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# Comparison of local cryotherapy and sonotherapy effectiveness in the treatment of gonarthrosis symptoms

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**Abstract**

**The aim of this study** was comparison of local cryotherapy and sonotherapy effectiveness in the treatment of gonarthrosis symptoms.

**Material and methods:** The studies on the comparison of local cryotherapy and sonotherapy effectiveness were conducted in a research group of one hundred people singled out from the patients staying at the Wieniec Zdrój Sanatorium in Wieniec Zdrój. Before the series of sonotherapy and cryotherapy treatments and after their completion, all patients were assessed using: Centimeter tape, Goniometer, VAS (Visual Analog Scale), Laitinen Questionnaire and Sit-up Test.

**Results:** After the rehabilitation, the intensity of pain was determined at 4.45 points, on a scale from 0 to 8 points. The intensity of pain in the VAS scale among respondents decreased significantly by 1.750 points. The average pain intensity was 1.40 points (SD = 0.778), which resulted in a significant change in the form of pain relief (p = 0.580). The frequency of pain ranges from 0 to 4 points (M = 1.35). The frequency of its occurrence decreased significantly (p = 0.670). After rehabilitation, the frequency of analgesics was on average 0.66 points, and the limit on physical activity was 1.40 points (p = 0.520). The limitation of physical activity was determined on average at the level of 1.04 points, which reduced its limit by 0.560 points. After rehabilitation, the range of motion in the knee joint increased to 99.60 °. On average, the range of movement of patients in the knee joint after rehabilitation increased by -1.429 °. After rehabilitation, knee circumference of the kneecap was between 30 cm and 76 cm. The average result was 42.375 cm and decreased significantly by 0.1676 cm. The circumference of the knee joint above the kneecap oscillated between 28 - 80.5 cm (D = 44.335 cm), which gave the effect of reducing the edema by 0.320 cm. The treatments performed varied only the results in the frequency of analgesics (p = 0.45). Better effects occurred in patients undergoing sonotherapy (M = 0.048) than in cryotherapy (M = 0.84).

**Conclusions:** Local cryotherapy and sonotherapy reduces the severity and frequency of pain and reduces swelling in the knee joints. Positive effects of therapy reduce the amount of analgesics used. However, better results are obtained in patients undergoing sonotherapy than in cryotherapy. In addition, the range of flexion movements of the knee joints is increased under the influence of treatments. There are significant differences in the improvement of the range of motion among patients treated with sonotherapy than cryotherapy.

**Key words:** osteoarthritis of the knee joints; sonotherapy; cryotherapy; physical therapy

## Introduction

Osteoarthritis is the most common ailment of the locomotor system. This term is understood as a clinical syndrome resulting from the combined effect of joint pain and impaired functional activity leading to a deterioration of the patients' quality of life [1]. Osteoarthritis belongs to chronic non-inflammatory joint diseases of multifactorial etiology, resulting from the disturbance of balance between regeneration and degradation of articular cartilage as well as subchondral bone [2]. Undeniably associated with aging, it is the most common cause of pain and disability in older people but may also affect younger people. In a comparable range, it applies to both sexes and appears in all races of the world [3].

The knee joint is the most frequently occupied area due to degenerative changes. The disease mainly affects people over 50 and is often diagnosed on both sides as primary lesions. The female population is predominant, and obesity is a significant risk factor. The general prevalence, despite discrepancies in published studies, was set at around 2-3% of the world's population. American research allowed to determine that 1/3 of American adults aged 25-74 have radiographic features of degenerative disease, although within one joint. The results of radiological studies published in the United Kingdom have shown that the incidence rises from 1% below 30 years of age, to above 50% in the population over 60 years of age. In Poland, no research results have been published so far that would allow reliable and full

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1 **Reference**


Mikołajewska E., Elementy fizjoterapii. Fizykoterapia dla praktyków, Wyd. PZWL, Warszawa 2011, ss: 154-159

