

# Comparison of the effects of a physiotherapy protocol and platelet-rich plasma treatment on pain, functionality, and kinesiophobia in women with medial compartment osteoarthritis of the knee

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## Abstract

**Introduction.** Although the popularity of platelet-rich plasma treatments has recently increased, physiotherapy is still one of the recommended methods of gonarthrosis treatment. The aim of the study was to examine the preferability of lower-cost physiotherapy compared with high-cost platelet-rich plasma treatment for gonarthrosis and the effects of both treatments on pain, functionality, and kinesiophobia.

**Methods.** Overall, 61 women participated in this randomized controlled study. The first group (physiotherapy) received conservative physiotherapy treatment (hot pack, ultrasound, transcutaneous electrical nerve stimulation, manual therapy) and home exercises. The second group (platelet-rich plasma) underwent only a home exercise program. An isometric knee exercise, an isotonic knee exercise, and dynamic step exercises for the quadriceps femoris muscle were planned for the home exercises. Exercise program compliance was monitored by exercise diary and telephone calls every day. The patients were evaluated in terms of pain levels, physical limitations (WOMAC and Lysholm scales), and kinesiophobia (Tampa Scale for Kinesiophobia). Data were collected 4 times (before treatment and in the 4<sup>th</sup>, 8<sup>th</sup>, and 12<sup>th</sup> week).

**Results.** The patients' average age was  $60.92 \pm 10.67$  years. In both groups, there was a decrease in pain and WOMAC and Tampa scores, and an increase in Lysholm scores compared with the pre-treatment outcomes ( $p < 0.05$ ). No between-group difference in these parameters was observed ( $p > 0.05$ ).

**Conclusions.** The scarce difference in the indirect comparisons of the groups in terms of pain, functionality, and kinesiophobia scores may indicate that the two treatment methods may be equally recommended.

**Key words:** platelet-rich plasma, physiotherapy, knee joint, gonarthrosis

## Introduction

Osteoarthritis is a degenerative disease of the knee joint which is characterized by joint pain and dysfunction that causes loss of the joint cartilage [1]. Its prevalence increases in men over 50 and in women over 40 years of age [2]. Osteoarthritis affects many joints and is especially common in the knee, hip, and first metatarsophalangeal joints, as well as in cervical and lumbar spine [3].

The aims of gonarthrosis treatment are to reduce the pain, eliminate the joint stiffness, protect and improve the joint movements, maintain and increase the muscle strength, improve the quality of life, and eliminate the kinesiophobia. Pharmacological treatments, physiotherapy and rehabilitation, intraarticular treatments, platelet-rich plasma (PRP) treatments, and surgery are the recommended treatment methods in gonarthrosis [4, 5]. Conservative physiotherapy for osteoarthritis includes various therapeutic methods, such as thermotherapy, spa, balneotherapy, low-power laser therapy, electrical stimulations, short-wave diathermy, ultrasound, acupuncture, manual therapy, and exercise [6]. Besides, the invasive methods such as intra-articular corticosteroid or PRP injections are common in osteoarthritis treatment [7]. In spite of the popularity of PRP treatment, physiotherapy is still one of the recommended methods, and physiotherapy interventions may reduce the need for invasive treatment [8]. Physio-

therapy is a treatment method in which the patient works one-on-one with the physiotherapist, so it keeps a high motivation of the patient and meets their expectations at a high rate. It is also considered to be different from other treatment options owing to its cost-effectiveness. At public hospitals in Turkey, the cost of this method varies from 25 to 45 Turkish liras for a session, while the price of PRP treatment varies from 150 to 175 Turkish liras per session (excluding the cost of materials). In private hospitals, this charge is even higher [9].

As stated by Mangone et al. [10], there is insufficient evidence regarding the high-cost PRP treatment; studies presenting positive, as well as negative results can be found. Therefore, the data available need to be expanded with new research. In the presented prospective, comparative, and cross-sectional study, we aimed to examine the preferability of low-cost physiotherapy compared with high-cost PRP treatment for gonarthrosis and the effects of these treatments in terms of pain, functionality, and kinesiophobia.

