

## USE OF VARIABLE MAGNETIC FIELD OF LOW FREQUENCY IN DEGENERATIVE KNEE JOINT DISEASE

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### Abstract

The work deals with application of magnetotherapy for treatment of degenerative disease of knee joint. It was statistically proved that this kind of treatment is beneficial for lowering of pain level, increases the locomotory ability and decreases the swollen tissue.

### Streszczenie

#### Zastosowanie wolnozmiennych pól magnetycznych w chorobie zwyrodnieniowej stawów kolanowych

Leczenie chorych ze zmianami zwyrodnieniowymi jest kompleksowe i oprócz działania przeciwzapalnego stosuje się wszelkie środki łagodzące ból. Jedną z metod fizykoterapeutycznych jest magnetoterapia. Celem pracy była ocena skuteczności magnetoterapii w chorobie zwyrodnieniowej stawów kolanowych. Na podstawie uzyskanych badań stwierdzono, że magnetoterapia ma istotny wpływ na obniżenie poziomu bólu, przyczynia się do zwiększenia zakresu ruchu w stawach i powoduje zmniejszenie obwodów kończyn dolnych.

**Key words:** magnetic field, degenerative knee joints disease

**Słowa kluczowe:** magnetoterapia, choroba zwyrodnieniowa stawów kolanowych

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### 1. Introduction

Gonarthrosis is one of the most frequent pathologies of knee. Degenerative joint disease is the most prevalent disease of motor apparatus. First, non-clinical changes may occur in the second or third decade of life. 35% of people aged 45–65 years suffer from the disease and 60–75% of people over 65 years old. Gonarthrosis has third place after coxarthrosis and degenerative changes of spine. It affects 5% of population, in 75% of cases are women. The disease makes women unable to work and often disable. Gonarthrosis is caused by repeated mechanical injuries, changes connected with strain put on the joint, which may be connected with oldery, sport injuries, excessive body weight or anomalies in body [1]. Patients with degenerative changes are treated in a complex way and, apart from anti-inflammatory action, various of pain-relieving agents are administered [2]. Physiotherapy plays significant role

in analgesic treatment. The aim of physiotherapy is to reduce pain, muscle tone, tissue oedema and to prepare patient for kinesytherapy aimed at sustaining or restoring proper mobility in joints affected by the disease.

More and more frequently magnetotherapy is used [3]. Treatment with magnetic field is a natural, biological form of therapy. It has been known since ancient times. Scientific bases for this kind of treatment appeared in the 20<sup>th</sup> century. The properties of magnetic fields, their effect on human organism were studied and better therapeutic devices are constructed [4, 5]. The purpose of this study was to assess efficacy of magnetic field of low frequency in gonarthrosis.

### 2. Materials and methods

The subjects of the study were patients from Wrocław's outpatient clinic suffering from degenerative knee joint disease involving both knee joints. Patients were not

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subjected to any other therapy during treatment. The research group consisted of 30 patients aged 56–65 (22 women and 8 men). Most of them with pain and limited mobility in knee joints. Characteristics of the group is shown in Table 1.

Table 1. Characteristics of the group

Total	Women			Men		
	Patients number	%	Mean age	Patients number	%	Mean age
30	22	73.3	60.4	8	26.7	61.4

Before therapy, history of the patients was taken: first name, surname, age, sex, duration of the disease. All patients were subjected to the procedures with magnetic field of low frequency. Apparatus emitting sinusoidal impulses, 1–10 mT, frequency 20–50 Hz, was used in the procedures. During the procedures, first, small intensities were used, then, the intensities were gradually increased to maximal dose. Applicator in shape of a spool with 315 mm diameter adjusted to the shape of the area subjected to the procedure. Each procedure lasted 20 minutes. 15 procedures were recommended. First 10 procedures were carried out every day and the following 5 procedures were carried out every second day. Each patient had procedure carried out at the same time of day. All patients were examined before the therapy and just after its completion. The examinations involved the area of two lower limbs. Obtained results were statistically analysed.