2 Kruczyński J., Szulc A., Wiktora Degi ortopedia i rehabilitacja. Wybrane zagadnienia z zakresu chorób i urazów narządu ruchu dla studentów i lekarzy, PZWL, Warszawa 2004.s: 23-34

3 Strojek K. An assessment of the effectiveness of cryotherapy is associated with kinesiotherapy in the treatment of osteoarthritis knee joints. Journal of Health Sciences 2014; 10(4): 389–390

determination of the incidence of this disease in our country. It is estimated, however, that about 8 million people are struggling with degenerative changes in Poland [4, 5].

Due to the non-inflammatory nature of joint changes, as well as the absence of co-morbidities in osteoarthritis, all methods are used when applying them adequately to the location of the lesions. Pharmacological treatment is not very effective, therefore balneological and physical methods are recommended in this disease [6, 7]. Treatment of musculoskeletal diseases would not be possible without the use of physical medicine methods that can be used in both acute and chronic conditions [8, 9, 10].

The aim of physiotherapy treatments is first to relieve pain, then anti-inflammatory treatment and congestion of the treatment area, and thus, improvement of the functional condition of the musculoskeletal system [11, 12, 13].

**Material and methods**

The research was carried out in a research group of 100 people, singled out from the patients staying at the Wieniec Zdrój Sanatorium in Wieniec Zdrój who had been diagnosed with degenerative changes in the knee joints. The subjects were divided into 2 groups. The first 50 people underwent local cryotherapy with liquid nitrogen, the other 50 people underwent sonotherapy.

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4 Helbin J., Kolarczyk E., Czynniki fizykalne wykorzystywane w metodach lecznictwa uzdrowiskowego, Problemy Higieny i Epidemiologii 2006; 87(3): 166-171.

5 Topolska M, Burak R, Duda M. Ocena skuteczności rehabilitacji pacjentów ze zmianami zwyrodnieniowymi stawów kolanowych. Forum Zaburzeń Metabolicznych 2017, tom 8, nr 2, 80–87

6 Zimmermann-Górska I., Reumatologia kliniczna, PZWL, Warszawa 2008. ss: 245-270

7 Pop T, Hamerla K, Przysada G. Czynniki wpływające na redukcję bólu u chorych z chorobą zwyrodnieniową stawu kolanowego. Przegląd MedycznyUniwersytetu Rzeszowskiego 2007; ss: 335- 345

8 Dziak A, Rehabilitacja Ortopedyczna. I wyd., Elsevier Urban & Partner, Wrocław 2008, ss: 345-354

9 Górski J., Fizjologia człowieka, Wyd. PZWL, Warszawa 2010, ss: 210-214

10 Silverwood V, Blagojevic-Bucknall M, Jinks C, et al. Current evidence on risk factors for knee osteoarthritis in older adults: a systematic review and meta-analysis. Osteoarthritis Cartilage. 2015; 23(4): 507–515.

11 Cichoń D., Demeczyszak I., Spyrka J., Wybrane zagadnienia z termoterapii, Kolegium Karkonoskie w Jeleniej Górze, Jelenia Góra 2010, ss: 34-39

12 Górski J., Fizjologia wysiłku i treningu fizycznego, Wyd. PZWL, Warszawa 2012, ss: 45-51

13 Przedborska A, Misztal M, Grzyb M, et al. Wpływ wybranych rodzajów ćwiczeń w warunkach leczenia uzdrowiskowego na wydolność stawów kolanowych w pacjentów z chorobą zwyrodnieniową. Acta Balneologica 2014; 136: 69–75.

