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# Evaluation of the Effectiveness of Comprehensive Physiotherapy in Relieving Pain in Patients With Heel Spurs

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## Abstract

***Background:*** *The use of various therapeutic procedures in relieving pain in patients with heel spurs is an issue that appears in modern rehabilitation with increasing frequency.*

***Objectives:*** *The study aimed to assess the effectiveness of physical procedures, kinesitherapy, and kinesiology taping in relieving pain in the treatment of changes caused by heel spurs.*

***Material and methods:*** *The study group consisted of 100 patients undergoing rehabilitation with treatments such as physical therapy, kinesitherapy, and kinesiology taping. The effectiveness was assessed using the up&go test and the VAS scale, as well as an original survey questionnaire.*

***Results:*** *Our studies have shown that most effective were ultrasound (39%), individual exercises (33%), and shock waves (30%). The consequence of comprehensive rehabilitation was an improvement in walking on a hard surface in 47% of the respondents and a reduction in foot pain after high activity during the day in 46.7% of the respondents.*

***Conclusions:*** *Our research has shown that selecting the right set of physiotherapy treatments can significantly reduce pain caused by heel spurs. Comprehensive rehabilitation must take into account the type and phase of the disease. Therefore, further analyses of the analgesic effect have been proposed, which can create the foundation for personalized pain relief therapy, defining guidelines for the treatment of heel spurs.*

***Key words:*** *heel spur, physical treatments, comprehensive physiotherapy, pain in the heel spur, disability*

## Introduction

Heel spur is one of the increasingly common diseases. It applies to patients who report pain on the plantar side of the foot, at the junction of the plantar fascia with the medial process. Ongoing inflammation of the plantar fascia is the most frequent cause of pain in this affliction. However, the initial symptoms of heel spurs appear as tension and pain in the heel area, occurring after sitting for a long time or at night [1]. Patients have gait disorders, which lead to abnormal gait patterns and the way in which individual body parts are loaded. The effect of this is the occurrence of pain in the hip and knee joints, which in turn can lead to inflammation of the tendons and fascia. The effect are new abnormalities of the musculoskeletal system. Pathologies in the plantar fascia, abductor hallucis muscle, flexor digitorum muscle, and trapezius plantaris muscle may influence the occurrence of the symptoms [2]. In addition, factors predisposing to the development of heel spurs include prolonged standing, intensive running, obesity, and flat feet [3]. The heel spur itself is defined as a protrusion of bony tissue arising from the calcaneal tuber on its inferior surface, most commonly at the medial process, although it can also occur at the lateral process [2]. Anatomically, the appearance of the heel spur is described as straight or irregular [4]. Typically, a heel spur has a triangular shape with a wide base and a sharp tip with smooth boundaries. Irregularly shaped spurs have poorly defined boundaries. Causes of plantar fasciitis include overuse or injuries to the ligaments that cause abnormalities. The heel spur is diagnosed on a lateral direct X-ray of the foot [5]. The major problem of patients with heel spurs is the pain syndrome, which is the first one with which patients come to rehabilitation. Foot pathology in the form of heel spurs is most common in middle-aged people. The discomfort associated with it translates into a reduced quality of life for patients, causing gait problems. The discomfort associated with heel spur translates into a reduced quality of life for patients, causing gait problems. The patients often experience limited dorsal flexion of the foot and extension of the big toe, inflammation of the plantar fascia along with a reduced range of extension movement of the foot [6]. Research results indicate that in Poland, the majority of patients

with this disease are between 36 and 89 years old, with the average age being approximately 61 years [7]. The incidence of heel spurs is seen in 55% of cases over the age of 62 [8]. The study aimed to assess the effectiveness of comprehensive rehabilitation in patients with heel spurs based on the results of a survey and a standardized test. The specific objectives were to assess the effect of kinesiology taping on linear walking and to assess the effect of shock wave and cryotherapy treatments on pain

## Research material and methodology

### Research material

The study was conducted twice on the first and tenth day of the procedure among patients of the rehabilitation clinic for 5 months with a comparison of the collected results.