- Measurement of the range of flexion motion in knee joints.
- Measurement of circumference of both limbs at three levels, with precision to 0.5 cm: on the level of knee crevice, on the level of medial head of quadriceps muscle of thigh, on the level of lateral head of quadriceps of thigh.

Pain was assessed on Domżał's modified 10-degree numeric scale [2], where 0 means lack of pain, 10 means severe pain.

### 3. Results

The results of the assessment of efficacy of therapy with magnetic field in degenerative knee joint disease as far as pain, range of mobility and circumference are concerned, on the level of knee joint, lateral head and medial head of quadriceps muscle of thigh before

and after the therapy are shown in table 2 and 3.

Median value indicates that 50% of studied patients experienced before therapy chronic pain, increasing in severity with every change of position. Whereas, after therapy, in 75% of studied cases there was a reduction of severity of pain to the level of slight pain occurring every day with small intervals. Comparative analysis indicates that therapy has statistically significant effect on both lower limbs (Table 2).

Analysis of the range of movement in knee joint in sagittal plane before and after therapy indicates significant reduction of limitation in flexion. Mean values of the range of movement indicate statistically significant increase in the range of flexion movement after therapy (Table 3). Also values of circumferences measured at the level of knee joint crevice of both lower limbs indicate significant reduction of circumferences after procedure with variable magnetic field. It may suggest reduction of oedema and positive effects of the therapy in degenerative knee joint disease. Calculated mean values of circumferences of both limbs at the level of medial head of quadriceps muscle of thigh indicate significant reduction of their circumference after therapy. No statistically significant variance was found in measurements of circumference of lower left limb before and after therapy at the level of lateral head of quadriceps muscle of thigh (Table 3). It can be assumed that it was a result of reduction of oedema and not wasting of the mass of quadriceps muscle of thigh.

### 4. Discussion

Research studies carried out by Sieroń and his co-workers [7–9] indicate that there is a wide spectrum of effects that magnetic field exerts on processes of aerobic and anaerobic respiration. It was also found that due to increased emission of endogenic opiates, magnetic fields alleviate pain. It was found that in treatment of degenerative joint disease, therapy with magnetic field is one of the most beneficial physiotherapeutic methods. On the basis of conducted study, the researchers came to the conclusion that magnetic field of low frequency has positive effect on alleviation of pain. It was also noticed by Sieroń and Krawczyk-Krupka [6] who claim that therapy with magnetic field of low frequency has positive effect on reduction of pain and, thereby, is an alternative method for analgesic pharmacological agents.

Table 2. Statistical characteristics of the level of pain and comparison between the values of pain (Wilcoxon's test) before and after therapy with magnetic field

Method		Median	Minimum	Maximum	Lower quartile	Upper quartile	Gap quartile	Wilcoxon test
Right lower limb	Before therapy	8.0	7.0	9.0	8.0	8.0	8.0	4.78
	After therapy	1.0	0.0	3.0	0.0	2.0	2.0	
Left lower limb	Before therapy	8.0	7.0	9.0	8.0	8.0	8.0	4.78
	After therapy	1.0	0.0	3.0	1.0	2.0	2.0	

With bold letters – significance of difference at the level  $p = 0.05$

Table 3. Statistical characteristics of values of range of mobility and circumference before and after therapy and their comparison using t-Student test

Trait		Right lower limb			Left lower limb		
		$\bar{x}$	sd	t-Student test	$\bar{x}$	sd	t-Student test
Range of movement	Before therapy	120,50	9,43	6,87	120,50	9,11	6,54
	After therapy	122,26	9,13		122,33	8,70	
Circumference at the level of knee joint crevice	Before therapy	46,83	5,71	3,16	46,68	5,37	3,6
	After therapy	45,0	5,74		45,50	5,30	
Circumference at the level of medial head	Before therapy	49,63	5,83	2,46	49,95	5,64	2,98
	After therapy	48,73	5,86		48,68	5,09	
Circumference at the level of lateral head	Before therapy	53,26	6,06	5,96	53,00	5,63	1,22
	After therapy	53,20	6,05		52,95	5,60	

