

Porównanie skuteczności terapii falą akustyczną i jonowym rezonansem cyklotronowym w chorobie zwydrodneniowej kręgosłupa lędźwiowego. Część II

Comparison of effectiveness of the acoustic wave therapy and ion cyclotron resonanse in degenerative vertebral freed column disease. Part II

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Streszczenie:

Wiele metod fizjoterapeutycznych jest stosownych w terapii choroby zwydrodneniowej kręgosłupa, co dowodzi, że brak jest metody idealnej dla wszystkich pacjentów. Kolejne nowe metody w tym zakresie są dowodem na poszukiwanie *personal treatment*, czyli leczenia spersonalizowanego. Metody te, co oczywiste, wymagają weryfikacji. Celem pracy jest ocena przydatności stosowania fali akustycznej i jonowego rezonansu cyklotronowego oraz ich łącznego stosowania w terapii choroby zwydrodneniowej kręgosłupa lędźwiowego.

Materiał i metody. Badaniami objęto grupę 80 chorych, mężczyzn i kobiet w wieku 35-75 lat (średnia wieku 50,6 lat) z chorobą zwydrodneniową kręgosłupa lędźwiowego. Pacjenci zostali losowo przydzieleni do czterech grup terapeutycznych. K – grupa leczona pozorowaną falą akustyczną i kinezyterapią wg. zmodyfikowanych ćwiczeń Meina, FA – grupa leczona falą akustyczną i kinezyterapią wg. zmodyfikowanych ćwiczeń Meina, JRC – grupa leczona jonowym rezonansem cyklotronowym i kinezyterapią wg. zmodyfikowanych ćwiczeń Meina, FA+JRC – grupa leczona falą akustyczną i jonowym rezonansem cyklotronowym. Przed i po trzytygodniowej terapii oceniano: ruchomość kręgosłupa-w płaszczyźnie strzałkowej w teście Schobera, w płaszczyźnie czołowej w teście Molla i Wrighta.

Wyniki. Test Schobera pokazał podobny poziom różnicy ruchomości przed i po terapii dla grupy JRC $2,8 \text{ cm} \pm 0,84$ i gr. FA+JRC $2,83 \text{ cm} \pm 1,1$ przy $p < 0,001$. Procent zmian względem gr. K dla gr. JRC wyniósł 56% poprawy dla gr. FA+JRC 70% poprawy. W teście Molla i Wrighta różnica ruchomości w płaszczyźnie czołowej przed i po terapii w gr. FA to $1,15 \text{ cm}$, w gr. JRC $2,47 \text{ cm}$, gr. FA+JRC $2,90 \text{ cm}$ przy $p < 0,001$

Wnioski. Jonowy rezonans cyklotronowy i fala akustyczna z jonowym rezonansem cyklotronowym zwiększą zakres ruchomości kręgosłupa w chorobie zwydrodneniowej odcinka lędźwiowego kręgosłupa.

Słowa kluczowe:

fala akustyczna, jonowy rezonans cyklotronowy, choroba zwydrodneniowa kręgosłupa lędźwiowego

Abstract

Many physiotherapy methods are appropriate in spine osteoarthritis treatment, which proves, that there is not an ideal method for all patients. Another new methods in this area are evidences in search of 'personal treatment'. It means personalized treatment. These methods, what is obvious, need to be verified. The aim of the study was to evaluate the utility of the acoustic wave and ion cyclotron resonance, and their combined use in the treatment of osteoarthritis of the lumbar spine.

Material and methods. The study group involved 80 patients, both men and women aged 35-75 years (average age 50.6 years) with osteoarthritis of the lumbar spine. Patients were randomly assigned to four treatment groups. K – group treated with simulated acoustic wave and kinesitherapy according to modified Mein's exercises, FA – group treated with acoustic wave and kinesitherapy according to modified Mein's exercises, JCR – group treated with ion cyclotron resonanse and kinesitherapy according to modified Mein's exercises, FA +JRC – group treated with acoustic wave and ion cyclotron resonance. Before and after three weeks of therapy there was an assesment of: the mobility of the spine in the sagittal planein Schober test and the frontal plane in Moll and Wright test.

Results. Schober test showed a similar level of mobility difference before and after treatment for a ICR group $2.8 \text{ cm} \pm 0.84$ and thickness. ICR+AW + $2.83 \text{ cm} \pm 1.1$ at $P < 0.001$. According to group K, 56% percentage changes of improvement gained ICR group, group AW+ICR gained 70% of improvement. In the Moll and Wright test mobility difference in the frontal plane before and after treatment in AW group is 1.15 cm in thickness. ICR 2.47 cm thick. AW+ICR 2.90 cm at $p < 0.001$

Conclusions. Ion cyclotron resonance and acoustic wave with ion cyclotron resonanse increase the range of motion for osteoarthritis of the lumbar spine.

