

## PATELLOFEMORAL PAIN REHABILITATION: OUTCOMES OF A HOME BASED PROGRAM

İnci AKARCALI\*, Nazan TUĞAY\*\*, Zafer ERDEN\*\*

Ahmet ATAY\*\*\*, Gürsel LEBLEBİCİOĞLU\*\*\*\*, M. Nedim DORAL\*\*\*\*\*

### ÖZET

**Giriş:** Çalışmanın amacı patellofemoral ağrısı olan hastalarda ev rehabilitasyonunun etkinliğini araştırmaktır.

**Hastalar ve Yöntem:** Bu amaçla, genel popülasyonu temsil eden (sporcu olmayan) 62 hasta (73 diz) çalışmaya alındı. Hastalara, açık ve kapalı kinetik zincir kuadriceps kuvvetlendirme, germe egzersizleri, patellar mobilizasyon, buz uygulaması, postür eğitimi ve aktivite modifikasyonundan oluşan 9 haftalık bir ev programı verildi. Diz çevresi kas kuvveti ve ağrı şiddeti 3, 6 ve 9. haftalarda değerlendirildi.

**Bulgular:** 9 haftalık ev programı sonunda kuadriceps ve hamstring kas kuvvetinde tedavi öncesine göre anlamlı artış, ağrı şiddetinde ise azalma saptandı ( $p < 0.05$ ). Patellofemoral semptomların durasyonu ile ağrı iyileşmesi arasında istatistiksel olarak anlamlı bir ilişki bulunamadı ( $r = -0.101$ ) ( $p > 0.05$ ).

**Sonuç:** Patellofemoral ağrısı olan hastalarda ev programının ağrıyı azaltıp kas kuvvetini artırarak etkin olduğu kanısına varıldı.

**Anahtar Kelimeler:** *Patellofemoral, Ağrı, Diz, Rehabilitasyon.*

### SUMMARY

PATELLOFEMORAL PAIN REHABILITATION: OUTCOMES OF A HOME BASED PROGRAM

**Introduction:** The purpose of this study is to investigate the effectiveness of a home based rehabilitation program in patients with patellofemoral knee pain.

**Patients and Methods:** With this aim, 62 patients (73 knees) from the general population (non athletes) were included in this study. The 9

weeks home program consists of open and closed kinetic chain quadriceps strengthening and flexibility exercises, patellar mobilization, ice, postural education and activity modification. Pain intensity and muscle strength were assessed at 3<sup>rd</sup>, 6<sup>th</sup> and 9<sup>th</sup> weeks.

**Results:** At the end of 9 weeks rehabilitation program, a significant reduction was detected in the pain intensity when compared with the pretreatment pain levels ( $p < 0.05$ ). Also, quadriceps and hamstring muscle strength was significantly increased at the end of the treatment ( $p < 0.05$ ). There was no significant statistical correlation between duration of the patellofemoral symptoms and pain relief ( $r = -0.101$ ) ( $p > 0.05$ ).

**Conclusion:** It is concluded that the home program was effective in improving muscle strength and reducing pain in patients with patellofemoral knee pain.

**Key Words:** *Patellofemoral, Pain, Knee, Rehabilitation.*

### INTRODUCTION

The patellofemoral pain syndrome (PFPS) is very common in the general population but even more so amongst athletes. Mc Connell demonstrated that patellofemoral pain affects one in four of the general population<sup>1</sup>.

Patellofemoral pain rehabilitation requires different approaches such as intense quadriceps muscle training exercises, iliotibial band and hamstring stretches and patellar taping to restore normal patellar tracking<sup>2-7</sup>.

The purpose of this study is to report the outcomes of a home based program which was prepared with regards of the current literature on the

\* Doç. Dr., Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Yüksekokulu Öğretim Üyesi.

\*\* Uzm. Fzt., Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Yüksekokulu Araştırma Görevlisi.

\*\*\* Yrd. Dr., Hacettepe Üniversitesi Tıp Fakültesi Ortopedi ve Travmatoloji Anabilim Dalı Öğretim Üyesi.

\*\*\*\* Doç. Dr., Hacettepe Üniversitesi Tıp Fakültesi Ortopedi ve Travmatoloji Anabilim Dalı Öğretim Üyesi.

