Patient Outcomes after 8-Week Rehabilitation Program in Patients with Anterior Cruciate Ligament Reconstruction: A Pilot Study and Preliminary Results

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Abstract

Purpose: The purpose of our study was to investigate the effects of 8–week physiotherapy and rehabilitation program on pain intensity, activity and functional level, knee circumference in patients with anterior cruciate ligament reconstruction.

Material and Methods: Eighteen patients with anterior cruciate ligament reconstruction participated in this study. The patients were performed physiotherapy and rehabilitation program for a total of eight weeks, three sessions per week. Pain intensity, activity level, functional level, and knee swelling were measured with Visual Analogue Scale, Tegner Activity Scale, Lysholm Knee Score, and Tape Measure at baseline and 8th week, respectively.

Results: We found significant improvements in activity level (p=0.001) and functional level (p=0.001) after the treatment. Pain intensity (p=0.001) and knee circumference (p=0.001) were significantly decreased after the treatment.

Conclusion: According to our results, we could report that 8-week physiotherapy and rehabilitation program has significant positive effects on activity and functional levels, pain intensity and knee circumference in patients with anterior cruciate ligament reconstruction.

Keywords: Anterior Cruciate Ligament; Rehabilitation; Physiotherapy

Introduction

The anterior cruciate ligament (ACL) is vital for knee joint kinematics, especially in rotation, and functions as an anterior–posterior stabilizer [1]. The ACL controls anterior movement of the tibia and inhibits extreme ranges of tibial rotation [2]. In the setting of ACL deficiency, the cartilage as well as the menisci in the medial tibiofemoral compartment is more susceptible to arthritic change than the lateral compartment [1].

In the United States of America, ACL injuries total between 100,000 and 200,000 in a year, making this the most common ligament injury. This number continues to increase in both the general population and in individuals who play sports [2].
ACL rupture is a catastrophic injury that is linked to short-term functional deficits and significant long-term morbidity, including development of osteoarthritis and significant progressive disability, despite surgical or conservative intervention [3].

ACL rupture is the most common knee pathology experienced by athletes during sports activities. ACL injury results in altered knee joint mechanics which frequently continue even after ACL reconstruction [4]. ACL reconstruction is a common treatment for athletes after ACL injury [5]. The treatment method often includes ACL reconstruction with the aim of restoring the mechanical stability of the knee joint and re-gaining knee function [6].

Some patients with ACL injuries may not be candidates for invasive methods because of serious comorbid medical conditions including serious cardiac, renal, or hepatic disease [2]. For individuals who opt for conservative methods, physical therapy aimed at strengthening the muscles around the knee, especially the quadriceps femoris and hamstring muscles, is pursued [2].

The purpose of our study was to investigate the effects of 8-week physiotherapy and rehabilitation program on pain intensity, activity and functional level, knee circumference in patients with anterior cruciate ligament reconstruction.

**Material and Methods**

This study was performed in Biomechanics and Performance Analysis Laboratory of Marmara University in May 2015 – October 2017. Seventeen men and one woman who underwent unilateral arthroscopic ACL reconstruction with hamstring tendon graft by the same surgeon participated in this study Figure 1. Exclusion criteria were previous knee surgery, multiple surgeries around knee (meniscus or any other ligament of knee joint), pregnancy or diagnosis of mental disorder.

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**Figure 1: Flow chart of the study protocol and exclusion diagram for the patients.**

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All subjects were informed about the study prior to their participation and written informed consent was provided. The study was approved by the University Faculty of Medicine Ethics Committee for Clinical Research (Protocol Number: 09.2016.150).

Outcomes

Medical history, age, sex, height, weight, and patient history were recorded during the first evaluation. Our parameters were pain intensity, activity and functional level, knee circumference Figure 2.

Before and after treatment, pain intensity was measured with a Visual Analogue Scale [7]; activity level was measured with Tegner Activity Level [8]; functional level was measured with Lysholm Knee Score [8]; knee circumference was measured with a tape measure [9].

