

## Evaluation of comprehensive spa treatment of osteoarthritis of the knee at the “Włókniarz” Sanatorium in Busko-Zdrój

### *Ocena skuteczności kompleksowego leczenia uzdrowiskowego choroby zwyrodnieniowej stawu kolanowego w Sanatorium „Włókniarz” w Busku-Zdroju*

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**Key words:** knee joint, osteoarthritis, spa treatment.

**Słowa kluczowe:** staw kolanowy, choroba zwyrodnieniowa, leczenie uzdrowiskowe.

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#### Abstract

**Aim of the research:** Evaluation studies have been carried out of the effectiveness of rehabilitation procedures with balneotherapy in osteoarthritis of the knee (OAK).

**Material and methods:** Sulphide and hydrogen-sulphide salt waters, and kinesitherapy and chosen physiotherapy methods were used in treatment. Sixty-five people with osteoarthritis of the knee, with an average period of 20 years of duration of the disease, took part in the studies. These patients were divided into two groups. In the first group, baths in sulphide and hydrogen-sulphide salt waters with physiotherapy treatment were used. In the second group, analogous physiotherapy treatment was used, however, due to medical contraindications, sulphide baths were not used.

**Results:** In both groups, a significant improvement of knee joint functions, alleviation of pain and improvement of endurance and aesthetics of walking were observed. Slightly better effects were observed in patients using baths in sulphide and hydrogen-sulphide salt waters.

**Conclusions:** In view of the achieved improvement of the clinical state in patients with OAK, this form of comprehensive sanatorium rehabilitation is recommendable.

#### Streszczenie

**Cel pracy:** Ocena skuteczności postępowania balneorehabilitacyjnego w chorobie zwyrodnieniowej stawu kolanowego (ChZSK).

**Materiał i metody:** W terapii wykorzystano wody siarczkowo-siarkowodorowe słone oraz kinezyterapię i wybrane metody fizykoterapeutyczne. W badaniach uczestniczyło 65 osób z ChZSK z średnim czasem trwania schorzenia 20 lat. Chorych tych podzielono na dwie grupy. W pierwszej grupie zastosowano kąpiele w wodzie siarczkowo-siarkowodorowej słonej oraz zabiegi fizykoterapeutyczne, natomiast w drugiej – identyczne zabiegi fizykoterapeutyczne, ale ze względu na przeciwwskazania zdrowotne nie zastosowano kąpiele.

**Wyniki:** W obu grupach zaobserwowano istotną poprawę funkcji stawu kolanowego, złagodzenie dolegliwości bólowych oraz poprawę wydolności i estetyki chodu. Nieco lepsze efekty stwierdzono u chorych korzystających z kąpiele w wodach siarczkowo-siarkowodorowych słonych.

**Wnioski:** W związku z uzyskaną poprawą stanu klinicznego u pacjentów z ChZSK ta forma kompleksowej rehabilitacji sanatoryjnej jest godna polecenia.

## Introduction

Kinesitherapeutic methods, physiotherapeutic methods, pharmacotherapy and balneological treatments are used in pain management and cases of limitation of joint functions.

There are many causes of osteoarthritis of the knee: all anatomical anomalies surrounding the joint, trauma, previous inflammations and others [1]. Changes of this kind are formed slowly, generally emerging in older people [2], and are the main reason for a reduced efficiency of the body. Osteoarthritis of the knee (gonarthrosis) is premature wear and degeneration of the tissues forming the joint (articular cartilage, the subchondral layer of the bones, synovial fluid, articular capsule, ligaments and muscles). During the course of the degenerative disease, the articular cartilage is damaged, bones are remodelled with formation of bone spurs (so-called osteophytes), the subchondral layer of the bones hardens and subchondral cysts are formed. Often, functioning of the synovial membrane (the inner layer of the articular capsule) is impaired. Osteoarthritis of the knee (OAK) is characterised by pain and knee joint dysfunction, where the degenerative process has been confirmed through X-ray. Osteoarthritis of the knee may emerge as early as in the second or third decade of one's life. In people over 60, it is present in 70–90% of cases [3].

