograph, we found that in the course of the study, when using own tendons of mm. Semitendinosus / gracilis the force symmetry severely differs for the operated and uninjured limb, in favor of the uninjured limb (Table 2 and Figure 6).

In the study of the rate of reduction of postoperative oedema in both groups of patients for greater accuracy, we introduced

Table 1. *Comparative analysis of patients operated on autograph and allograft./n -number of examined patients, X arithmetic mean, SD-standard deviation (Standard Deviation).*

Indicators	**Operative methods**						**P**
	Autograft			**Allograft**			
	n	**X**	**SD**	**n**	**X**	**SD**	
IKDC-1 - preoperative	**25**	**20,03**	**3,01**	**25**	**24,32**	**3,81**	**<0,001**
IKDC-2 - postoperative	**25**	**92,82**	**3,34**	**25**	**91,63**	**3,36**	**0,213**
Lischolm-1 - preoperative	**25**	**33,28**	**8,41**	**25**	**31,16**	**7,43**	**0,606**
Lischolm-1 - postoperative	**25**	**89,80**	**7,75**	**25**	**93,24**	**3,13**	**0,220**

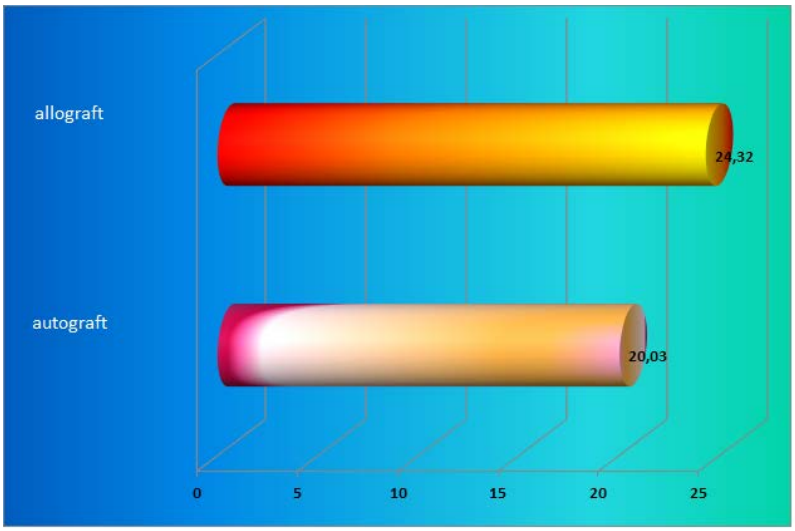

Figure 2. *Comparative analysis of patients operated with autograft and allograft methods according to IKDC-1 – preoperative.*

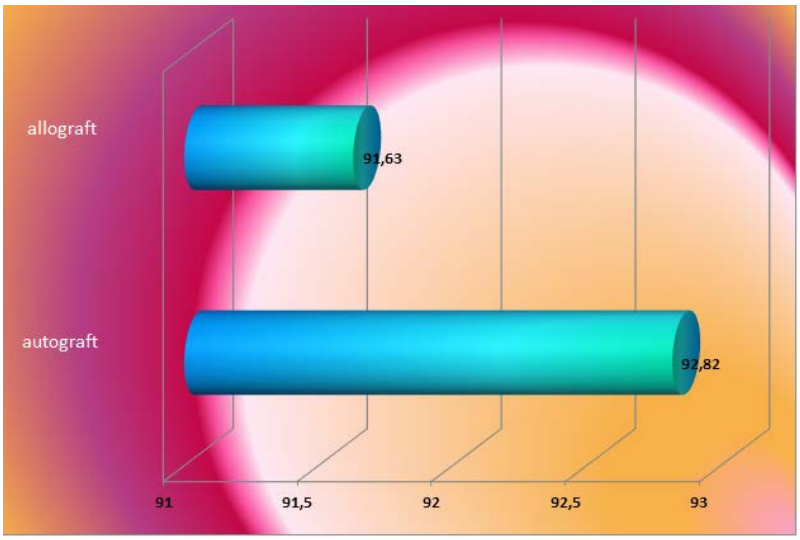

Figure 3. *Comparative analysis of patients operated with autograft and allograft methods according to IKDC-2 - postoperatively.*