\*\*\*\*\* Prof. Dr., Hacettepe Üniversitesi Tıp Fakültesi Ortopedi ve Travmatoloji Anabilim Dalı Öğretim Üyesi.

Bu çalışma Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Yüksekokulu "Ortopedik Rehabilitasyon Ünitesi" ve Hacettepe Üniversitesi Ortopedi ve Travmatoloji Kliniği'nde yapılmıştır.

conservative management of patellofemoral pain. With this aim, patients are followed with a well designed home program and regular controls instead of in an outpatient clinic because it is time and cost effective.

## MATERIALS AND METHODS

Sixty-two patients referred for treatment of PFPS were included in this study. These patients represented the general population, and they were not professional athletes but a few of them were interested in recreational sports. None of these patients were rehabilitated before this study for their knee pain. The other selection criteria was: age between 15-45 years; at least two months of pain history; negative findings in the clinical examination of knee ligaments, bursae, menisci, synovial plicae, hamstring, quadriceps and patellar tendons, no history or clinical evidence of patellofemoral dislocation, subluxation.

At the time of initial physical examination, specific attention was paid to patellar alignment, specifically tilt and subluxation. Patients who had (-) patellar tilt test and (-) apprehension test were included in the study.

Patients had standard AP and lateral radiographs of the both knees. Additionally, each patient tangential radiographs performed to assess the patellofemoral relationship. Patients, who had high degree of degenerative arthritis and patellar subluxations were excluded from the study.

Forty women and 22 men with a mean age of  $27.3 \pm 9.3$  (SD) years were studied for two years. Typical patellofemoral pain symptoms were found in the right knees of 27 patients, left knees of 24 and both knees of 11 patients (total of 73 knees) during physical activities. The mean Q angle of these patients was  $15.2^\circ$  (range =  $14.6^\circ$ - $16.1^\circ$ ).

## Evaluation Procedures

The patients were evaluated at the first visit and once every three weeks during the home program period with the following methods:

Initial evaluation: Intensity of pain was evaluated by using Visual Analog Scale (VAS) (0-10 cm)<sup>8</sup>. Presence of retropatellar pain was tested clinically by means of pain aggravating activities such as climbing up and down stairs and inclines, squatting and running.

The duration of the symptoms before starting treatment was recorded. Malalignment of the lower extremities and flexibility of peripatellar soft tissues

(hamstrings, rectus femoris, gastro-soleus, iliotibial band) were examined. The strength of quadriceps and hamstring muscle groups was evaluated between 0-5 by using Lovett's manual muscle testing<sup>9</sup>. Pre and posttreatment flexibility and muscle strength tests were done by the same physiotherapist. Height (cm) and weight (kg) of all the subjects were measured and the body mass index (BMI) was calculated.

## Following Evaluations

After the initial visit, all patients were given appropriate home exercises for nine weeks. During this treatment period, pain intensity and muscle strength was evaluated every three weeks.

## Home Rehabilitation Program

The rehabilitation program was divided into three phases:

First phase (0-3<sup>th</sup> weeks): The immediate goals of the acute phase was to decrease pain, inflammation and loading at the patellofemoral joint. With this aim, the patients were given nonsteroidal anti-inflammatory drugs, ice and relative resting. Also some instructions were given to decrease loading such as postural correction, activity modification, changes in shoe wear. The home program consists of quadriceps setting, straight leg raising and isometric muscle strengthening exercises of hip adductors. Subjects were instructed to perform the exercises twice a day for 15-20 minutes per session and asked to apply an ice pack at the end of the session.

Second phase (4-6<sup>th</sup> weeks): After patellofemoral symptoms have subsided, we focused on restoring soft tissue mobility and strengthening of the extensor mechanism. Stretching exercises of the rectus femoris, hamstrings, gastro-soleus and iliotibial band were included in the home program.

Third phase (7-9<sup>th</sup> weeks): The goal of this late phase was returning the patient to his/her previous activity level. In addition to the previous exercises, patients were given a series of progressive functional activities. The patients who had no pain in bilateral shallow squatting, activities progressed to bilateral deep squatting and then unilateral squats and hopping activities. At the end of this 9 weeks program, patients were instructed on preventive measures.

