

University of Novi Sad, Faculty of Medicine Novi Sad¹
University Clinical Center of Vojvodina, Novi Sad, Medical Rehabilitation Clinic²
Institute of Public Health, Novi Sad³
Special Hospital for Rheumatic Diseases, Novi Sad⁴

Original study
Originalni naučni rad
UDK 616.728.3-002:615.8
<https://doi.org/10.2298/MPNS2308203D>

INFLUENCE OF THE OUTCOME OF KNEE OSTEOARTHRITIS TREATMENT ON PATIENT

UTICAJ ISHODA LEČENJA OSTEOARTROZE KOLENA NA FUNKCIONALNOST PACIJENTA

Jelena ĐUKIĆ^{1, 2}, Maja JEVTIĆ^{1, 3} and Ksenija BOŠKOVIĆ^{1, 4}

Summary

Introduction. The aim of this work is to evaluate the impact of physical procedures on the functional status of patients with gonarthrosis. **Material and Methods.** 30 patients with knee osteoarthritis were examined (9 male patients, 21 female patients) in the prospective study. All patients were treated on an outpatient basis in the Special Hospital for Rheumatic Diseases in Novi Sad during 2022. Functional status and quality of life were assessed with use of the Western Ontario and McMaster Universities Arthritis Index questionnaire and a specific questionnaire for patients with knee osteoarthritis. The Western Ontario and McMaster Universities Arthritis Index is a standardized questionnaire used in the assessment of osteoarthritis of the hip and knee. The specific questionnaire for patients with osteoarthritis of the knee joint was created by the researchers and contains: general information, a visual-analog pain scale before and after therapy, and a table that monitors the range of motion of the lower extremities during treatment. The results obtained from this kind of research were processed with use of statistical methods. Statistical significance is defined at the probability level of the alternative hypothesis from $p \leq 0.05$ to $p < 0.001$. **Results.** Correlation between the treatment outcome and patients' individual characteristics (gender, age, type of work, time diagnosis) is shown. **Conclusion.** All patients had positive results and improved quality of life, as well as reduced soreness, after two weeks, regardless of their individual characteristics.

Key words. Treatment Outcome; Osteoarthritis, Knee; Pain; Functional Status; Quality of Life; Surveys and Questionnaires

Introduction

The aim of the work was to examine the impact of treatment outcome on patient functionality. In the course of the prospective study, we also investigated the relationship between individual characteristics (gender, age, body mass, occupation, type of work) and the level of functional abilities and pain before and after therapy with physical procedures. With the assumptions that the functionality of patients after knee osteoarthritis (OA) treatment depends on age, gender, the job the person does/has been doing and how long they have been suffering from knee OA. As well as that after the application of physical ther-

Sažetak

Uvod. Cilj ovog rada jeste procena uticaja fizikalnih procedura na funkcionalni status pacijenata sa gonartrozom. **Materijal i metode.** U prospektivnoj studiji ispitano je 30 pacijenata sa osteoartrozom kolena (devet pacijenata muškog pola, 21 pacijent ženskog pola). Svi pacijenti su ambulantno lečeni u Specijalnoj bolnici za reumatske bolesti Novi Sad tokom 2022. godine. Za procenu funkcionalnog statusa i kvaliteta života korišćeni su upitnici: *The Western Ontario and McMaster Universities Osteoarthritis Index* i specifični upitnik za pacijente sa osteoartrozom kolena. *The Western Ontario and McMaster Universities Osteoarthritis Index* je standardizovan upitnik koji se koristi u proceni osteoartroze kuka i kolena. Specifični upitnik za pacijente sa osteoartrozom zglobova kolena napravili su istraživači i sadrži: generalije, vizuelno-analognu skalu bola pre i posle terapije i tabelu koja prati obim pokreta donjih ekstremiteta u toku lečenja. Rezultati dobijeni ovakvim istraživanjem obrađeni su statističkim metodama. Statistička značajnost je definisana na nivou verovatnoće alternativne hipoteze od $p \leq 0,05$ do $p < ,001$. **Rezultati.** Prikazana je korelacija ishoda lečenja sa individualnim karakteristikama pacijenata (pol, starost, vrsta posla, vreme uspostavljene dijagnoze). **Zaključak.** Svi pacijenti su nakon dve nedelje imali pozitivne rezultate i poboljšan kvalitet života kao i smanjenu bolnost, nezavisno od njihovih individualnih karakteristika.