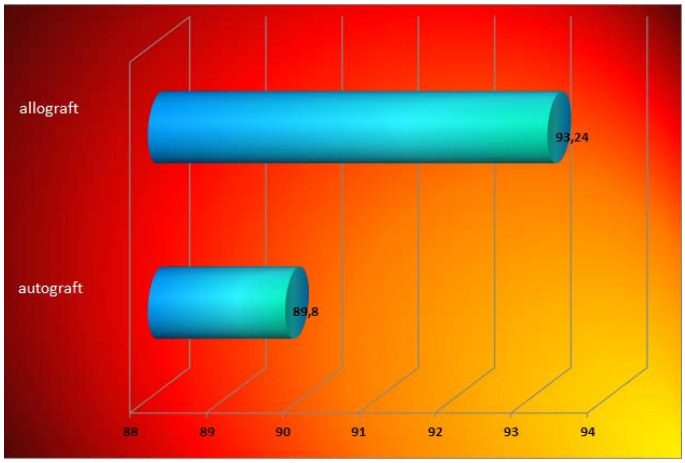

Figure 4. *Comparative analysis of patients operated with autograft and allograft Lischolm methods – preoperative.*

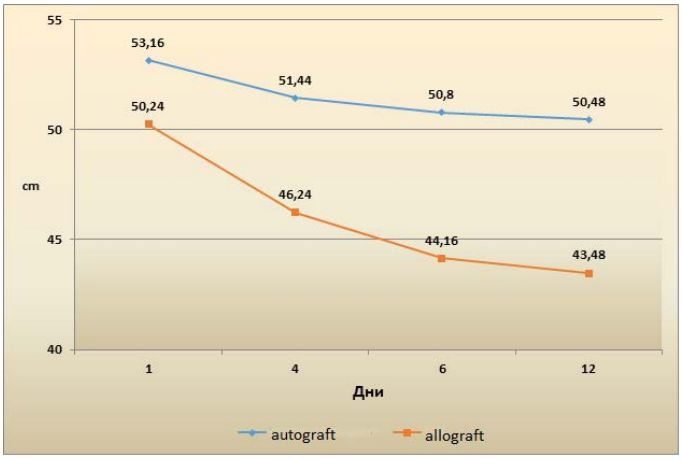

Figure 7. *Comparative analysis of the decrease in the swelling of the operated knee by days and operative method.*

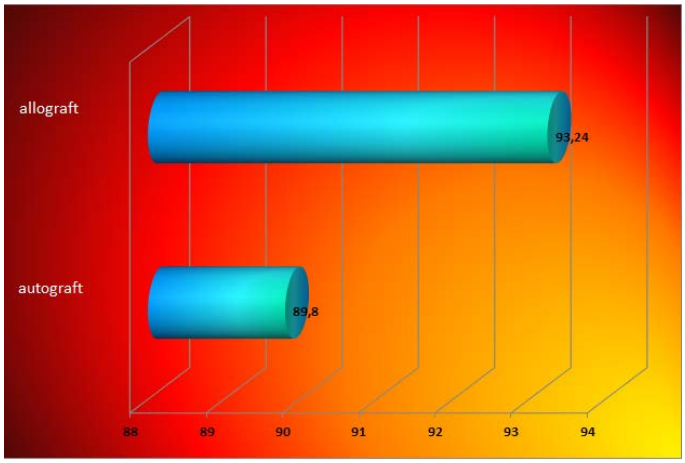

Figure 5. *Comparative analysis of patients operated with autograft and allograft Lischolm methods - postoperatively.*

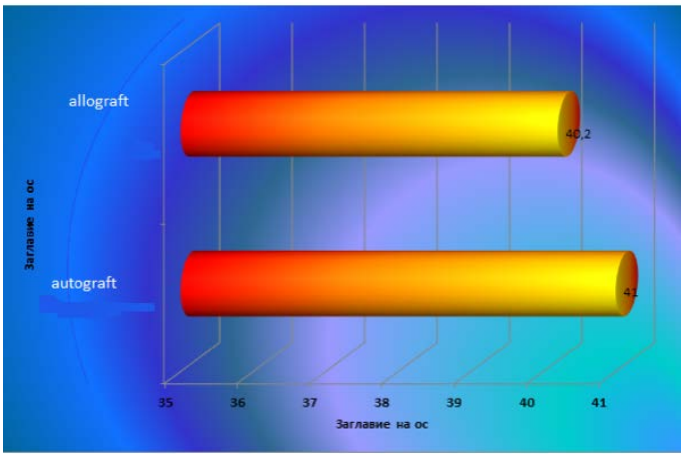

Figure 8. *Comparative analysis of patients operated on with autograft and allograft methods, by knee circumference preoperatively.*

