Incline walking and isometric quadriceps strengthening exercises in a patient with knee osteoarthritis. A case study

D.O.I: https://doi.org/10.4127/jbe.2018.0138

TSAGKARAKI CHRYSANTHI¹, STASINOPOULOS DIMITRIOS²

¹ Msc student in Sports Physiotherapy, PT, European University Cyprus
² Chairperson / Associate Professor, Physiotherapy, Coordinator of MSc in Sports Physiotherapy Coordinator of Physiotherapy Program, Director of Cyprus Musculoskeletal and Sports Trauma Research Centre (CYMUSTREC) Physiotherapy Program, Dep. of Health Sciences, School of Sciences, European University Cyprus Nicosia, Cyprus

ABSTRACT

The aim of this study was to evaluate the effectiveness of an incline walking protocol in combination with isometric quadriceps strengthening exercises to reduce pain, improve strength, and function in a patient with knee osteoarthritis (OA). A patient with OA in the right knee for one and a half year was included in the present report. The subject followed a three (3) week (10 sessions totally) physiotherapy program, which included incline walking and isometric strengthening exercises of the quadriceps. The programme was individualized on the basis of the patient’s description of pain experienced during the procedure. Outcome measures were pain, using a visual analogue scale and the KOOS questionnaire, strength using the Oxford scale and function, using the KOOS questionnaire and the 6-minute walk test. The subject was evaluated before the treatment, at the end of the treatment (3rd week) and 1 month (7th week) after the end of the treatment. At the end of the treatment and at the follow-up, pain was reduced, strength and function were increased. The results of the study suggest that the combination of incline walking and quadriceps isometric exercises can im-

Key Words: Osteoarthritis, Quadriceps, Isometric, Walking, Knee
prove pain, strength and function in a patient with knee OA. Future well-designed studies are needed to confirm the results of this case study.

INTRODUCTION

Knee osteoarthritis (OA) is a chronic degenerative multifactorial disorder with an important socio-economic burden on society (1). Although its symptoms are clear and its diagnosis is simple, the most appropriate treatment has not been proven. The treatment of OA is either medical or physiotherapeutic. Medical treatment is either conservative (drugs, injections) or surgery. Physiotherapy treatment includes electrotherapeutic (low-intensity laser, therapeutic ultrasound, TENS) and non-electrotherapeutic modalities such as exercise therapy, soft tissue techniques, mobilization techniques and so on. The main treatment approach in the management of OA is the exercise therapy (2). Studies show that patients with OA can safely perform aerobic exercise on a treadmill or cyclometer (3) along with muscle strengthening exercises around the knee joint to reduce pain and improve functional ability (4). Isometric contractions have been used in musculoskeletal problems to reduce pain, increase strength and improve function but have not been assessed in the treatment of knee OA in combination with aerobic exercise. Therefore, the purpose of this study is to determine the effectiveness of a walking protocol on uphill and isometric quadriceps strengthening exercises to reduce pain and improve function in a patient with knee OA.

CASE PRESENTATION

A 53-year-old male patient, former professional footballer, with knee osteoarthritis for 1.5 years (diagnosis by a qualified physician excluding the remaining knee joint injuries) underwent total menisectomy about 20 years ago, resulting in the development of osteophytes in the joint. The program was individualized on the basis of the patient’s description of pain experienced during the procedure and conducted in the clinic under the supervision of the physiotherapist (TC). The program included walking on a gym treadmill with a 5% uphill gradient. The patient on the first day of the session commenced the 10-minute walk with a 5% uphill gradient. The duration and upward inclination in the corridor increased progressively according to the patient’s symptom (5% -15%). After walking, the patient followed a program of isometric quadriceps exercises in an open kinetic chain without additional resistance.