## Subjects and methods

### Participants

The female patients who were admitted to the Private Anamed Hospital (Mersin, Turkey), diagnosed with medial compartment osteoarthritis of the knee (between August

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2019 and March 2020), and referred to physiotherapy or PRP treatment by the physician voluntarily participated in this study. The study groups were randomly selected in accordance with the patient protocol numbers. The PRP group consisted of patients whose treatment decision was taken by the same physician.

All study subjects were women aged over 40 years who presented bilateral degenerative medial compartment knee arthritis grade II or III according to the Kellgren-Lawrence scale and had pain complaints (for more than 3 months) of 4 or above according to the visual analogue scale (VAS). Patients who were diagnosed with osteoarthritis of the knee grade I or IV according to the Kellgren-Lawrence scale, received unilateral treatment, complained of pain below level 4 according to VAS, had experienced pain for less than 3 months, or had previously undergone knee surgery were not included in the study. Participants were excluded from the analysis if they wanted to leave the study, received additional treatments related to the knee during the study, discontinued the treatment for any reason, or exhibited less than 80% compliance with the home exercises. The inclusion criteria were met by 70 patients and the study was carried out among 61 subjects (Figure 1).

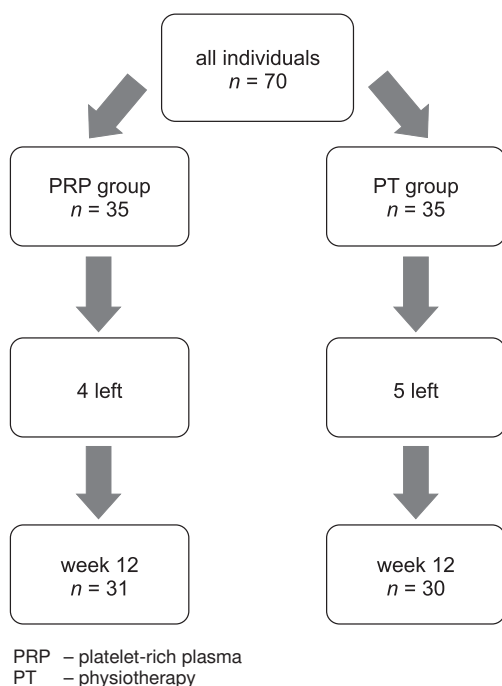


Figure 1. Study flow-chart

## Procedure

The characteristics of the patients were recorded. The subjects were evaluated for pain levels with VAS, for physical limitations with the WOMAC index, for functionality with the Lysholm Knee Scoring Scale, and for kinesiophobia levels with the Tampa Scale for Kinesiophobia [11–14]. The participation in the exercise program was followed with an exercise follow-up form. Data were collected 4 times (before treatment, in the 4<sup>th</sup> week, in the 8<sup>th</sup> week, and in the 12<sup>th</sup> week).

## Treatment protocol

A home exercise program followed by PRP injections was administered to the patients in the PRP group. A total of 3 injections with 4-week intervals were applied and the patients' compliance with the home exercise program was followed daily for 12 weeks by phone calls. Approximately 8 cm<sup>3</sup> of venous blood was taken from the upper extremity with the PRP kit and prepared for centrifugation. Centrifugation was performed for 15 minutes at 4000 rpm with a 800D CENTRIFUGE (Medwelt Healthcare Products, Turkey) device. After centrifugation, the middle layer of blood was drawn into the injector and about 3 cm<sup>3</sup> of PRP for each knee was prepared. The joint space was detected in the anterior-inferior region of the knee from the lateral side of the patellar tendon with palpation while the patient was sitting and the knee was flexed. After the injection, the patient was treated with ice (10 minutes). The same PRP kit (REDkit) was used for all subjects.