The tests consisted of 3 stages. The first of these was the selection of patients with osteoarthritis of the knee joints, which was carried out by a doctor. The second stage, before series of treatments and after their completion in all patients, was the assessment using the following tools:

- **Centimeter tape** - the first measurement taken at the level of the knee joint, the second 5 cm above the kneecap base,
- **Goniometer** - the active range of flexion of the knee was measured,
- **VAS** (Visual Analog Scale) - analog-visual scale used for subjective assessment of pain intensity by the patient. It is assumed that the value 0 corresponds to the total absence of pain, 10 - is the strongest pain imaginable [14],
- **Laitinen Questionnaire** - allows you to determine the intensity and frequency of pain, the amount of analgesics used, and shows to what extent the pain limits physical activity [15],
- **Sit-ups test** - the patient performs as many squats or half-squats as he can do painlessly. For the squat made without pain, he is granted 1 point.

The third stage included the development of the results obtained and statistical analysis using the Statistica 8 program.

Each patient was given in a series of 10 treatments. Group 1underwent local cryotherapy with liquid nitrogen using KRIOPOL R. The treatment was performed on the knee joint area not exceeding 3 minutes. Group 2 underwent sonotherapy with a BTL device. The dose was selected individually depending on the patient's condition.

**Statistical analysis**

The statistical analysis of the collected material was carried out using Statistica 8. For all variables, descriptive statistics were calculated. For variables in the interval scale, meeting the conditions of normal distribution, the average, standard deviation, and minimum and maximum were calculated. To assess intra-group variability in two groups, Student's t-test for dependent variables was used. In order to compare the results between the two groups, Student's t-test for independent groups was used. The statistical significance was assumed to be $p < 0.05$.

**Results**

The study was attended by 100 people, aged from 31 to 93 (D = 60.98, SD = 9.836 years). Weight averaged 75.45 kg and ranged from 53 to 114 kg, and the average increase was 170.78

14 Kochański M., Kochański W., Medycyna fizykalna., PHU Technomex, Gliwice 2009, ss:193-199.

15 Laitinen J., Acupuncture and transcutaneous electrostimulation in the treatment of chronic sacrolumbalgia and ischialgia, AJ Chinese Medica 1979. ss: 12-14.

cm. The average BMI of the subjects was 25.892, which indicates overweight in the study group. The population included people with a BMI equal to 17.5 to 35.1. Gender was 61% female and 39% female [16, 17].

In the examined group, the average perimeter of the knee joint was 42.543 cm (SD = 6.2451). However, the circumference of the knee joint above the patella was on average 82 cm (SD = 7.7175). There were no significant differences in the circumferences of the knee joint among patients due to belonging to a given rehabilitation group. After the rehabilitation, knee circumference of the kneecap was between 30 cm and 76 cm (D = 42.375 cm). Circuits in the knee joint before and after rehabilitation decreased significantly (p = 0.000) by 0.1676 cm. In the case of knee joint circumference above the kneecap before and after rehabilitation, the improvement was significant (p = 0.000) and amounted to 0.300 cm (see Figure 1).