## Statistical Analysis

Student t-test for paired samples were applied to the following criterion variables; intensity of pain

(VAS) measured prior and during treatment at 3<sup>rd</sup>, 6<sup>th</sup> and 9<sup>th</sup> weeks in 73 knees. For comparison of pre and posttreatment (at 9<sup>th</sup> week) quadriceps and hamstring muscle strength, Wilcoxon ranked sums test was used. The relation between duration of symptoms and intensity of knee pain was determined by Pearson's correlation coefficient. SPSS 8.0 for Windows program was utilized for statistical analysis.

**RESULTS**

In 73 knees of 62 subjects, the mean duration of symptoms before taking part in the study was 13.42 ± 19.46 (SD) months. The mean of BMI in 40 female subjects was 24.79 ± 3.73 (SD) kg/m<sup>2</sup> and 24.02 ± 3.56 (SD) kg/m<sup>2</sup> in 22 males. Mean value of BMI in 62 patients without considering the sexes, was 24.52 ± 3.66 (SD) kg/m<sup>2</sup>.

At the initial examination, climbing up stairs was found to be the most painful activity with a percentage of 61.29% of the subjects (Table I).

Table I  
**Distribution of Painful Activities in Patients with PFPS (n = 62)**

Activities	Percentage of Complaints
Ascending stairs	61.29
Descending stairs	59.67
Squatting	50.00
Walking for a long period	25.80
Descending an incline	6.45
Sitting for a long period	6.45
Ascending an incline	4.83

The mean baseline VAS pain score in 73 knees of the 62 patients was 7.23 ± 2.29 (SD). At the end of the 9 weeks home program, this mean score decreased to 2.43 ± 2.37 (SD). When the baseline VAS pain score was compared with the VAS pain scores of the 3<sup>rd</sup>, 6<sup>th</sup> and 9<sup>th</sup> weeks, statistically significant reductions were found in each follow-up (p<0.05) (Table II).

Table II  
**Comparison of Pretreatment and Follow-up Pain Intensity Score (VAS = 0-10 cm) (n = 73)**

	D	S <sub>D</sub>	t	P*
Pretreatment-3 <sup>rd</sup> weeks	1.57	1.71	7.83	<0,05
Pretreatment-6 <sup>th</sup> weeks	3.17	2.24	12.08	<0,05
Pretreatment-9 <sup>th</sup> weeks	4.79	2.23	18.32	<0,05

\* p: Student t-test.

Table III shows the distribution of patients in relation to the intensity of pain at the first visit and following treatment weeks. At the end of the home program, knee pain resolved completely or was minimized (pain score was 0-3) in 57.5% of the patients. Before the beginning of the treatment, baseline pain score was very high (between 9-10) in 32.88% of the patients, whereas this percentage decreased to 2.73% at the 6<sup>th</sup> week and to 0% at the 9<sup>th</sup> week (Table III).

Table III  
**Distribution of Patients with Respect to Pain Intensity (n = 73)**

Pain Score (VAS (0-10 cm))	First visit		3 <sup>rd</sup> weeks		6 <sup>th</sup> weeks		9 <sup>th</sup> weeks	
	n	%	n	%	N	%	n	%
0-3	2	2.73	9	12.32	24	32.87	42	57.53
3.1-6	22	30.14	28	38.38	30	41.09	21	28.76
6.1-9	25	34.25	26	35.61	17	23.28	10	13.69
9.1-10	24	32.88	10	13.69	2	2.78	0	0.00

When baseline and posttreatment quadriceps and hamstring muscle strength was compared, statistically significant differences were detected (p<0.05) (Table IV). Both muscle groups became stronger at the end of the home program with respect to the baseline period. No correlation was found between the duration of patellofemoral pain and the degree of pain reduction (r = -0.101, p<0,05).

Table IV  
**Comparison of Pre and Posttreatment (9<sup>th</sup> Weeks) Muscle Strengths (n = 73)**

Muscles	Z	P*
Quadriceps	-5.665	<0.05 P = 0.0001
Hamstring	-5.235	<0.05 P = 0.0001

\* p: Wilcoxon ranked sums test.