An isometric knee exercise, an isotonic knee exercise, and dynamic step exercises for the quadriceps femoris muscle were planned for the home exercises (Figure 2). The patient was motivated to perform these exercises with 2 sets of 10 repetitions per knee in a day. During the movement, the contraction time was 5 seconds, and the rest time was 3 seconds. Also, there was a rest time of 3 minutes between the 2 sets. Conservative physiotherapy (hot pack, ultrasound, transcutaneous electrical nerve stimulation [TENS], manual therapy) was administered in the physiotherapy group for 3 weeks (15 sessions). An approximately 50°C hot pack was applied for 20 minutes. Ultrasound was performed with 1 MHz frequency and 1 W/cm<sup>2</sup> power with circular movements around the patella for a total of 10 minutes, 5 minutes for each knee. Conventional TENS was implemented by using the 'Program 5 constant modulation' option of a HT-66B TENS Unit (Hometech, Taiwan) with 100 Hz frequency, 100 µs pulse, and 10–30 mA amplitude intensity by creating a slight tin-



Figure 2. Isometric, isotonic, and dynamic step exercises for quadriceps femoris muscle



Figure 3. Medial and lateral shift technique



Figure 4. Patella mobilization

gling. Lateral and medial shift methods were selected from Mulligan’s mobilization with movement techniques as the manual therapy approach (Figure 3). Then, patella mobilization was performed as 2 sets for 20 seconds of lateral, medial, superior, and inferior glides of the patient’s knee (Figure 4). The same exercises were administered to both the physiotherapy group and the PRP group as a home program.

**Statistical analysis**

The data were evaluated with the SPSS 23.00 package program. After the Shapiro-Wilk test, the distribution of the descriptive characteristics of the participants was indicated with arithmetic mean, standard deviation, percentile slice, and min-max values. Independent samples *t*-tests were used to compare normally distributed variables. Repeated measures analysis of variance (ANOVA) served to analyse the data collected before treatment and in the 4<sup>th</sup>, 8<sup>th</sup>, and 12<sup>th</sup> week. The value of *p* < 0.05 was considered as significant.

**Ethical approval**

The research related to human use has complied with all the relevant national regulations and institutional policies,

has followed the tenets of the Declaration of Helsinki, and has been approved by the Research Ethics Committee of the Faculty of Health Sciences, Hasan Kalyoncu University (decision No.: 2019/69).

**Informed consent**

Informed consent has been obtained from all individuals included in this study.

**Results**

The average age of all patients was 60.92 ± 10.67 years (min-max: 50–85). Age, height, weight, and body mass index averages of the groups were similar (*p* > 0.05). The demographic characteristics of the participants are shown in Table 1.

The ANOVA test was performed for the repeated measurements to compare the scale scores and pain scores of the patients. We found that the results of the measurements performed at 4 different times were significantly different. Post-hoc Bonferroni correction was applied to determine the source of the differences; a significant difference was revealed between the average scores of VAS during activ-

Table 1. Distribution of age, height, weight, and body mass index averages of individuals