With bold letters is written significance of difference in values at level  $p = 0.05$

Increase in the range of movement in studied knee joints was probably connected with the fact that pain was reduced, what contributes to improvement in mobility and to maintaining necessary range of movement. Magnetic field of low frequency has also anti-inflammatory effect and it can also contribute to reduction of pain and improvement in mobility of joints, as well as to reduction of oedema. Observed significant statistical differences in measurements of circumference indicate that it is an effective anti-inflammatory therapy. Also other authors [7,8,9] draw attention to the analgesic, anti-inflammatory and anti-oedema effects of magnetotherapy in treatment of degenerative changes. Many studies [2,10] confirm that there is reduction of pain, improvement of mobility in joints in patients suffering from osteoporosis after this therapy. The results obtained in the study are compatible with reports of other authors [5,6,7,8] who confirm that magnetic field of low frequency is effective in treatment of gonarthrosis. The fact that magnetotherapy has become a prevalent physiotherapeutic method is a confirmation that it is a

right choice of therapy of people with degenerative knee joint disease.

## 5. Conclusions

Therapy with magnetic field of low frequency has significant effect on reduction of the level of severity of pain in patients with degenerative knee joint disease.

Therapy with magnetic field of low frequency contributes to the increase in the range of movement of joints.

Reduction of circumference in the area of knee joints of patients subjected to magnetotherapy indicates that oedema was reduced as a result of therapy.

## References

1. T. Żuk, A. Dziak: *Ortopedia z traumatologią narządów ruchu*. PZWL, Warszawa 1993.
2. E. Jankowska, T. Pietraszkiewicz, J. Thannhauser, L. Borodulin-Nadzieja: *Wykorzystanie magnetostymulacji w terapii zespołów bólowych narządu ruchu*. Acta Bio-Opt. Inform. Med., 6 (2000) 29–33.

3. P. Kocjan, K. Brzozowski: *Ograniczenie w stosowaniu zmiennego pola magnetycznego niskiej częstotliwości*. Fizjoterapia, Nr 3 (1998) 9–11.
4. J. Czernicki, M. Woldańska-Okowska, M. Karasek: *Wpływ leczniczego stosowania pola magnetycznego niskiej częstotliwości na wydzielanie melatoniny u pacjentów z zespołami bólowymi kręgosłupa*. Fizjoterapia, Nr 3 (1998) 3–5.
5. R. Rutowski, M. Szpilczyńska-Maciejewska, I. Krynicka: *Magnetoterapia. Zastosowanie leczniczego pola magnetycznego*. Acta Bio-Opt. Inform. Med., 4 (1998) 3–6.
6. A. Sieroń, A. Krawczyk-Krupka: *Komórkowe efekty oddziaływania wolnozmiennych pól magnetycznych*. Acta Bio-Opt. Inform. Med., 4, (1998) 79–85.
7. A. Sieroń: *Magnetoterapia – magnetostymulacja. Podstawy cz. I*. Acta Bio-Opt. Inform. Med., 4 (1998) 1–2.
8. A. Sieroń: *Magnetoterapia – magnetostymulacja. Podstawy cz. II*. Acta Bio-Opt. Inform. Med., 4 (1998) 45–46.
9. M. Woldańska-Końska, J. Czernicki, M. Hyż: *Ocena skuteczności przeciwbólowej pól magnetycznych o różnej charakterystyce*. Balneologia Polska, 41(1–2) (1999) 57–61.
10. M.C. Hochberg, R.D. Altan, K.D. Brandy i in.: *Leczenie zachowawcze choroby zwyrodnieniowej stawu kolanowego*. Medycyna Praktyczna, Nr 11 (1996) 117–122.

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