Ključne reči: ishod lečenja; osteoartritis kolena; bol; funkcionalni status; kvalitet života; ankete i upitnici

apy procedures in patients with osteoarthritis of the knee, pain is reduced by over 50%.

Material and Methods

The research was approved by the ethics committee of the Special Hospital for Rheumatic Diseases in Novi Sad for the purpose of producing a degree thesis. Subjects examined in the prospective study were 30 patients with a diagnosis of knee OA (9 male patients, 21 female patients) with an average age of 66.3 years. All patients, i.e., research participants were treated at the Special Hospital for Rheumatic Diseases in Novi Sad during August

Abbreviations

OA	– osteoarthritis
WOMAC	– The Western Ontario and McMaster Universities Arthritis Index
VAS	– visual-analog scale
IBM SPSS	– English Statistical Package for the Social Sciences

2022. The survey was conducted in patients with knee OA in terms of their pain, stiffness, body functions, and the mobility of the lower extremities was measured. Participation in the study was voluntary, which the respondents confirmed by their written consent. The research protocol data were collected using the The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire and a specific questionnaire for patients with knee osteoarthritis. The WOMAC is a standardized questionnaire used in the assessment of OA of the hip and knee. It consists of 24 items divided into 3 subscales: pain, stiffness, body function. The first subscale pain subscale includes five items: walking, climbing the stairs, pain at night, pain at rest and weight bearing. The stiffness subscale includes two items: morning stiffness and daytime stiffness. The body functions subscale includes 17 items: going down the stairs, climbing the stairs, getting up from a sitting position, standing, bending forward, walking on a flat surface, getting in/out of a car, going to a store, putting on shoes, lying in bed, undressing, getting out of bed, getting in/out of a bath, sitting, sitting on/getting up from the toilet, heavy housework, light housework. The goal is to rate the activities in each category according to the degree of difficulty, where 0 is nothing, 1 is mild, 2 is moderate, 3 is strong, and 4 is extremely strong. The patient should circle one of the offered numbers for

each item. The specific questionnaire for patients with knee OA was made by the researchers and includes: general information (patient's initials, gender, place of residence, age, body weight, body height, occupation, type of work), time of the diagnosis, how often the patient takes analgesics, how many times a year they go to physical therapy, and a visual-analog scale (VAS) for pain assessment before, during and after the therapy. Statistical data processing methods: Statistical analysis and data processing was carried out within the statistical program IBM SPSS ver. 25 (English Statistical Package for the Social Sciences), and within the Microsoft Office package (Word and Excel). The results were presented in tables and graphs. The methods of descriptive statistics were implemented as follows: frequencies (f), percentages (%), range of variability – minimum (Min) and maximum (Max) value, measure of central tendency: M – arithmetic mean, i.e., average value and measure of data variability and SD – standard deviation, i.e., average standard deviation from the arithmetic mean. The t-test for independent samples was used to determine statistically significant differences between the two groups of subjects in the sample. ANOVA test was used to examine differences between three or more groups of subjects. Differences in repeated measurements were tested with the t-test for repeated measurements, while association was determined via Pearson's correlation coefficient. Statistical significance is defined at the probability level of the alternative hypothesis from $p \leq 0.05$ to $p < 0.001$.

The total sample in the study consisted of 30 (N=30) respondents of both genders who were patients at the Special Hospital for Rheumatic Diseases.