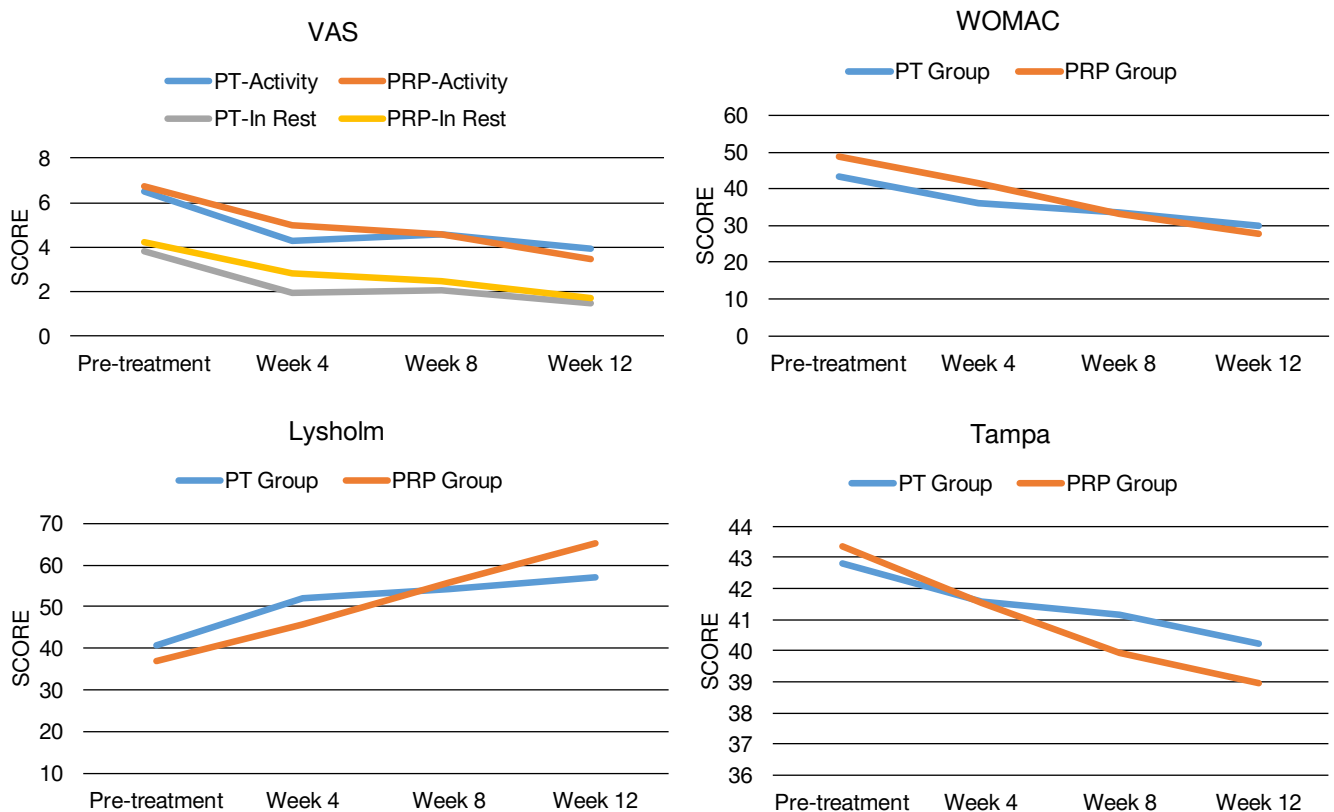
Characteristics	PT group (n = 30) Mean ± SD	PRP group (n = 31) Mean ± SD	t/z	p
Age	63.33 ± 9.79	58.26 ± 10.61	1.940	0.057
Height	159.03 ± 5.63	159.61 ± 6.14	-0.384	0.702
Weight	79.87 ± 12.27	77.46 ± 10.80	0.812	0.420
Body mass index	31.68 ± 5.28	30.38 ± 4.53	1.029	0.308

PT – physiotherapy, PRP – platelet-rich plasma  
 Statistical significance at *p* < 0.05, independent samples *t*-test

Table 2. VAS, WOMAC, Lysholm, and Tampa scores before treatment and at the end of weeks 4, 8, and 12

Adjustment variable	Group	Before treatment Mean ± SD	Week 4 Mean ± SD	Week 8 Mean ± SD	Week 12 Mean ± SD	F	η <sup>2</sup>
VAS during activity	PRP (n = 31)	6.71 ± 1.77	4.98 ± 2.53	4.56 ± 2.09	3.47 ± 2.27	35.093*	0.373
	PT (n = 30)	6.50 ± 1.44	4.26 ± 1.90	4.55 ± 1.79	3.94 ± 1.95		
VAS during rest	PRP (n = 31)	4.21 ± 1.78	2.83 ± 2.15	2.46 ± 1.89	1.74 ± 1.99	34.750*	0.371
	PT (n = 30)	3.79 ± 1.67	1.92 ± 1.59	2.05 ± 2.01	1.49 ± 1.88		
WOMAC	PRP (n = 31)	48.61 ± 16.28	41.55 ± 14.41	33.35 ± 11.66	27.87 ± 11.62	46.87*	0.443
	PT (n = 30)	43.30 ± 13.68	36 ± 10.59	33.47 ± 10.78	29.93 ± 11.10		
Lysholm	PRP (n = 31)	37.06 ± 17.72	45.65 ± 17.79	55.84 ± 16.64	65.26 ± 16.55	59.173*	0.501
	PT (n = 30)	40.80 ± 17.20	51.97 ± 16.03	54.07 ± 18.31	57.20 ± 20.16		
Tampa	PRP (n = 31)	42.80 ± 7.47	41.60 ± 6.86	41.17 ± 7.47	40.23 ± 7.55	16.976*	0.223
	PT (n = 30)	42.80 ± 7.47	41.55 ± 6.14	39.94 ± 6.32	38.97 ± 6.62		