Osteoarthritis of the knee was stated in patients examined in an outpatient setting and was confirmed after a physical examination in the local sanatoria and based on the X-ray pictures confirming the diagnosis [4].

## Aim of the research

The aim of the research was to evaluate the effectiveness of the comprehensive spa treatment of OAK with a special consideration of bath treatments in sulphide and hydrogen-sulphide salt waters from Busko.

## Material and methods

Sixty-five people with OAK participated in the research, including 55 women aged 39–69 (average age of 54.05), with a period of 19.93 years of duration of the disease, and 10 men aged 41–70 (average age of 56.5), with a period of 20.2 years of duration of the disease.

The control group included OAK patients who for various reasons could not benefit from mud treatments and bath treatment in the sulphide and hydrogen-sulphide salt waters from Busko. The control group numbered 25 people, including 20 women aged 38–62 (average age of 47.2), with a period of 18.9 years of duration of the disease, and 5 men aged 40–68 (average age of 54.4), with a period of 19.5 years of duration of the disease. Diseases of the cardiovascular system were the most frequent contraindications for sulphide and hydrogen-sulphide baths.

Patients from both of the studied groups continued their previous pharmacological treatment using only non-steroidal anti-inflammatory drugs. The patients who have not been receiving drugs previously were not introduced to analgesic and anti-inflammatory treatment.

An average of 14 bath treatments in sulphide and hydrogen-sulphide salt waters from Busko at a temperature of 37–38°C and 10–15 min of treatment time were used in the group of patients under study. In both of the groups, the OAK patients received the same remaining treatments: classic massage, water massage, massage using equipment, magnet therapy and kinesitherapeutic treatments with the same exercise program.

Pain of the knee joints, especially under load, and reduction of joint mobility were found in all patients. The above-mentioned symptoms were detrimental to a great degree to the walking capabilities of the patients. The following were evaluated before the treatment and after the finished spa treatment, on the day prior to the last day of both groups' stay:

- a) the level of pain intensity on the 4-point Domżał scale [5]:
  - 1 – pain syndrome preventing the execution of movement,
  - 2 – pain syndrome impairing the execution of movement,
  - 3 – pain syndrome with no distinguishable impairment of movement,
  - 4 – regression of the pain syndrome,
- b) a subjective assessment of improvement on a 10-point scale:
  - 10–6 pts – major improvement,
  - 6–2 pts – relative improvement,
  - 2–0 pts – no improvement,
- c) the duration of walking 20 m in the same conditions (in s),
- d) a measurement of the circumference of the knees (in cm).

## Statistical analysis

The research was carried out in 2011–2012. The results of the research were analysed statistically using Student's *t*-test [6].

## Results

All clinical indexes under study had a statistically significant improvement after the completion of the spa treatment in patients with OAK, both in the group with sulphide water baths and in the control group (no baths), though the improvement had a lower impact and a lower level of significance in the control group. And thus:

- a) the level of pain intensity on the 4-point Domżał scale had decreased from  $1.99 \pm 0.7$  pts to  $3.25 \pm 0.9$  pts (*p*

- < 0.001), and in the control group from  $2.10 \pm 0.4$  pts to  $2.90 \pm 0.5$  pts ( $p < 0.01$ ),
- b) basing on the subjective assessment of improvement on the 10-point scale, in the group of patients under study, major improvement was found in 47 people (72.30%), relative improvement in 11 people (16.92%) and no improvement in 7 people (10.78%); whereas in the control group major improvement was found in 14 people (56.00%), relative improvement in 6 people (24.00%), and no improvement in 5 people (20.00%),
- c) walking capabilities improved very significantly in the group of patients under study, as evidenced by the greatly shorter duration of walking 20 m in the same conditions, from  $39.3 \pm 4.0$  s to  $34.5 \pm 4.4$  s ( $p < 0.01$ ); and in the control group from  $39.8 \pm 7.2$  s to  $35.9 \pm 5.0$  s ( $p < 0.05$ ),
- d) knee-joint swelling was reduced significantly in the patients under study:
- in the left knee-joint from  $43.5 \pm 2.9$  cm to  $40.3 \pm 1.2$  cm ( $p < 0.01$ ); and in the control group from  $42.5 \pm 2.6$  cm to  $40.9 \pm 1.3$  cm ( $p < 0.05$ ),
  - in the right knee-joint from  $43.9 \pm 2.7$  cm to  $40.6 \pm 1.8$  cm ( $p < 0.01$ ); and in the control group from  $43.9 \pm 2.2$  cm to  $42.6 \pm 1.8$  cm ( $p < 0.05$ ).