Key words:

acoustic wave, ion cyclotron resonanse, degenerative disease of the lumbar spine

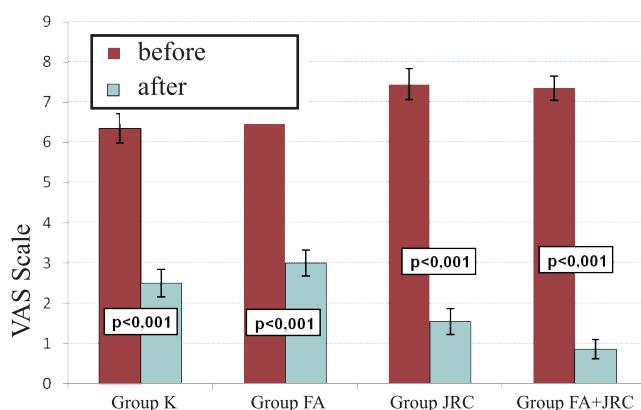
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As already shown in part I, the use of acoustic waves and ion cyclotron resonance in the treatment of lumbar osteoarthritis had a beneficial effect consisting in increased mobility of the lumbar spine. Further findings suggested reduced perception of pain within the lumbar spine. Pain reduction was observed following the three-week treatment in all therapeutic groups. The most significant pain reduction as measured by VAS was achieved in the ICR group (5.90 at $p<0,001$) and the AW+ICR group (6.50 at $p<0.001$). Results in the modified Latinen score showed a 23% improvement in group ICR and a 42% improvement in group AW+ICR as compared to group K receiving simulated physical (sham) treatment; $p<0.01$.

Tab. 4. The results of the perception of pain in VAS (mm)scale of patients with osteoarthritis of the lumbar spine before and after three weeks of treatment with statistical evaluation in each of the treatment groups according to statistical assessment of K – kinesis.

VAS Scale	Group K (n=20)		Group FA (n=20)		% changes	Value in rel. to K	p	Group JRC (n=20)		% changes	Value in rel. to K	p	Group FA+JRC (n=20)		% changes	Value in rel. to K	p	ANOVA value p
	Mean	SD	Mean	SD	Mean			Mean	SD	Mean			Mean	SD	Mean			
Przed Before	6,35	1,66	7,95	1,50	25%	0,005		7,45	1,70	17%	0,045		7,35	1,39	16%	0,058	0,016	
Po After	2,50	1,54	3,00	1,45	20%	0,306		1,55	1,43	-38%	0,044		0,85	1,09	-66%	0,001	<0,001	
Różnica Difference	-3,85	0,93	-4,95	1,28		0,009		-5,90	1,33		<0,001		-6,50	1,47		<0,001	<0,001	

K – group treated with simulated acoustic wave and kinesitherapy according to modified Mein's exercises, FA group treated with acoustic wave and kinesitherapy according to modified Mein's exercises, JCR – group treated with ion cyclotron resonance and kinesitherapy according to modified Mein's exercises, FA +JRC – group treated with acoustic wave and ion cyclotron resonance, p Anova indicates statistical significance at the level of significance – according to groups among themselves



K – group treated with simulated acoustic wave and kinesitherapy according to modified Mein's exercise, FA – group treated with acoustic wave and kinesitherapy according to modified Mein's exercises, JRC – group treated with ion cyclotron resonanse and kinesitherapy according to modified Mein's exercises, FA+JCR – group treated with acoustic wave and ion cyclotron resonanse

Fig. 5. Comparison of changes in pain intensity in VAS (mm)scale before and after the three-week treatment in therapeutic groups patients with osteoarthritis of the lumbar spine with statistical assessment in each treatment group