**DISCUSSION**

Patellofemoral pain is encountered in the general population as frequently as among athletes. The supervised physical therapy of these patients in the outpatient clinics is very difficult in our country's conditions owing to time and cost. For this reason, we decided to use a well planned home based rehabilitation program for these patients who are frequently referred to us. In this framework, 62 patients with chronic patellofemoral pain were treated with a home program consisting of three phases and the efficacy of this approach was investigated.

In our patients there was a long period between beginning of the symptoms and being referred to physical therapy. At attendance, their pain score was a mean of 7.23. At the end of 9 weeks rehabilitation, this score was reduced to 2.43. Most of the subjects had benefitted from the treatment. The reduction of patellofemoral pain to a minimum level in 42 of 73 knees (57.5%) shows that the treatment was successful in this group. Unfortunately, a pain expressed as 6.1-9 still continued in 10 knees (13.6%). The treatment didn't progress to the second phase in this group and it was decided that there was persistent damage in their patellofemoral joint. These patients were reevaluated for the patellofemoral surgery. Arthroscopic lateral retinacular release were performed all of them.

In an attempt to compare this study with the related literature, we were unable to find studies on the outcome of a home program for patellofemoral pain in the general population. In the studies of Devereaux and Lachman<sup>10</sup> and Dehaven et al<sup>11</sup>, the results of conservative treatment were more successful than ours, however their patients were selected from the athletic population. Gerrard stated good results in 86% of the patients treated with Mc Connell taping, isometric and eccentric exercises at the end of a 5 steps rehabilitation program<sup>12</sup>. The high rate of improvement in this study can be attributed to patellar taping and supervised clinical physiotherapy. It is suggested that external patellar supports such as taping and bracing improves patellar tracking and this form of treatment has produced successful clinical results<sup>3 4,5</sup>.

However there are contradictory opinions in radiologic studies. Larsen et al. reported an unpublished randomized controlled trial of the McConnell technique by Kowall (unpublished data, 1993) that improved some parameters, such as pain, radiographic findings and EMG activity, but the study concluded that "there is no beneficial effect of adding a patellar taping program to a standard physical therapy program"<sup>13</sup>. Bockrath et al stated that taping would not be effective in changing the patellofemoral congruency or patellar rotation angle but would reduce the pain<sup>14</sup>. Another study indicated that patellar taping is effective in medialising the patella but this position was not maintained after exercise<sup>13</sup>.

The reason why we couldn't use patellar taping in the present study is the uncertainty about its effectiveness. Also, we were unable to trust our patients on its correct application.

By taking into consideration activities which increase the patellofemoral joint reaction forces (PFJRF) and cause pain, we designed a muscle strengthening program in which joint stress would be minimal. This program consisted of open and closed kinetic chain quadriceps activities.

The isolated strengthening of VMO in restoring dynamic patellar stability seems possible according to biomechanical data. Although it is controversial whether isolated VMO exercises actually increases VMO strength or provides generalize quadriceps strengthening, this form of treatment has produced successful clinical results<sup>1,11,15</sup>. But recent studies indicate that VMO is never functions independent of vastus lateralis<sup>16,17,18</sup> and that quadriceps strengthening exercises also carries VMO up to the required threshold value<sup>19</sup>. In this study, the results of these recent studies were considered while planning extensor mechanism strengthening exercises and achieved good results. In our opinion, manual muscle testing is not a very suitable and sensitive method to assess the minimal differences in muscle strength objectively. Unfortunately, the pre and posttreatment measurements of torque for knee extension also EMG records were not performed because of the lack of equipment. However, all of the manual strength tests were done by the same physiotherapist.

Obesity can be a risk factor for patellofemoral pain syndrome since it causes increased patellofemoral joint reaction forces. It is observed that, average BMI of our patients was in the 25-26.9 kg/m<sup>2</sup>'s range which reflects first degree of obesity in both sexes<sup>20</sup>.

This study indicates that a well designed home program including quadriceps and hamstring muscle strengthening exercises, soft tissue stretches and biomechanical instructions can be useful in patients with patellofemoral syndrome.

We believe that, regular physiotherapy follow-up, good patient cooperation, and instructions supported with booklets and diagrams contributed to the efficacy of out-patient program.

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