Table 1. Average age of the sample and structure of the respondents**Tabela 1.** Prosečna starost i struktura ispitanika

		Frequency/Frekvencija	Percentage/Procenat	Min/Min	Max/Maks	M/M	SD/SD
Age (years) Starost u godinama	40 - 60	5	16.7%				
	61 - 60	13	43.3%				
	61 - 78	12	40%	40.00	78.00	66.30	9.10
	Total (Σ)	30	100%				

Legend: Min - minimum sample value; Max - maximum sample value; M - arithmetic mean; SD - standard deviation

Legenda: Min – minimalna vrednost uzorka; Max – maksimalna vrednost uzorka; M – aritmetička sredina; SD – standardna devijacija

Table 2. Structure of the respondents according to BMI categories**Tabela 2.** Struktura ispitanika prema kategorijama BMI

		Frequency/Frekvencija	Percentage/Procenat
BMI (kg/m ²)	Malnutrition/Neuhranjenost	0	0%
	Normal weight/Normalna težina	0	0%
	Overweight/Prekomerna težina	18	60%
	Obesity/Gojaznost	12	40%
	Severe obesity/Ozbiljna gojaznost	0	0%
	Total (Σ)/Ukupno	30	100%

Legend: BMI - Body Mass Index/Legenda: BMI - Indeks telesne mase

Table 3. Structure of the respondents according to type of work
Tabela 3. Struktura ispitanika prema vrsti posla

		Frequency/Frekvencija	Percentage/Procenat
Type of work Vrsta posla	Sitting/Sedeći	10	33.3%
	Standing/Stojeći	20	66.7%
	Hard physical work/Težak fizički posao	0	0%
	Kneeling/Klečeći	0	0%
	Total (Σ)/Ukupno	30	100%

Table 4. Structure of the respondents according to the duration of disease
Tabela 4. Struktura ispitanika prema trajanju bolesti

		Frequency/Frekvencija	Percentage/Procenat
Duration of the condition (years) Trajanje bolesti (u godinama)	< 1 y	14	46.7%
	1 - 5 y	12	40%
	5 - 10 y	4	13.3%
	> 10 y	0	0%
	Total (Σ)/Ukupno	30	100%

es Novi Sad. Male respondents made up 30% while female respondents made up 70% of the total sample.

36.7% of the total sample reside in a village, while 63.3% respondents live in a city.

The age of patients with knee osteoarthritis in the total sample (N=30) ranged from a minimum of 40 to a maximum of 78 years, thus, the average age was M=66.30 years. The respondents were divided into three age categories. In the sample, 16.7% respondents aged 40 to 60 years, 43.3% respondents aged 61-60 years, while 40.0% respondents were 61-78 years old (**Table 1**).

The body mass index (BMI) categories were calculated according to the criteria as follows: < 18.5 – malnutrition, 18.5- < 25 – normal weight, 25- < 30 – overweight, 30- < 40 – obesity and 40+ severe obesity. In the sample, 60% respondents were overweight, while 40% were obese (**Table 2**).

26.7% of the total sample consisted of employed persons, while 73.3% of respondents were retired.

33.3% of the total sample consisted of persons who work in the sitting position, while 66.7% work

while standing. There were no respondents who perform heavy physical work or work in a kneeling position (**Table 3**).

The duration of the disease was divided into intervals, on which bases four groups were formed. Of the total number of respondents (N=30), 46.7% have been diagnosed with osteoarthritis less than 1 year ago, 40% have had the condition for 1 - 5 years, while 13.3% of respondents were diagnosed with osteoarthritis 5 - 10 years ago (**Table 4**).

Results

Difference in quality of life before and after therapy

After the presented descriptive indicators on the WOMAC questionnaire, we used the t-test for repeated measurements to examine whether there is a statistically significant difference in the quality of life before and after therapy.

There is a statistically significant difference in the achieved average values before and after therapy.

Table 5. Difference in quality of life before and after therapy
Tabela 5. Razlike u kvalitetu života pre i nakon terapije

	M/M	SD/SD	t/t	df/df	p/p
Pain, before/Bol, pre	6.80	2.83			
Pain, after/Bol, posle	5.37	1.54	4.241	29	0.,000
Stiffness, before/Ukočenost, pre	0.80	1.35			
Stiffness, after/Ukočenost, posle	0.57	0.86	2.041	29	0.,050
Bodily functions, before/Telesne funkcije, pre	22.63	10.31			
Bodily functions, after/Telesne funkcije, posle	19.33	9.39	4.639	29	0.,000
WOMAC, before/pre	30.23	13.23			
WOMAC, after/posle	24.60	9.42	5.170	29	0.,000