PRP – platelet-rich plasma, PT – physiotherapy, VAS – visual analogue scale, WOMAC – Western Ontario and McMaster Universities Osteoarthritis Index, Lysholm – Lysholm Knee Scoring Scale, Tampa – Tampa Scale for Kinesiophobia  
 \* statistical significance at  $p < 0.001$ , repeated measures analysis of variance (ANOVA)



PT – physiotherapy, PRP – platelet-rich plasma  
 Figure 5. Distribution of pain, functionality, and kinesiophobia scores in time

ity and VAS at rest, the WOMAC index, and the Lysholm and Tampa scores in all groups ( $p = 0.001$ ). Also, we established the intervention effect size as 37%, 37%, 44%, and 50%, respectively (Table 2).

The mean scores of VAS during activity and at rest, the WOMAC index, and the Lysholm and Tampa scores were found to differ in time in both groups ( $p < 0.05$ ). Both groups' VAS, WOMAC, and Tampa scores of week 4, week 8, and week 12 decreased compared with the average outcomes in the pre-treatment evaluation. Lysholm scores of both groups increased in week 4, week 8, and week 12 compared with the average outcomes in the pre-treatment evaluation (Figure 5).

## Discussion

In this study, which aimed to examine the preferability of PRP treatment compared with lower-cost physiotherapy and the effects of the treatments, conservative physiotherapy and a home program were applied to one of the study groups, while PRP treatment and a home program were administered in the other.

It is known that the age limit in the diagnostic criteria for osteoarthritis of the knee is 38 years; the condition is observed more often in women and its incidence increases over the age of 40 years [15, 16]. Because osteoarthritis is more common in women, we included only female individuals in our study. Also, the average age of the participants was  $60.92 \pm 10.67$  years (min-max: 50–85).

There are many risk factors for gonarthrosis. Especially, overweight persons are at a high risk of osteoarthritis. In a study by Öz et al. [17], obesity was stated to be directly related to osteoarthritis risk factors. Raud et al. [18] also emphasized that obesity was a risk factor for osteoarthritis and exerted negative effects on pain and function. Our participants' average body mass index equalled  $31.02 \pm 4.91$  (min-max: 21–45)  $\text{kg}/\text{m}^2$  and the majority of the sample consisted of obese individuals.

In the physiotherapy treatment of osteoarthritis, hot and cold applications, therapeutic ultrasound, TENS, and acupuncture were the most commonly used methods [6]. Therapeutic ultrasound applications relieve pain and positively affect the physical function of patients with osteoarthritis [19, 20]. TENS can be added to the treatment to reduce pain in osteoarthritis [21, 22]. In the light of the literature recommendations, we used ultrasound, TENS, and hot applications in addition to manual therapy in the conservative physiotherapy program and we strengthened our treatment protocol.

The evidence level of the effect of strengthening exercises for the quadriceps femoris muscle is high [21]. It is highlighted that therapeutic exercises should be included in the main treatment program for osteoarthritis in addition to the various physiotherapy modalities [6]. As strengthening exercises are effective for knee osteoarthritis, we also recommended isometric and isotonic strengthening exercises for the quadriceps femoris muscle and dynamic step exercises as a home-based exercise program for both patient groups. The treatment protocol consisted of local exercises involving the knee. The 22% change in kinesiophobia scores could have resulted from the local exercises that were applied only to the knee. We suppose that kinesiophobia would heal more with different kinds of exercise.