Based on diagnostic imaging and assessment of the functional status, physical treatments were assigned to each patient. The study group consisted of 100 people (77 women and 23 men) undergoing a rehabilitation stay for over 10 working days. 30 of them used shockwave treatments six times. The breaks in therapy were 1 week long. The final assessment of 70 patients was made after 10 days of treatment, with 30 patients using shockwave – after 6 weeks of therapy. The detailed distribution of procedures performed on the patients is presented in Table 1.

**Table 1.** Percentage distribution of treatments used by people in the study group

| Shockwave | 30 | 30.0% |
|---|---|---|
| High energy laser | 9 | 9.0% |
| Manual therapy | 27 | 27.0% |
| Cryotherapy | 57 | 57.0% |
| Ultrasound | 62 | 62.0% |
| Kinesiology taping | 40 | 40.0% |

Data source: own research.

**Figure 1.** Example of kinesiology taping application on a heel spur during therapy

The largest group of patients was subjected to ultrasound (n = 62) with the following parameters: 0.8 W/cm$^2$, frequency 1 MHz, procedure time 5 min, head surface 5 cm$^2$ with a substance coupling the ultrasound gel. Cryotherapy was used by nearly six out of ten respondents (57%), cooling time of 3 minutes, plantar area of the foot and calcaneal tuberosity. 40% of the surveyed used kinesiology taping. The application was used to relieve the calf muscles, plantar fascia, and the painful area in the calcaneal tubercle area (Fig. 1). The shock wave at Storz Medical was performed on the most

sensitive points located within the calcaneal tuberosity, 3000–3500 shocks, the pressure was 2.0–3.0 bar, frequency 12–15 Hz. The remaining part of the beats, 2000–3000, 1.8–3.0 bar, frequency 15–21 Hz were located in the lower leg muscles as well as the intrinsic foot muscles. This treatment was performed in 30% of patients 6 times, with one-week breaks in therapy, which was an exception compared to the evaluation of the effectiveness of other therapies. Manual therapy consisting of a 10-minute massage of the plantar fascia along with a massage of the calf muscles was performed in 27% of the study participants. One in ten (9%) of the subjects used the high-energy laser on the Mphi device. The treatment was performed on the calcaneal tubercle and plantar fascia in cases of pain spreading into the foot area. During the analgesic effect, the following parameters were used: MLS (Multiwave Locked System) therapy with a power of 550 mW, 700 Hz, power density of 6.69 J/cm$^2$, and the treated area did not exceed 20 cm$^2$. The effectiveness of the therapy was assessed on the first and tenth day of the treatment.

**Table 2.** Percentage distribution of the spur treatment period in the study group

| Treatment Period | N | % |
|---|---|---|
| Less than 6 months | 37 | 37.0 |
| Longer than 6 months but less than a year | 24 | 24.0 |
| Longer than a year | 22 | 22.0 |
| Many years | 16 | 16.0 |
| TOTAL | 100 | 100.0 |

Data source: own research.

In terms of the treatment period, the largest percentage (n = 37) of people were treated for heel spurs for less than 6 months. People undergoing treatment for 6 months but less than a year (n = 24) constituted 24% of the study group, while those undergoing treatment for more than a year (n = 22) constituted 22% of the study group. The smallest group (n = 16) consisted of people who had been treated for the disorder for many years, representing the remaining 16% of the study population; the data are presented in Table 2.

**Table 3.** Percentage distribution of activities hindered by heel spurs in the study group

| Activities | N | % |
|---|---|---|
| Walking on a hard surface | 71 | 71.0% |
| Walking in flat/elegant shoes | 47 | 47.0% |
| Walking on uneven ground | 56 | 56.0% |
| Walking up the stairs | 33 | 33.0% |
| Descending the stairs | 37 | 37.0% |
| Lifting heavy objects with bent legs | 30 | 30.0% |
| Driving a car | 33 | 33.0% |
| Standing in line for more than 30 minutes | 31 | 31.0% |
| Fast march over a distance of less than 100 m | 20 | 20.0% |

Data source: own research.

