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Effects of Physical Therapy on Pain Severity and Knee Related Symptoms in Knee Osteoarthritis with or without Neuropathic Pain

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ABSTRACT

Introduction: There is increasing awareness of the existence of neuropathic pain (NP) symptoms in addition to mechanical pain in knee osteoarthritis (OA). The aim of this study is to evaluate the effect of physical therapy on NP in women with OA.

Methods: Forty-one women with symptomatic OA according to American College of Rheumatology criteria who underwent 15 sessions of physical therapy were included in this retrospective study. Pain severity was evaluated using the Numeric Pain Rating Scale (NPRS). PainDETECT was used to assess NP. Those with a PainDETECT score between 13 and 38 were considered to have NP. Patients without NP were classified as group 1, and patients with NP were classified as group 2. The Knee Injury and Osteoarthritis Outcome Score (KOOS) was used to evaluate knee-related conditions.

Results: Mean age was 57.8±5.9 years. Mean duration of pain was 24 months (median 108) in group 1 and 54 months (median 102) in group 2 (p=0.163). NP was detected in 14 patients (34%). Mean NPRS scores at baseline were 6.0 (3.0) and 10.0 (0.3) in groups 1 and 2, respectively. Mean NPRS scores after treatment were 3.0 (3.0) and 8.0 (2.5) in groups 1 and 2, respectively. The mean NPRS score decreased significantly in both groups ($p<0.05$). Mean NPRS scores one month later were 2.0 (3.0) and 7.5 (3.0) in groups 1 and 2, respectively ($p<0.05$). In group 1, a significant improvement was observed in all KOOS domains after treatment and at the 1st-month control ($p<0.05$). However, significant increases were observed only in the KOOS pain and activities of daily living subgroups of group 2 after treatment ($p<0.05$). Multiple linear regression analysis revealed that NP was a negative predictive factor for improvement in KOOS symptom and quality-of-life subscores after treatment and at the end of the first month (p=0.001, p=0.032).

Conclusion: In this study, NP was present in almost 1/3 of OA cases and negatively affected pain relief after physical therapy. Furthermore, NP was a negative predictive factor for improvement in knee-related function and quality of life.

Keywords: Knee osteoarthritis, physical therapy, neuropathic pain

Introduction

Knee osteoarthritis (OA) is a progressive degenerative joint disease primarily characterized by chronic pain and functional impairment. While knee OA pain is predominantly nociceptive, it can sometimes have nociplastic or neuropathic characteristics (1). A previous meta-analysis reported rates of possible neuropathic pain (NP) and probable NP in patients with knee OA assessed with the PainDETECT questionnaire as 40% and 20%, respectively (2). In another study, NP prevalence has been reported 23% in knee or hip OA (3). A previous study by Güngör Demir et al. (4) using the Douleur Neuropathique-4 (DN4) questionnaire reported a NP rate of 49% in patients with knee OA. Moreover, Golob et al. (5), concluded that 14.8% of the patients with knee OA had possible NP, whereas 24.6% had probable NP using the PainDETECT questionnaire.

Classic treatment for knee OA primarily involves patient education, protective measures, and physical therapy interventions. Simple analgesics are generally used as first-line treatment. However, it has been suggested that simple analgesics are less effective in individuals with NP (5). In symptomatic patients with a NP component, adding centrally acting analgesics to the treatment regimen is usually more beneficial than regimens without them. Psychological and physical methods are frequently used together in the treatment of NP. However, there is a paucity of rigorous studies evaluating the efficacy and safety of these

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therapeutic interventions (6). Physical therapy methods, consisting of various physical activities and exercises, can improve function and alleviate pain. However, a previous study on individuals with lower extremity OA suggested that improvement was less pronounced after a 12-week exercise program in those who had NP-like symptoms prior to treatment (7). The cornerstone of knee OA treatment includes patient education, alongside optimizing body weight and engaging in exercises (8).

Antidepressant medications have demonstrated only minimal improvements in pain and function among patients with OA (9). However, they should be used with caution due to potential side effects.

A limited body of research examines the effects of physical therapy interventions on individuals with NP secondary to OA. This study aims to evaluate improvement in pain following physical therapy in this population.