Legend: M - arithmetic mean; SD - standard deviation; t - t-test for paired samples; p - statistical significance; df - degrees of freedom
Legenda: M - aritmetička sredina; SD - standardna devijacija; t - t-test za uparene uzorke; p - statistički značaj; df - stepeni slobode

Table 6. Difference in VAS values before and after therapy**Tabela 6.** Razlike u vrednostima VAS (vizuelno analogne skale) pre i nakon terapije

	M/M	SD/SD	t/t	df/df	p/p
VAS before therapy/Pre terapije	6.77	1.28	12.624	29	0.000
VAS after therapy/Posle terapije	3.97	1.16			

Legend: M - arithmetic mean; SD - standard deviation; t - t-test for paired samples; p - statistical significance; df - degrees of freedom

Legenda: M - aritmetička sredina; SD - standardna devijacija; t - t-test za uparene uzorke; p - statistički značaj; df - stepeni slobode

py in all subscales of the WOMAC questionnaire, and in the total score. On the pain subscale, there is a difference in the average values before and after the therapy ($t=4.241$, $p < 0.001$), with the finding of reduced pain sensation after the therapy ($M=5.37$) compared to the initial values ($M=6.80$). Stiffness after therapy is also less ($M=0.57$) compared to the period before therapy ($M=0.80$), $t=2.041$, $p < 0.050$. Body functions also improved after therapy ($M=19.33$) in comparison to the baseline values ($M=22.63$), $t=4.639$, $p < 0.001$. Following the previous findings, the overall quality of life is better after the therapy ($M=24.60$) than before it ($M=30.23$), $t=5.179$, $p < 0.001$ (**Table 5**).

Difference in pain intensity before and after therapy

We also examined whether there was a statistically significant change on the VAS scale before and after the therapy. Given that it includes two repeated measurements, we tested the differences with the t-test of paired samples.

The subjects rated the intensity of pain on a scale from 0 to 10, where the higher number indicates greater intensity of pain. Average pain intensity before therapy was $M=6.77$, and after therapy $M=3.97$. This difference is statistically significant ($t=2.041$, $p < 0.001$) (**Table 6**).

Respondents' general data and quality of life

After testing the differences in the measured parameters, we proceeded to examine whether there were differences between different categories of respondents, considering the measured subscales of the WOMAC questionnaire.

The t-test for large independent samples examined whether men and women, urban and rural residents, and people working in a standing or sitting position differ statistically significantly on the subscales (pain, stiffness and body functions) and the overall quality of life measured by the WOMAC questionnaire. Statistical significance remained above the limit value of 0.05, and we concluded that the mentioned categories had similar quality of life before and after therapy in the domains: pain, stiffness, physical functioning, but also similar overall quality of life.

The ANOVA test was used to examine whether subjects of different age categories (40 - 60, 61 - 60 and 61 - 78 years) statistically significantly differ on the subscales (pain, stiffness and body functions) and the overall quality of life measured by the WOMAC

questionnaire. Statistical significance was above the threshold value of 0.05, and we concluded that respondents of different ages had similar quality of life before and after therapy in the domains of pain, stiffness, physical functioning, but also similar overall quality of life. Also, the ANOVA test was used to examine whether subjects with different durations of the condition (< 1 year, 1 - 5 years, 5 - 10 years) differ statistically significantly on the subscales (pain, stiffness and body functions) and the overall quality of life measured by the WOMAC questionnaire. The statistical significance above is the limit value of 0.05, and we concluded that subjects with different durations of the condition had a similar quality of life before and after therapy in the domains of pain, stiffness, physical functioning, but also a similar overall quality of life.