The most common symptom in the study group was difficulty walking on a hard surface, which was indicated by 71% of the respondents. The remaining symptoms are shown in Table 3.

## Methodology

In this study, the research method used was a diagnostic survey and a controlled sample. It did not constitute a medical experiment and therefore the opinion of the Bioethics Committee was not obtained. Two research tools were used: a self-authored questionnaire and the up&go standardized test. The diagnosis of the disease was made by a specialist orthopaedic doctor. After completing the survey, the respondents were examined using the up&go test. It consisted of walking a distance of three meters and back in the shortest possible time. Additionally, the level of pain was assessed using the VAS (Visual Analogue Scale). The inclusion criteria for patients in the study were: heel spurs detected radiologically, patients who had no other foot injuries in the last 3 months, and those who gave consent to both stages of the study. The exclusion criteria were: foot injury within the last 3 months, taking steroids in the heel area, condition after foot surgery, presence of rheumatic, vascular, and neurological diseases, pregnancy, malignant tumours, presence of metal implants, and lack of consent to the study.

The collected research material was subjected to statistical analysis in the Statistica 13.3 program by StatSoft. Qualitative data were analyzed. The dependencies between variables were assessed using the Pearson chi-square test. The Shapiro-Wilk test was used to verify the normality of variable distribution. The lack of normal distribution determined the use of nonparametric tests in the analyses. The results were obtained in the form of numbers, percentages and presented in multi-contingency tables. The level of statistical significance was assumed to be $p<0.05$.

## Results

The effectiveness of therapeutic procedures in patients with heel spurs was assessed (Table 4).

**Table 4.** Percentage distribution of the degree of patient satisfaction with the effectiveness of the treatments used by people in the study group

| Treatments | N1 | N2 | % |
|---|---|---|---|
| Shockwave | 30 | 30 | 100.0% |
| High energy laser | 9 | 5 | 55.0% |
| Manual therapy | 27 | 24 | 89.0% |
| Cryotherapy | 57 | 13 | 23.0% |
| Ultrasound | 62 | 39 | 63.0% |
| Kinesiology taping | 40 | 32 | 80.0% |

N1 – number of people using the treatments, N2 – number of people satisfied with the treatments

Data source: own research.

The conducted studies have shown that in the entire studied population, people using rehabilitation treatments indicated shock wave therapy as the most effective treatment (100%). Manual therapy came second (89%) among the respondents. The use of kinesiology taping treatments was indicated by 80% of the respondents. The remaining results are presented in Table 4.

The conducted studies verified whether the treatments applied significantly reduced pain (Table 5).

**Table 5.** Comparison of average and standard deviations of pain levels depending on the use of rehabilitation treatments

| Treatment | Occurrence of pain after completion of physiotherapy | M (SD) | t(98) | P |
|---|---|---|---|---|
| Shockwave | NO | 3.89 (1.71) | 1.42 | 0.16 |
| | YES | 3.33 (1.94) | | |
| High energy laser | NO | 3.69 (1.73) | -0.49 | 0.62 |
| | YES | 4.00 (2.40) | | |
| Manual therapy | NO | 3.67 (1.76) | -0.45 | 0.66 |
| | YES | 3.85 (1.90) | | |
| Cryotherapy | NO | 3.95 (2.41) | 1.08 | 0.28 |
| | YES | 3.54 (1.46) | | |
| Ultrasound | NO | 3.50 (2.04) | -0.96 | 0.34 |
| | YES | 3.85 (1.62) | | |
| Kinesiology taping | NO | 3.60 (1.54) | -0.77 | 0.44 |
| | YES | 3.90 (2.11) | | |

M – average, SD – standard deviation, t – test value, p – statistical significance level

Data analysis showed that in the case of any of the physiotherapy treatments used, there were no statistically significant differences between the groups using it or not in terms of the level of pain experienced. In the case of two treatments (shockwave and cryotherapy), the level of pain experienced decreased after the completion of physiotherapy. In the remaining cases, the level of pain experienced increased despite the rehabilitation.