Methods

Forty-one women who were admitted to the outpatient clinics of University of Health Sciences Türkiye, İstanbul Physical Therapy Rehabilitation Training and Research Hospital between 01.08.2018 and 31.12.2018 with symptomatic knee OA according to American College of Rheumatology criteria and who were scheduled for 15 sessions of physical therapy [hot pack, transcutaneous electrical nerve stimulation (TENS), short-wave diathermy or ultrasound] were included in this retrospective study. Patients with additional comorbidities that could cause NP were excluded from the study. This study was approved by the University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (protocol code: 2020/111, decision number: 2020-05-16, date: 02.03.2020). Patients participating in the study were asked to sign an informed consent form. Demographic and clinical characteristics before treatment, at the end of treatment, and 1 month after treatment were recorded. Numeric Pain Rating Scale (NPRS), Turkish version of PainDETECT questionnaire for NP and Turkish version of knee injury and Osteoarthritis Outcome Score (KOOS) scores were completed from the patients' files. Those with a PainDETECT score between 13 and 38 were considered to have NP. Patients without NP were classified as group 1, and patients with NP were classified as group 2.

Numeric Pain Rating Scale

NPRS is an 11-point metric ranging from 0 to 10, where 0 indicates the complete absence of pain and 10 represents the maximum possible pain. Within this framework, patients are required to verbally designate a numerical value that best reflects the intensity of pain experienced during the preceding 24-hour period. Additionally, a written format is commonly used, with values from 0 to 10 expressed in words. The NPRS demonstrates commendable sensitivity while yielding data amenable to statistical analysis (10).

PainDETECT Questionnaire

The PainDETECT questionnaire, initially created for chronic low back pain, has been adapted for knee OA and shown to be effective in detecting NP components. This assessment includes seven weighted sensory-descriptive questions and two items illustrating the temporal and propagation aspects of pain. The overall score ranges from 0 to 38 points. For NP, a score of ≤12 indicates low probability; scores within 13-18 indicate indeterminate probability; and a score of ≥19 indicates high probability (11). In our study, the Turkish version of PainDETECT Questionnaire was used (12).

Knee Injury and Osteoarthritis Outcome Score

The KOOS consists of five dimensions relevant to patients, each assessed individually: pain, symptoms, activities of daily living (ADL), sports and recreational functions, and overall quality of life. It employs a Likert scale, providing five possible response options rated from 0 (indicating no issues) to 4 (indicating severe issues); the score for each of the five dimensions is the total of the respective items, where a score of 0 reflects a significant knee problem, while a score of 100 indicates no knee issues (13). The reliability and validity of the KOOS-Turkish version have been evaluated in individuals with knee OA (14).

Statistical Analysis

The Shapiro-Wilk test was used to assess whether the data conformed to a normal distribution for statistical analysis. The Friedman and Wilcoxon tests were used to compare means within groups, while the Mann-Whitney U test was used to compare means between groups. To evaluate the impact of potential confounding variables on improvements as measured by KOOS and NPRS, a multiple linear regression analysis was conducted. Data analysis was performed using the SPSS 22.0 software. A p value of less than 0.05 was regarded as statistically significant.

Results

Demographic and clinical features are outlined in Table 1. The average duration of knee pain was 67.0±72.3 months. An NP component was identified in 14 (34%) patients based on assessments using the PainDETECT score. No statistically significant differences were found between the two groups in the patients' demographic, anthropometric, and clinical characteristics (Table 1).

The intensity of pain assessed using the NPRS score showed a significant reduction following treatment and at the end of the first month in patients without NP (group 1) ($p=0.0001$) (Table 2). In group 2, a notable decrease in pain was observed after treatment ($p=0.003$) and at the end of the first month post-treatment ($p=0.001$) compared with pre-treatment levels.

Pain intensity, as measured by NPRS, decreased by 21.8% and 42.3% at the end of physical therapy in the groups with and without NP, respectively ($p=0.012$). By the first month after treatment, pain relief in the groups with and without NP was 33.7% and 48.0%, respectively ($p=0.005$).