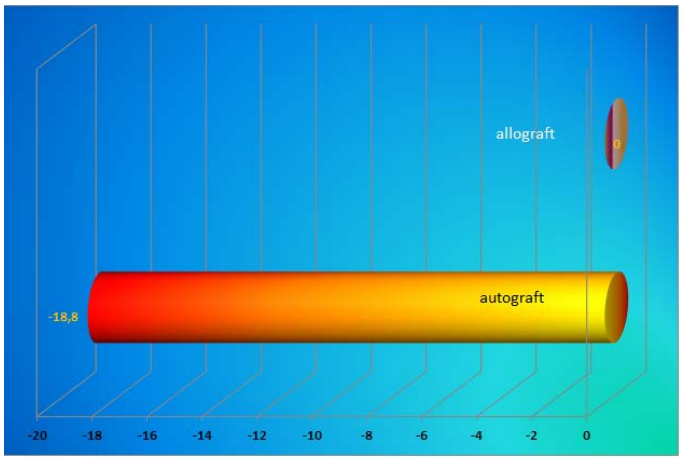

Figure 6. *Comparative analysis of patients operated on autograft and allograft methods by Power-1 (symmetry of power of the operated limb and the uninjured limb).*

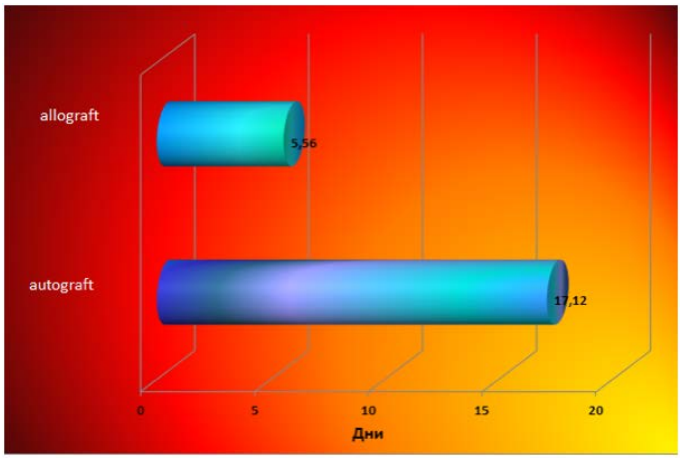

Figure 9. *Comparative analysis of patients operated with autograft and allograft methods, by reduction of 1/2 of the oedema.*

Показатели	Оперативен метод						P
	Автографт			Алографт			
	n	X	SD	n	X	SD	
Power-1	25	-18,80	11,39	25	0,00	0,00	<0,001

Table 2. *Comparative analysis of patients operated with autograft and allograft methods for studying the symmetry of power of the operated limb (Power-1).*

Table 3. *Comparative analysis of the decrease in the swelling of the operated knee by day-sand operative method. * - the same letters in the verticals mean no significant difference, and the different - the presence of such (p <0,05).*

Decline (Day)	Operative methods						P
	Autograft			Allograft			
	n	X	SD	n	X	SD	
1	**25**	**53,16**	**5,79**	**25**	**50,24**	**5,06**	**0,064**
4	**25**	**51,44**	**5,69**	**25**	**46,24**	**5,12**	**0,001**
6	**25**	**50,80**	**5,50**	**25**	**44,16**	**4,76**	**<0,001**
12	**25**	**50,48**	**5,58**	**25**	**43,48**	**4,13**	**<0,001**

Table 4. *Comparative analysis of patients operated on with autograft and allograft methods: preoperative knee circumference, reduction of 1/2 of the swelling.*

Indicators	Operative methods						P
	Autograft			Allograft			
	n	X	SD	n	X	SD	
Knee circumference preoperative (cm)	**25**	**41,00**	**4,39**	**25**	**40,20**	**4,23**	**0,209**
Reduction of 1/2 of the swelling (days)	**25**	**17,12**	**2,22**	**25**	**5,56**	**1,69**	**<0,001**

the term "reduction of 1/2 of the oedema." For this purpose, we made measurements of the circumference of the injured knee 6 cm proximal to the base of the patella preoperatively. We then measured on the first postoperative day and recorded the difference. In the following days, the aim of the measurements was to detect the moment when the difference between the first two measurements was reduced to 1/2. Here the advantage is again on the allograft side - in these patients the reduction of 1/2 of postoperative oedema occurs within 7– 8 days, while in the other group it persisted for an average of 18-20 days. (Table 3 and Figure 7).