**Table 6.** Comparison of average and standard deviations of walking time before and after rehabilitation with the use of kinesiology taping (N = 40)

| | | M (SD) | t(38) | p |
|---|---|---|---|---|
| Time | Before rehabilitation | 9.89 (2.18) | 5.10 | < 0.001 |
| | After rehabilitation | 9.45 (1.99) | | |

M – average, SD – standard deviation, t – test value, p – statistical significance level

The conducted analyses (Table 6) allow us to conclude that there were statistically significant differences between the times obtained by the subjects before and after rehabilitation in the case of kinesiology taping ($t(38) = 5.10$, $p < 0.001$). The participants achieved a higher time before the therapy ($M = 9.89$, $SD = 2.18$) compared to the time they achieved after the therapy ($M = 9.45$, $SD = 1.99$).

**Table 7.** Comparison of average and standard deviations in the VAS (Visual Analogue Scale) before and after rehabilitation using kinesiology taping (N = 40)

| Scale | M (SD) | t(38) | p |
|---|---|---|---|
| VAS before rehabilitation | 7.12 (1.07) | 20.60 | < 0.001 |
| VAS After rehabilitation | 3.30 (1.28) | | |

M – average, SD – standard deviation, t – test value, p – statistical significance level

The conducted analyses (Table 7) allow us to conclude that there were statistically significant differences between the VAS scale results obtained by the subjects before and after rehabilitation in the case of taping ($t(38) = 20.60$, $p < 0.001$). The subjects obtained higher VAS scores before the therapy ($M = 7.12$, $SD = 1.07$) compared to the scores obtained after the therapy ($M = 3.30$, $SD = 1.28$). It can therefore be concluded that the use of taping facilitates the subjects' movement.

**Table 8.** Nonparametric Kruskal-Wallis statistics for equality of medians for the VAS scale depending on the time of having the spur

| Scale | Duration of having a spur | | | | Kruskal--Wallis test H(3) | p |
|---|---|---|---|---|---|---|
| | Up to 6 months Mdn | From 6 months to 1 year Mdn | More than a year Mdn | Many years Mdn | | |
| VAS | 17.10 | 22.40 | 15.46 | 21.00 | 2.98 | 0.39 |

Annotation: Mdn – average rank, p – statistical significance

Data source: own research.

Analyzing the obtained data (Table 8), there are no statistically significant differences between the groups with different duration of heel spurs and the VAS test results after the completed rehabilitation ($H(3) = 2.98$, $p = 0.39$). It can therefore be concluded that the duration of having the spur did not differentiate the subjects in terms of the results obtained on the pain intensity scale.

## Discussion

Heel spur is one of the most common diseases. In Poland, the incidence of it remains at the level of 2 million people with an increasing tendency. It is estimated that 11–21% of people under 40 years of age have heel spurs [8]. In the literature, studies on the correlation between the development of heel spurs and the patient's gender can be found. They show that women are more susceptible to the occurrence of plantar heel spurs, while men correlate with the occurrence of superior heel spurs [9]. In the studies, 77% of women were qualified for the study, which is consistent with the literature data on the predominance of this gender. The work used criteria for the inclusion and exclusion of patients, which were based on literature data [10]. The main symptom of heel spurs in patients is pain, as patients often suffer from plantar fasciitis. Its examination in the motor system is mainly based on a functional examination, because the pain in these cases is mainly felt in the load phase (standing, walking) [11]. In our study, a group of patients had similar symptoms, with 71% of the subjects reporting difficulty walking on a hard surface. Other observed pain symptoms include a so-called rest pain, which is mild compared to the one occurring during limb loading and walking [11]. Therefore, in the conducted research, we used the basic research tools: the VAS to assess the degree of pain intensity and the up&go test to assess walking speed. The speed of locomotion was examined, i.e., the maximum loading of the feet, which is often a problem for patients with heel spurs. In the literature, we do not find similar diagnostics of patients using the up&go test. However, there are numerous publications in which the pain of patients with heel spurs was assessed using the VAS. The authors draw attention to the physiotherapeutic treatment of patients with heel spurs; however, the