In the group, 1 notable enhancements were seen in the KOOS pain symptom, ADL, sports activity, and quality of life sub-scores following treatment and one month after the treatment concluded ($p<0.001$) (Table 2). However, in group 2, significant improvement was found only in the KOOS pain and ADL sub-scores after treatment and at the end of the first month after treatment ($p=0.007$, $p=0.003$).

Multiple linear regression analysis was conducted to determine the effect of NP on KOOS-assessed improvement while controlling for potential confounding factors. The results demonstrated that NP was a significant determinant of clinical outcomes. Accordingly, NP was identified as a negative predictor of improvement in the KOOS symptom subscale both at the end of treatment and at 1 month post-treatment. This finding indicates that the presence of NP adversely affects improvement as measured by the KOOS symptom score (Table 3).

Furthermore, the PainDETECT score was found to be a significant negative predictor of improvement in the KOOS quality of life subscale at both the end of treatment and at 1 month post-treatment. As the NP score increased, the degree of improvement in KOOS quality of life decreased (Table 3).

Discussion

In this study, the NP rate was 34% among patients with knee OA. The severity of pain and disability was high among the knee OA patients with an NP component. Pain intensity was reduced significantly after 15 sessions of physical therapy for a total of 3 weeks in patients with and without NP, both after treatment and at the 1st-month controls.

Table 1. Demographic and clinical characteristics

	Group 1 n=27	Group 2 n=14	p value
Age (years)	57.0±7.0	57.0±10.3	0.879
BMI (kg/m^2)	32.0±10.0	35.0±8.3	0.424
Duration of education (years)	5.0±5.0	5.0±7.3	0.872
Duration of knee pain (months)	24.0 (108.0)	54.0 (102.0)	0.163
Duration of last episode of knee pain (weeks)	4.0 (5.0)	8.0 (6.5)	0.063
Kellgren-Lawrence scores-right knee	2.0 (1.0)	3.0 (1.0)	0.442
Kellgren-Lawrence scores-left knee	2.0 (1.0)	3.0 (1.0)	0.586

Data is given as median (interquartile range). Means were compared with Mann-Whitney U test. BMI: Body mass index

Table 2. KOOS and NPRS scores in two group pre-treatment, end of the treatment and after one month. The effect of physical therapy on recovery, as assessed with NPRS scores and KOOS subscores, was evaluated in groups defined by PainDETECT scores

KOOS	Group	Pre-treatment	End of the treatment	One month after treatment	p value
Pain	Group 1	53.0 (25.0)	67.0 (25.0)	78.0 (22.0)	**0.0001**
	Group 2	36.0 (16.8)	36.0 (19.8)	44.0 (20.5)	**0.007**
Symptom	Group 1	68.0 (26.0)	71.0 (24.0)	82.0 (21.0)	**0.0001**
	Group 2	54.0 (23.8)	49.5 (28.3)	57.0 (26.8)	0.726
ADL	Group 1	59.0 (32.0)	71.0 (19.0)	79.0 (24.0)	**0.0001**
	Group 2	43.5 (23.3)	43.5 (20.3)	53.5 (18.3)	**0.003**
Sport	Group 1	25.0 (25.0)	40.0 (20.0)	40.0 (25.0)	**0.002**
	Group 2	7.5 (21.3)	15.0 (23.8)	20.0 (21.3)	0.133
Quality of life	Group 1	43.0 (19.0)	50.0 (25.0)	50.0 (31.0)	**0.0001**
	Group 2	25.0 (10.8)	28.0 (16.0)	31.0 (14.3)	0.192
NPRS	Group 1	6.0 (3.0)	3.0 (3.0)	2.0 (3.0)	0.0001
	Group 2	10.0 (0.3)	8.0 (2.5)	7.5 (3.0)	0.0001

Data are presented as median (interquartile range). Means were compared using the Friedman test. KOOS: Knee Injury and Osteoarthritis Outcome Score, NPRS: Numeric Pain Rating Scale