Discussion

The total sample in our research consisted of 30 respondents with an average age of 66 years. The largest percentage were women (70%), while men made up only 30% of the respondents with knee osteoarthritis. The age range was from 40 to 78 years. It is stated in researches by other authors that the incidence peaks between the age of 55 to 64 years, more in women than in men [1]. According to O'Connor MI and Hooten EG, one of the reasons why women are more often affected is the way they walk, which is different from the way men walk [2]. Pain was examined before and after therapy in order to see any possible changes and progress. After processing the collected data, we concluded that there is significant progress when it comes to pain. The patients declared after the therapy that there was a reduction in pain. The subjects rated the intensity of pain on a scale from 0 to 10, where a higher number indicates greater intensity of pain. The average pain intensity before the therapy was $M=6.77$, and after therapy $M=3.97$. This difference is statistically significant ($t=2.041$, $p < 0.001$), but there was no reduction in pain by more than 50%. The two-week therapies that patients underwent when visiting the Special Hospital for Rheumatic Diseases in Novi Sad were enough to change the WOMAC test results significantly, thus, progress was certainly visible. According to the data received after the statistical processing, we concluded that there were significant changes in the WOMAC test results on all subscales of the WOMAC questionnaire, as well as in the total score. There was a sta-

tistically significant difference in the achieved average values before and after therapy. On the pain subscale, there was a difference in the average values before and after the therapy ($t=4.241$, $p < 0.001$), with the finding that pain sensation reduced after the therapy ($M = 5.37$) compared to the initial values ($M = 6.80$). Stiffness after therapy also decreased ($M = 0.57$) compared to the period before therapy ($M = 0.80$), $t=2.041$, $p < 0.050$. Body functions also improved after the therapy ($M = 19.33$) compared to the baseline values ($M = 22.63$), $t=4.639$, $p < 0.001$. Following the previous findings, the overall quality of life was better after the therapy ($M = 24.60$) than before it ($M = 30.23$), $t=5.179$, $p < 0.001$. Osteoarthritis is the primary cause of pain and disability and represents a significant economic burden on individuals and the society [3]. The latest update from the Global Burden of Disease study estimates that 242 million people worldwide live with symptoms and limitations related to knee or hip OA [4]. In their study on the effect of ozone therapy on knee osteoarthritis, researchers Costa T et al. found that the ozone therapy showed short-term efficacy compared to placebo combined with hyaluronic acid, but was not promising compared to other current treatments [5]. In their 2016 paper, Tang X et al. assessed the prevalence of symptomatic knee OA by gender, age, rural/urban area, socioeconomic status, and geographic location. Among 17,128 subjects, 8.1% had symptomatic knee OA. The prevalence was higher in women (10.3%) compared to men (5.7%). Also, the prevalence increased with age. Symptomatic knee OA was more common in rural than urban areas [6]. In our research, 36.7% of the total sample lived in a village, and 63.3% of respondents lived in a city. One of the risk factors and aggravating circumstances when it comes to OA is obesity. The prevalence of OA is expected to increase gradually with aging of the population and the increasing prevalence of obesity [7]. As obesity affects the entire organism and makes it difficult for all organ systems to work properly, it also has particular effect on bone metabolism, which can be seen in López-Gómez JJ. [8]. In our research, we found that the body mass in the total sample ($N=30$) ranged from a minimum of 68 to a maximum of 105 kilograms, and the average body mass of the entire sample was $M=85.37$. BMI was calculated based on body height and weight. The average BMI in the sample ranged from 25.51 to 35.43, with an average $BMI=29.93$. 60% of respondents in the sample were overweight, while 40% were obese, which shows that the total sample consists of overweight patients and the ones who belong to the obese category, justifying thus the above statement that obesity is an important risk factor for knee OA. Person's occupation can affect the quality of life in many ways, so certain occupations carry higher prevalence of certain diseases. We examined the relationship be-