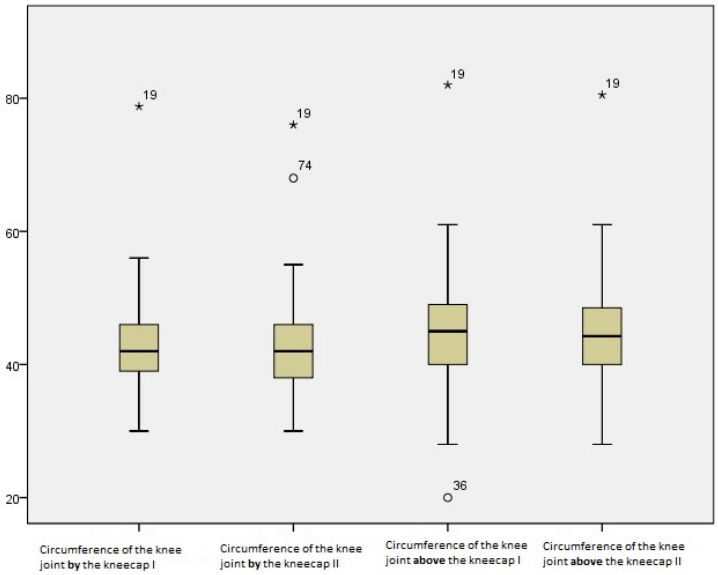


**Figure 1:** Circuits in the knee joint before and after rehabilitation.

The range of motion in the knee joint in the examined group ranged from 60° to 125° (D = 98.17°). The subjects were significantly different due to their belonging to the group due to their range of motion in the knee before rehabilitation. Patients included in the group of sonotherapy achieved better results in this area. There, the range of movement was on average 100.76°, while in the group of patients undergoing cryotherapy treatment it was

16 Guenther D, Schmidl S, Klatte TO, et al. Overweight and obesity in hip and knee arthroplasty: Evaluation of 6078 cases. World Journal of Orthopedics 2015; 6(1): 137–144.

17 Silverwood V, Blagojevic-Bucknall M, Jinks C, et al. Current evidence on risk factors for knee osteoarthritis in older adults: a systematic review and meta-analysis. Osteoarthritis Cartilage. 2015; 23(4): 507–515.

95.64 °. After rehabilitation, the range of motion in the knee joint increased on average to 99.60 degrees. Differences in measurements before and after the treatments were statistically significant (p = 0.000) (see Figure 2).

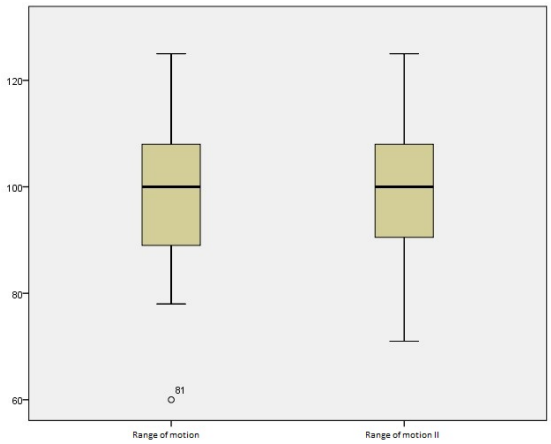


**Figure** *2***:** Differences in measurement results in terms of knee joint movement before and after rehabilitation.

The next measurements concerned the intensity of pain in the VAS scale. The intensity of pain among the examined patients ranged from 2 to 10 points (D = 6.20 points) (SD = 1.764). The t-test for independent samples did not show any significant differences in the assessment of pain intensity in the VAS scale among patients before rehabilitation. On average, by 1.75 points, the pain intensity on the VAS scale decreased among the examined patients before and after the rehabilitation. Differences were significant at the statistical level (p = 0.000).

The next measurements concerned the squat test. The examined patients performed on average from 0 to 25 squats, which gave an average score of 4.78 squat (SD = 4.576). Patients after the rehabilitation performed from 0 to 31 squats (D = 8.01) (SD = 8.004). On average, 3,230 squats performed more after the rehabilitation with cryotherapy and sonotherapy. Differences were statistically significant (see Figure 3).