Treatment Program

Physiotherapy and rehabilitation program was applied with the same physiotherapist (O.A) for a total of eight weeks, three sessions per week Figure 3. During the first four weeks, the aim of physiotherapy and rehabilitation program was to decrease the knee effusion, to eliminate the pain, to gain full range of motion (flexion and full extension). Closed kinetic chain exercises, walking exercises, straight leg rise and isometric quadriceps and hamstring exercises were performed. Ice compression with knee elevation was regularly applied. Electrotherapy modalities were regularly applied. Hanging exercise was performed to gain full knee extension. Aggressive, progressive and resistive exercises were performed at last four weeks. Resistive theraband exercises were progressively applied. Required electrotherapy modalities were chosen. Core stabilization, cycling exercises, balance and proprioceptive exercises were performed at 5th – 8th weeks. Figure 4

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 11.5 software (IBM Corporation, USA), with a p value <0.05 considered statistically significant. All numerical data were expressed as mean±standard deviation. Data obtained from patients before and after treatment were assessed by using the Wilcoxon Signed Test.
Results

The study included 1 female (6%) and 17 males (94%). A total of 18 patients completed the study. Age, height, body weight, and body mass index of the subjects were presented in Table 1.

<table>
<thead>
<tr>
<th>Demographic features</th>
<th>Mean±SD</th>
</tr>
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<tbody>
<tr>
<td>Age (year)</td>
<td>28.38±5.48</td>
</tr>
<tr>
<td>Body Height (cm)</td>
<td>179.27±7.60</td>
</tr>
<tr>
<td>Body Weight (kg)</td>
<td>82.88±13.88</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.68±3.21</td>
</tr>
<tr>
<td>Gender (F/M)</td>
<td>1/17</td>
</tr>
</tbody>
</table>

Table 1: Baseline data of subject's socio demographic characteristics.
SD: Standard Deviation; BMI: Body Mass Index; n: number; F: Female; M: Male

There were statistically significant improvements in terms of pain intensity (p=0.001), activity level (p=0.001) and functional level (p=0.001), knee circumference (p=0.001) after the treatment Table 2.

<table>
<thead>
<tr>
<th></th>
<th>Pre – Treatment Mean±SD</th>
<th>Post – Treatment Mean±SD</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain Intensity (cm)</td>
<td>3.78±1.73</td>
<td>0.96±1.00</td>
<td>9.193</td>
<td>0.001*</td>
</tr>
<tr>
<td>Activity Level (Score)</td>
<td>4.38±0.60</td>
<td>5.77±0.80</td>
<td>-6.934</td>
<td>0.001*</td>
</tr>
<tr>
<td>Functional Level (Score)</td>
<td>73.44±17.27</td>
<td>84.83±15.17</td>
<td>6.873</td>
<td>0.001*</td>
</tr>
<tr>
<td>Knee Circumference (cm)</td>
<td>1.30±0.68</td>
<td>0.41±0.35</td>
<td>6.469</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

Table 2: Comparison of pre-treatment and post-treatment measurement values of the subjects.
SD: Standard Deviation
Wilcoxon Signed Test

The percentage amounts of increase are shown in the table with italic format.

Discussion

The hypothesis of this study was to improve activity and functional level and to decrease pain intensity and knee circumference after 8-week physiotherapy and rehabilitation program in patients with anterior cruciate ligament reconstruction. The findings of this study support the hypothesis that 8-week treatment program develops patient outcomes after anterior cruciate ligament reconstruction.

The most important finding of the current study was that the influence of 8-week rehabilitation affected activity and functional level in patients following anterior cruciate ligament reconstruction. One of the most important issues is to return to their pre-injury activity and functional level for patients with anterior cruciate ligament reconstruction [10]. After 8 weeks of rehabilitation, activity and functional level were significantly improved 31.5% and 15% according to baseline assessment, respectively.

It is well-known that knee swelling and pain affects knee mechanics and muscle activity. Therefore, knee swelling and pain should be eliminated in the early period of rehabilitation [11]. In addition to activity and functional level, our rehabilitation program significantly decreased pain intensity and knee circumference 74.5% and 68.5%, respectively.

There were two important limitations in our study. First of them was assessment parameters of the subjects. We could use more objective evaluation methods for patients. Ultrasound or magnetic resonance imaging for knee swelling, objective performance tests for activity and functional level could be better options to assess the patients. Second limitation was gender distributions. Although 17 men participated in the study, there was only 1 woman in the study.

Further studies are needed to assess the patient and clinical outcomes with more objective methods and to include more cases.

Conclusion

In conclusion, 8-week physiotherapy and rehabilitation program may be beneficial on pain intensity, activity level, functional level, and knee circumference in patients with anterior cruciate ligament reconstruction.

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References