model presented in their work concerns patients in the early stage of spur formation [12]. These are people reporting a high level of pain expressed on the VAS. This stage is characterized by a combination of pharmacotherapy with rehabilitation to reduce inflammation as quickly as possible, after which laser therapy, phonotherapy, electromagnetic shockwave, and cryotherapy are used [13]. The combination of certain treatments yields better results than a single treatment. It is more effective to combine laser therapy with ultrasound and cryotherapy with ultrasound than to perform these treatments independently [14]. The results of the research indicate a substantial 100% effectiveness of the shock wave treatment. Similar results can be found in the literature, where the authors point out that a therapy consisting of five physiotherapy sessions comprising extracorporeal shock wave treatments and additional ultrasound reduces subjective pain complaints [15]. After the use of shock wave therapy, the authors observed a statistically significant reduction in the intensity of pain experienced by patients during the day (from 5.28±1.46 to 1.1±1.03) and at night (from 1.65±1.84 to 0.17±0.58) as well as prevention of relapses [16]. On the other hand, the combination of shockwave and pulsed electromagnetic field treatment resulted in statistically substantial decreases in pain, disability, and activity limitation immediately after the treatment [17]. In other studies, in patients who used ultrasound, the pain intensity gradually decreased, and the greatest pain reduction was observed after 10 sessions and lasted up to 6 weeks after the end of therapy [18].

Effective treatment of heel spurs requires a holistic approach that takes into account the causes and symptoms experienced by each individual. Prevention includes appropriate orthopedic care, physical exercise, and in case of pain, the use of nonsteroidal anti-inflammatory drugs [19]. Our research confirms that, in addition to the above-mentioned, it is advisable to use physical treatments and kinesiology taping. Kinesiology taping applications shorten walking time and facilitate movement for patients undergoing rehabilitation. The results of our study showed that the time to walk 3 meters was higher before the therapy (M = 9.89, SD = 2.18) compared to the time obtained after the therapy (M = 9.45, SD = 1.99). In addition, the pain at the end of the therapy was reduced by 3.82 on the VAS. Other researchers also emphasize

that both kinesiotaping and shock wave therapy reduce pain, disability, and activity limitation in patients, but kinesiotaping is more effective in reducing pain and disability [10]. Similarly to the present study, the pain level was reduced by 3.18 points on the VAS. According to the researchers, kinesiology taping significantly improves the functional condition of the foot after injuries. Morris and others, in turn, emphasize that it is worth combining this method with other available medical procedures, e.g., physical exercises or physical therapy [20]. Based on the available literature, this paper focuses on the use of the most common physical treatments and manual therapy, and kinesiology taping is used to maintain the effect. The literature establishes that the use of kinesiology taping of the calcaneus can provide up to 3 weeks of temporary pain relief, while elastic therapeutic tapes can reduce pain in the gastrocnemius muscle-fascia complex for 1 week [21]. The use of this method is simple, cheap, quick, and can be used for hematomas and pain [21]. Our studies on the evaluation of the effectiveness of using, among others, kinesiology taping in the rehabilitation of heel spurs are the second to appear in the available literature in the last five years. Our studies are of a pilot nature. To better document our observations, it is necessary to continue the study on a larger number of patients and with long-term observation of pain intensity after the end of therapy. Similarly to other researchers, it would be recommended to divide the patients into several groups, taking into account BMI, a high index of which is a predisposing factor for the formation of heel spurs.

## Conclusions

Based on the research, the following conclusions were drawn:

1. The duration of having the spur did not differentiate the subjects in terms of pain intensity measured using the VAS scale.
2. The use of kinesiology taping shortens the time needed to cover a distance during linear walking.
3. Shock wave and cryotherapy treatments indeed reduce pain in patients with heel spurs after completing rehabilitation. This ensures long-term effects of patients functioning without pain.

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