Table 3. The effect of neuropathic pain on recovery. A regression model

Outcome variable	Predictor variable	B	Std. Beta	Sig.	Adj R^2	F	p	Durbin-Watson	VIF
KOOS symptom End of the treatment	(Constant)	8.2		0.004	0.141	7.5	0.009	2.1	
	Presense of neuropathic pain	-12.5	-0.41	0.009					1.01
KOOS symptom One month after treatment	(Constant)	12.3		0.001	0.09	4.9	0.032	2.2	
	Presense of neuropathic pain	-10.7	-0.34	0.032					1.00
KOOS-QOL End of the treatment	(Constant)	18.8		0.001	0.099	5.3	0.026	1.5	
	PainDETECT score	-1.0	-0.35	0.026					2.76
KOOS-QOL One month after treatment	(Constant)	24.3		0.001	0.095	5.2	0.028	1.7	
	PainDETECT score	-1.0	-0.34	0.028					1.00

KOOS: Knee Injury and Osteoarthritis Outcome Score, QOL: Quality of life, Std. Beta: Standardized beta coefficient, Sig.: Significance, Adj R^2: Adjusted R-squared, VIF: Variance inflation factor

Definition of NP in patients with knee OA is useful for planning the treatment (15).

A notable discovery from this research was that the group without the NP component exhibited significant improvements in KOOS pain scores, ADL, sports activity, and quality of life subgroups after treatment and at the 1st month control. However, the patients showed a significant improvement only in the KOOS pain and ADL subgroups of the NP group (Table 2). Polat et al. (16) reported that there was a significant improvement in WOMAC pain and stiffness scores ($p<0.05$) after 15 sessions of TENS and hot pack application in knee OA patients both with and without NP.

In a previous study, a poor improvement has been found after 15 sessions of physical therapy in knee OA patients with central sensitization and depression (17). In another study, the authors concluded that the patients with lower extremity OA who had NP as measured by PainDETECT questionnaire, showed a weak improvement in pain after 12-week exercise program (7).

In this study, pain severity and disability were higher in patients with an NP component. NP, pain catastrophism and central sensitization accompanies reduced knee related functional status in knee OA (18). In a study conducted by Aşkın et al. (19) with 60 patients with knee OA, NP component was detected in 66.7% of the patients according to the PainDETECT score and 46.7% according to the DN4 score. In another study conducted by Garip et al. (20), in which 150 patients participated, the prevalence of NP was reported as 44% ($p=0.00$). Similarly, Hochman et al. (21), found that the NP rate is 34% in a study with 80 knee OA patients. In another study, the NP rate was 31.1% among 109 patients with knee OA, as measured by the PainDETECT questionnaire. Scores ≥19 were accepted as likely NP, ≥13 to ≤18 as possible NP and ≤12 as unlikely NP (22). In another study conducted by Dainese et al. (23) with 96 patients, the NP rate was reported as 40% by using the PainDETECT questionnaire. In our study, this rate 34% of the patient population and was consistent with previous studies.

These results highlight the significance of considering NP in the treatment of knee OA, as it influences treatment outcomes and patient-reported improvements. The results of this study suggest that addressing NP alongside conventional OA management may be crucial for optimizing patient care and enhancing treatment efficacy. These insights contribute to a more comprehensive understanding of the multifaceted nature of knee OA and highlight the significance of tailored treatment approaches based on individual pain profiles.

Study Limitations

This study has strengths and limitations. Its strengths are that all of the tests were conducted through face-to-face interviews, both NP and pain severity were assessed, and patients were followed up after treatment. Its limitations are that it was conducted with a relatively small number of patients and a retrospective design.

Conclusion

NP in women with knee OA can significantly influence the response to physiotherapy interventions. Tailoring a special physiotherapy program to consider the NP component and pain sensitization may lead to better outcomes in knee-related pain and function in these patients.

Ethics

Ethics Committee Approval: This study was approved by the University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (protocol code: 2020/111, decision number: 2020-05-16, date: 02.03.2020).

Informed Consent: Patients participating in the study were asked to sign an informed consent form.

Footnotes

Authorship Contributions: Surgical and Medical Practices - A.K., Z.S.E.; Concept - F.S., D.B., A.K., Z.S.E.; Design - F.S., D.B.; Data Collection or Processing - F.S., D.B., A.K., Z.S.E.; Analysis or Interpretation - F.S., D.B., N.P.; Literature Search - F.S., D.B., N.P.; Writing - F.S., D.B., İ.K., N.P., A.K.

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