In the first exercise, the patient was sitting in a chair and extended his knee, remaining isometrically at 45 degrees for twenty (20) seconds and at 0 degrees for thirty (30) seconds (Figure 1).
The knee returned controlled and slowly to the starting position after the contraction (90°). This exercise was performed in three sets of 8 reps. In the second exercise, the person was sitting in a chair with his right limb placed in a stool with his knee extended to about 80 degrees. From this position, isometric hip flexion performed at about 90 degrees and knee extension without resting on the stool retaining in this position for thirty (30) seconds (Figure 2).

Figure 1

Figure 2

The second exercise was performed on three sets of 8 reps. The treatment protocol was performed 3 times in the first two weeks, day by day, while in the third week it was performed 4 times. The patient was instructed to use his limb during the course of the study but to avoid activities that irritated his knee. He was also told to refrain from taking anti-inflammatory drugs throughout the course of the study. Patient compliance with this request was monitored using a treatment diary (5). Communication and interaction (verbal and non-verbal) between the therapist and patient was kept to a minimum, and behaviours sometimes used by therapists to facilitate positive treatment outcomes were purposefully avoided. For example, patient was given
no indication of the potentially beneficial effects of the treatments or any feedback on their performance in the pre-application and postapplication measurements (5). Pain, strength and function were measured in this study. Pain was measured on a visual analogue scale (VAS), where 0 (cm) was “least pain imaginable” and 10 (cm) was “worst pain imaginable”. The pain VAS was used to measure the patient’s worst level of pain over the previous 24 h before each evaluation, and this approach has been shown to be valid and sensitive of the VAS. In addition, the pain was evaluated with the Knee Injury and Osteoarthritis Outcome Score (KOOS) (6) which has been validated into the Greek language (7). The strength was evaluated with the Oxford scale (8) by assessing the extension of the knee from a seated position. Function was evaluated by the KOOS questionnaire with the 6-minute walk test (6MW) (9), which is an effective measurement test in knee OA patients (10,11). The patient was evaluated at the baseline (week 0), at the end of the treatment (3rd week) and one month after the end of the treatment (week 7).

RESULTS

At the end of the treatment and at the follow – up there was a decline in pain and a rise in strength and function (Table 1).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Pain, strength, function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VAS cm + Oxford scale</td>
</tr>
<tr>
<td>0 week</td>
<td>7/10cm &amp; 4+/5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd week</td>
<td>5/10cm &amp; 5/5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>7th week</td>
<td>4/10cm &amp; 5/5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
DISCUSSION

The present study has looked at the effect of walking on a treadmill and the isometric strengthening of the quadriceps in a patient with knee OA; its findings have demonstrated significant improvements in terms of pain, strength and disability. The results obtained from this case report are novel; as to date, similar studies have not been conducted. The dose of the treatment protocol (sets, repetitions, range of motion, strength, inclination) was based on the therapist’s experience according to the patient’s symptoms. Personalizing a program seems to have better results in rehabilitation (12). It cannot be determined which of the two interventions led to the change of symptoms. Walking on uphill as well as strength training are a powerful treatment intervention in knee OA (10,13). In the present study, the patient noted a significant increase in the meters (115) he was able to walk after the 6MW test. This demonstrates the importance of walking on an uphill gradient as it improved the function of the lower extremity, greatly increasing the strength of the muscles against the distance. Isometric strengthening exercises are suggested when the patient is unable to perform large-scale knee extension exercises due to pain or weakness (14). The supervision of a program, as in the present study, seems to have better clinical results than a home exercise program (12). Although the results of this study are positive cannot be generalized. Future well-designed studies are needed to confirm the short-term and long-term effects of this intervention in patients with knee OA.

REFERENCES


Address for correspondence:

Stasinopoulos Dimitrios (phD)
chairperson/ associate professor, physiotherapy, physiotherapy program, Dep. of health Sciences, School of Sciences coordinator of mSc in Sports physiotherapy coordinator of physiotherapy program 6, Diogenes Str. engomi, P.O.Box 22006, 1516, Nicosia, Cyprus Tel. +35722713044 [f] +35722713013 D.Stassinopoulos@euc.ac.cy [w] www.euc.ac.cy