tween the type of work the respondents are engaged with and the results after therapy. 33.3% of the total sample consists of persons who work while sitting, while 66.7% work while standing. There are no respondents doing heavy physical work or working in a kneeling position. As there was no statistically significant difference in the results after therapy in relation to the type of work, we also divided patients according to the time of diagnosis. The duration of the condition was divided into intervals, and four groups were formed on that basis. Out of the total number of respondents ($N = 30$), 46.7% were diagnosed with OA within the past year, 40% have had the condition for 1-5 years, while 13.3% respondents were diagnosed with OA 5-10 years ago. Selten EMH et al. conducted a study on the choice of treatment modality when it comes to knee OA. The aim of the study was to examine whether the theory of expected behavior is related to treatment choices in knee OA. Knee OA patients were randomly selected and filled out a treatment questionnaire where they were offered five treatment modalities - injections, pain medication, physical therapy and arthroplasty. The negative results that were obtained were the treatment choices that came down to painkillers and arthroplasty. Therefore, scientists came to the conclusion that physical agents, as well as physical activity, have a positive effect on the treatment of knee OA [9]. All of our patients were taking certain analgesics, so we examined their status on that topic. How often did they take painkillers? We obtained the following results: Pain-relief medicines were occasionally taken by 46.7% of the respondents, while about half of the respondents (53.3%) avoided taking them, which shows that medications were not the first choice for our patients. In Milenović N et al., we see that people with knee OA take painkillers in most cases and have good or excellent response to therapy [10]. All correlations are positive, indicating that the higher the score on the body function subscale (which represents worse functioning), the higher the values of the mentioned variables that describe the range of knee movements. After statistical data processing, we concluded that the outcome of treatment does not depend on the patient's age, gender, job, or how long they have suffered from knee OA, and that all patients improve to a similar degree after two weeks of therapy at the Special Hospital for Rheumatic Diseases in Novi Sad.

Conclusion

The outcome of the treatment of patients with knee osteoarthritis does not depend on the patient's gender, age, job or duration of the condition. What is important is that all patients had positive results and improved quality of life after two weeks regardless of their individual characteristics.

References

1. Losina E, Weinstein AM, Reichmann WM, Burbine SA, Solomon DH, Daigle ME, et al. Lifetime risk and age at diagnosis of symptomatic knee osteoarthritis in the US. *Arthritis Care Res (Hoboken)*. 2013;65(5):703-11.
2. O'Connor MI, Hooten EG. Brakout session:gender disparities in knee osteoarthritis and TKA. *Clin Orthop Relat Res*. 2011;469(7):1883-5.
3. Fatoye F, Gebrye T, Fatoye C, Mbada C. A systematic review of economic models for cost effectiveness of physiotherapy interventions following total knee and hip replacement. *Physiotherapy*. 2022;116:90-6.
4. Robinson WH, Lepus CM, Wang Q, Raghu H, Mao R, Lindstrom TM, et al. Low-grade inflammation as a key mediator of the pathogenesis of osteoarthritis. *Nat Rev Rheumatol*. 2016;12(10):580-92.
5. Costa T, Rodrigues-Manica S, Lopes C, Gomes J, Marona J, Falcão S, et al. Ozone therapy in knee osteoarthritis. *Acta Med Port*. 2018;31(10):576-80.
- Rad je primljen 14. III 2023.
Recenziran 5. XI 2023.
Prihvaćen za štampu 11. XI 2023.
BIBLID.0025-8105:(2023):LXXVI:7-8:203-208.
6. Tang X, Wang S, Zhan S, Niu J, Tao K, Zhang Y, et al. The prevalence of symptomatic knee osteoarthritis in China: results from the China Health and Retirement Longitudinal Study. *Arthritis Rheumatol*. 2016;68(3):648-53.
7. Jang S, Lee K, Ju JH. Recent updates of diagnosis, pathophysiology, and treatment on osteoarthritis of the knee. *Int J Mol Sci*. 2021;22(5):2619.
8. López-Gómez JJ, Pérez Castrillón JL, de Luis Román DA. Impact of obesity on bone metabolism. *Endocrinol Nutr*. 2016;63(10):551-9.
9. Selten EMH, Geenen R, Schers HJ, van den Hoogen FHJ, van der Meulen-Dilling RG, van der Laan WH, et al. Treatment beliefs underlying intended treatment choices in knee and hip osteoarthritis. *Int J Behav Med*. 2018;25(2):198-206.
10. Milenović N, Hornjak M, Lukač S, Šimunda A, Veselinović M, Bajić G. Assessment of the quality of life in patients with knee osteoarthritis. *Med Pregl*. 2022;75(3-4):103-8.