## Discussion

The obtained research results indicate that beneficial effects of symptom treatment were achieved both in the group of patients with OAK who used sulphide and hydrogen-sulphide salt water from Busko bath treatments, and in the control group without bath treatments in sulphide water. The final healing effects of spa treatment in Busko-Zdrój are more marked in people who attended the cycle of treatments in sulphide and hydrogen-sulphide salt water, and where the main component was hydrogen sulphide and the products of its dissociation: hydrosulphides ( $\text{HS}^-$ ) and sulphides ( $\text{S}^{2-}$ ) [7].

Bath treatments in sulphide and hydrogen-sulphide salt water (SHSW) from Busko have a beneficial influence both locally on the skin and in general terms. Dilatation of subcutaneous blood vessels and stimulation of microcirculation improve blood supply to the skin and joints [8]. In rheumatology, SHSW from Busko are used in treating osteoarthritis in peripheral joints and the spine, ankylosing spondylitis, psoriatic arthritis, rheumatoid arthritis, gout, enthesopathy and other diseases of the musculo-ligamentous system, and post-traumatic and post-operative conditions of the motor organ [9, 10]. The main healing component of SHSW is hydrogen sulphide, whose participation in major vital processes should not be surprising as one of the first living organisms on Earth – cyanobacteria – use it for photosynthesis under anaerobic conditions [11].

Hydrogen sulphide is produced *in vivo* from sulphur amino acids – L-cysteine, L-homocysteine and L-cystathionine [12].

A distinct analgesic and anti-inflammatory effect of sulphide baths was found, which, being a general effect, may be connected above all to stimulation of the pituitary-adrenal axis.

Legwant [13] in his research proved that after a 21-day-long balneotherapy using sulphide and hydrogen-sulphide salt water in Busko-Zdrój, the concentration of plasma cortisol is increased and that of ACTH and  $\beta$ -endorphin decreased in patients with spinal pain syndromes. Thus, it can be assumed that hydrogen sulphide and hydrosulphides may serve the role of a physiological regulator of the hypothalamic-pituitary-adrenal axis [14].

Cencora *et al.* [15] also found that after sulphide bath treatments, the levels of total cholesterol, LDL cholesterol and fibrinogen are decreased.

A similar effect of shsw from Busko was observed by Zielonka *et al.* [16] in patients with osteoarthritis and concomitant elevated levels of lipids, where sulphide water baths and cryotherapy were used.

In the control group, due to contraindications for baths in SHSW, only rehabilitation using classic and water massages, massage using equipment, magnet therapy and kinesitherapy (the same exercise program for all people under study) was used. Despite the lack of balneotherapy in the group called the control group, an improvement of various clinical parameters occurred on a slightly lower level. This difference resulted most likely from the lack of the synergistic effect of balneotherapy in shsw and rehabilitation, which occurred in the group under study [17].

## Conclusions

The comprehensive spa treatment in Busko-Zdrój, aggregating balneotherapy in sulphide and hydrogen-sulphide salt water from Busko and select methods of rehabilitation, shows analgesic and anti-inflammatory effects, contributing positively to the clinical state of the patients with osteoarthritis of the knee joints. In the control group of patients where the same methods of rehabilitation were used without balneotherapy in sulphide and hydrogen-sulphide salt water from Busko (due to contraindications), beneficial treatment effects, expressed in an improvement of walking capability, regression of pain intensity and tissue swelling were also obtained, but to a lower level of significance. The mineral components, and especially hydrogen sulphide and its products of dissociation (hydrosulphides and sulphides), are the most significant elements of balneotherapy in Busko, interacting in a synergistic way with rehabilitation, creating together a comprehensive system of spa treatment in Busko-Zdrój.

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