From the results for the reduction of 1/2 of the oedema presented in Table 4, Figures 8 and 9, it can be seen that a significant difference between the two studied methods is established in the indicator of reduction of 1/2 of the oedema. The mean values of this indicator are significantly lower in patients operated with the allograft method, and no statistically significant difference was found between the two patient groups based on the indicator Knee circumference preoperatively (in the figure the columns are shown in the same color).

In both studied groups, we did not have an incident of rerupture within the follow-up period.

Discussion.

The most commonly used grafts for ACL reconstruction are autograft of own patellar ten-don (BTB) and tendons of mm. Semitendinosus and Gracillis (HS). For most surgeons, the first choice of graft is HS autograph, taking into account the large number of articles reporting a significant degree of morbidity in the donor site of the middle third of the patellar tendon, such as patellofemoral osteoarthritis, patellar tendon contracture, loss of end of extension, patellofemoral pain, etc. [3]. Despite the growing popularity of HS auto-grafts, they also showed a lot of morbidity in the area of tendon harvesting, such as damage to the superficial branch of the saphenous nerve [4,5], weakness of the adductor muscles after taking the tendons of the Semitendinosus and m. Gracilis [4,5], squat pain, although the frequency and intensity is significantly lower than with the use of a bone-tendon-bone graft [6], sacrificing an important stabilizer of the knee joint and a dynamic synergist of anterior cruciate ligament, as according to Beynnon et al. during their in vivo studies, this role was greatest in the range of 15 to 60 degrees of flexion, loss of knee flexion force and loss of up to 5 degrees of total knee flexion, and limited tendon volume in some patients. The potential advantages of allografts are the same as for autografts, but the morbidities from the donor site are avoided, which makes them an increasingly attractive choice for surgeons.

In general, most surgeons believe that allograft tissue is safe to use, as shown by the American Orthopaedic Society of Sports Medicine, with 86% of colleagues surveyed saying they use allograft in their practice [7-11].

The data from our study showed that there was no statistical difference in the clinical results of patients operated with allograft and those with autograft, as the only parameters in which there were clear differences were in the study of symmetry of the strength of the two lower limbs of patients and fading of 1/2 of the oedema, and in both indicators the patients operated with allograft had an advantage. The difference in the symmetry of strength, we attribute to the fact that in patients with autografts strength is lost both in knee flexion due to loss of function of the muscle's semitendinosus and gracilis, and in extension due to muscle imbalance and reciprocal weight loss of the extensor muscle group after the loss of the above muscles [3].

The frequency of re-rupture after primary reconstruction of ACL with allograft is higher in some authors [7], but the difference is usually not statistically significant, and we believe that the increased frequency of re-rupture in these authors is due to faster postoperative rehabilitation program due to a significantly faster reduction of pain in the allograft group. This may lead to an earlier return of patients from the allograft group to high levels of sports activity compared to the autograft group, and this is before sufficient biological incorporation of the graft has occurred, which may put the allograft group at greater risk.

The contribution of our study is that we traced the differences in the symmetry of muscle strength of the limbs in the two types

of grafts, the decrease in oedema and 1/2 of it, as well as the creation of a unified rehabilitation program for patients to unify clinical results.

Disadvantages.

We recognize the same disadvantages to our study. The patient groups are not randomized, and the time frame of the follow-up is limited. Further inquiry in this kind of research is needed with long-term follow-up in order to discern whether the results in our study will remain the same.

Conclusion.

With our study, we recorded the clinical results after the reconstruction of ACL with auto-graft tissue and allograft tissue and observed the advantage of the second group in the rate of disappearance of postoperative symptoms. We also proved that the development of a single strict rehabilitation protocol focusing on the principle of gradual increase in workloads achieves comparable results in the frequency of re-rupture in both groups.

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