There are studies which compared conservative physiotherapy with PRP treatment. Lin et al. [23] investigated the effectiveness of PRP injection in patients with rotator cuff tendinopathy. As a result of that study, the effectiveness of PRP injection vs. placebo injection and physiotherapy in the

control group was not distinguished in terms of pain reduction and functional recovery in the short term (3–6 weeks) or medium term (12 weeks). However PRP injection provided significant pain relief in periods exceeding 24 weeks, although it was not found more effective in functional recovery as compared with the control group. In our study, we did not observe a difference between the PRP and the physiotherapy groups with regard to pain or functional recovery in short (3–6 weeks) or medium (12 weeks) periods. In this sense, our results were similar to those obtained by Lin et al. [23]. Pasin et al. [24] applied a physiotherapy program (TENS, ultrasound, and hot application), PRP injection, and corticosteroid injection to 90 patients. They divided the subjects into 3 groups and aimed to compare the effects of these treatments on pain, functionality, and quality of life in patients with subacromial compression syndrome. An exercise program was also administered to all groups. In the 8<sup>th</sup> week, the PRP group showed higher scores in functionality. VAS during rest and activity and SF-36 pain sub-parameter were compared between the groups. All treatment methods turned out effective in subacromial compression syndrome; the cheap, non-invasive physiotherapy method should be the first preferred treatment method. Contrary to the study by Pasin et al. [24], in week 8, we found no difference between the PRP and physiotherapy groups in terms of VAS scores. We also observed that the effects of both interventions were greater in the functionality scores, as implied by the WOMAC and Lysholm score effect sizes in both groups.

Van Ark et al. [25] aimed to report the results of PRP injection combined with physical therapy applied in patients with patellar tendinopathy. The exercise-based program administered after PRP injection was promising in these individuals and it was possible to use the methods in combination. In a study by Filardo et al. [26], patients with chronic jumper's knee were treated with multiple PRP injections and physiotherapy. The results were compared with a group treated with a physiotherapy approach. The data were clinically evaluated before treatment, after treatment, and 6 months later, and a significant improvement was observed in all scores after PRP injections. When physiotherapy was added to the treatment, further improvement was recorded. Baysal et al. [4] examined physiotherapy and PRP injection in gonarthrosis treatment. Patients diagnosed with gonarthrosis were included in the study and divided into 3 groups. A total of 15 sessions of TENS, ultrasound, and hot/cold application, as well as a 15-day home exercise program were administered in the physiotherapy group. A home exercise program for 15 days after PRP injection was given to the PRP group. The control group received only a home exercise program for 15 days. After the treatment, there was a significant difference in pain and in the WOMAC score in all groups. It was stated that in addition to electrotherapy and PRP injection, a home exercise program can be used to relieve symptoms of the disease and improve quality of life. This study was similar to our research in terms of groups and treatment protocols. The differences in our study involved the injection intervals (4 weeks) and the addition of manual therapy applications to the treatment program for the physiotherapy group.

Mangone et al. [10] stated that PRP injections could be considered as a valid method for controlling pain, stiffness, and joint function, but they should be treated as a second-line approach in gonarthrosis therapy owing to the high cost. We agree with this view as a result of our study, and also we believe that the relatively low-cost physiotherapy program reinforced with manual therapy and exercise should be preferred as a primary treatment of gonarthrosis as it may reduce

the need of invasive treatment. The results of our study may contribute to the literature referring to the effects of PRP treatment and physiotherapy and raise the awareness of examining the choice of physiotherapy or PRP in the clinical practice.

## Limitations

One of the limitations of our study was that the PRP injections were not performed with imaging techniques; moreover, the home exercise follow-up was based on the patients' statements. In future research, an injection group could be added as a control group, and cost studies can also be carried out to provide cost data concerning both the PRP injections and physiotherapy treatment.

## Conclusions

In conclusion, we can state that both investigated treatments are effective for gonarthrosis. The fact that there was no much difference in the indirect comparisons of the groups may indicate that the two treatment methods may be equally recommended. Therefore, we recommend that the physiotherapy program, which is associated with a relatively low cost, should be preferred as the primary treatment for gonarthrosis.

## Disclosure statement

No author has any financial interest or received any financial benefit from this research.

## Conflict of interest

The authors state no conflict of interest.

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