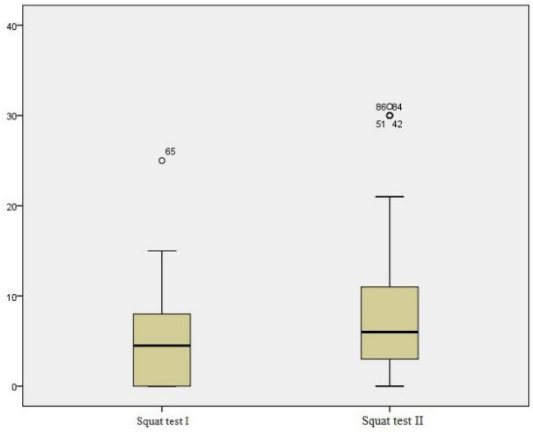


**Figure** *3***:** Differences in the results of the squat test before and after rehabilitation.

The last tool was the Laitinen test. Pain severity in the studied group of patients ranged from 1 to 4 points (D = 1.98 points). The pain frequency on a 4-point scale was determined on average at 2.02. The frequency of taking analgesics was from 0 to 4 points (D = 1.18 points). The limitation of physical activity was from 0 to 4 points (D = 1.60 points). The worst respondents functioned in the frequency of pain. After the rehabilitation period, its average severity was 1.40 points (SD = 0.778). The frequency of pain was from 0 to 4 points (D = 1.35 points). The frequency of analgesics was on average 0.66 points, and the restriction of physical activity was 1.40 points. Differences in the results of the Laitinen test before and after the rehabilitation proved significant. In all indicated ranges there was a significant improvement among patients undergoing cryotherapy and sonotherapy. On average, the severity of pain was reduced by 0.580, and the frequency of pain decreased by 0.670. The frequency of analgesics decreased by 0.520 points. However, the reduction in activity decreased by 0.560 points.

Another goal of the study was to verify whether the performed rehabilitation procedures in the first group of people undergoing sonotherapy and in the second cryotherapy significantly influence the patients' functioning and whether there are differences in the results achieved due to the group of patients.

The results of the t test for independent samples showed that there are no significant differences in the effects of sonotherapy and cryotherapy in measurements in knee joint circumferences (see Figure 4).

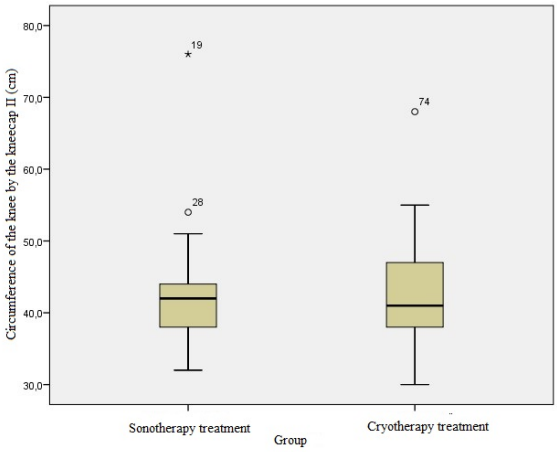


**Figure** *4***:** Results of knee joint circumferences measurement performed through the patella due to the treatment group.


**Figure** *5***:** Results of knee joint circumference measurement above the patella due to the treatment group.

However, there are significant differences in the improvement of the range of motion among patients undergoing sonotherapy and cryotherapy ($p = 0.011$). Patients undergoing sonotherapy achieved better results after surgery $M = 102.48$ than patients undergoing cryotherapy ($M = 96.78$).

There were no significant differences in the results of pain intensity on the VAS scale and in the post-rehabilitation sit-ups test due to rehabilitation procedures.

However, the performed treatments diversified the results in the frequency of analgesics ($p = 0.45$). Better effects occurred in patients undergoing sonotherapy ($M = 0.048$) than in cryotherapy ($M = 0.84$).

## Conclusions

Literature review and own research carried out on a 100-person group of patients with degeneration in the knee joint allow to draw specific conclusions. Local cryotherapy and sonotherapy reduces: severity of pain, frequency of occurrence and existing edema [18]. Physical therapy performed has an impact on reducing the amount of analgesics used. Rehabilitation performed increases the range of flexion movements of the knee joints. There are significant differences in the improvement of the range of motion among patients treated with sonotherapy than cryotherapy [19].

18 Pisula-Lewandowska A. Zastosowanie fizykoterapii w przypadku zmian zwyrodnieniowych stawu kolanowego. Praktyczna Fizjoterapia i Rehabilitacja 2012; ss: 40–44

19 Janak A., Skrzek A., Krioterapia w odnowie biologicznej sportowców – przegląd badań, Acta Bio – Optica et Informatica Medica 2009, 4, vol. 15: 319-321.

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