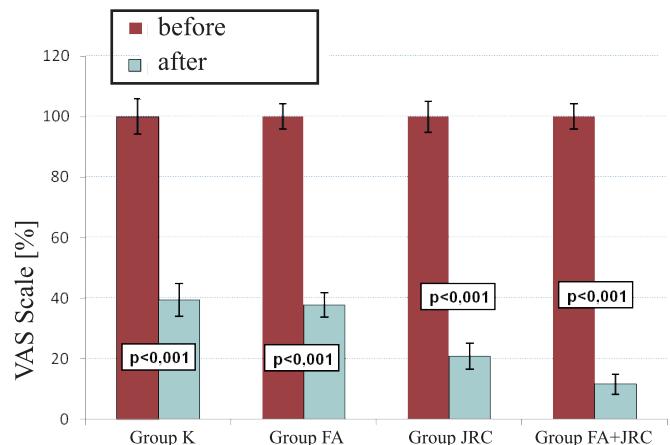
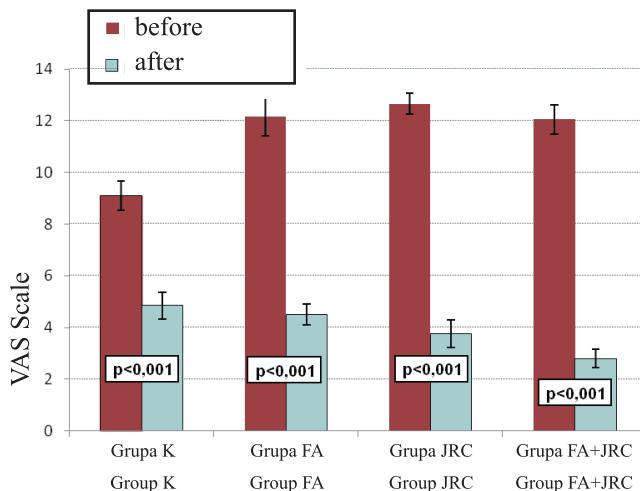


Fig. 6. The average percentage changes for individual therapeutic groups in pain intensity in VAS (mm) scale before and after the three-week treatment in therapeutic group with Mein's modified exercises, AW+ICR – group treated with acoustic wave and ion cyclotron resonanse with osteoarthritis of the lumbar spine

Tab. 5. The results of the perception of pain based on Pain Questionnaire by Laitinen patients with osteoarthritis of the lumbar spine in each treatment group before and after three weeks of treatment with respect to statistical assessment according to K – kinesis group

Pain Questionnaire by Laitinen [points]	Group K (n=20)		Group FA (n=20)		% changes in rel. to K		Group JRC (n=20)		% changes in rel. to K		Group FA+JRC (n=20)		% changes in rel. to K		ANOVA	
	Mean	SD	Mean	SD	Value	p	Mean	SD	Value	p	Mean	SD	Value	p	p	p
Przed Before	9,10	2,55	12,15	3,27	34%	0,004	12,65	1,81	39%	<0,001	12,1	2,54	32%	0,001	<0,001	
Po After	4,85	2,28	4,50	1,79	-7%	0,547	3,75	2,36	-23%	0,095	2,80	1,54	-42%	0,005	0,010	
Różnica Difference	-4,25	2,22	-7,65	2,60		<0,001	-8,90	2,02		<0,001	-9,25	2,36		<0,001	<0,001	

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Fig. 7. Comparison of pain intensity conducted by Questionnaire pain by Laitinen before and after the three-week in treatment group in therapy patients with osteoarthritis of the lumbar spine with statistical assessment in each treatment group

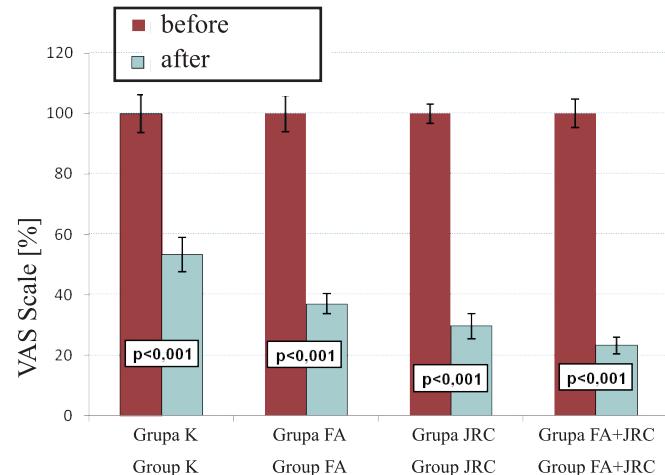


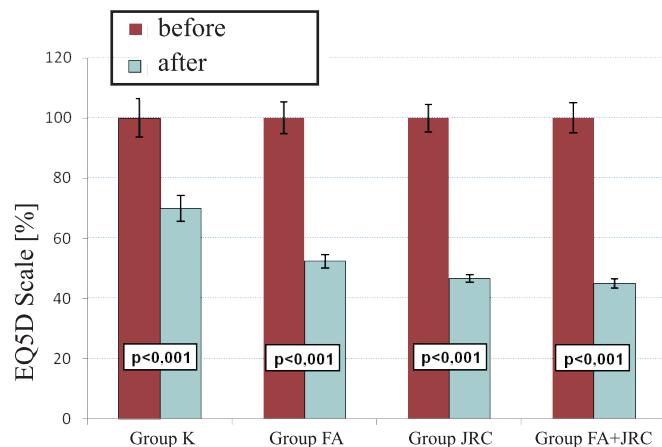
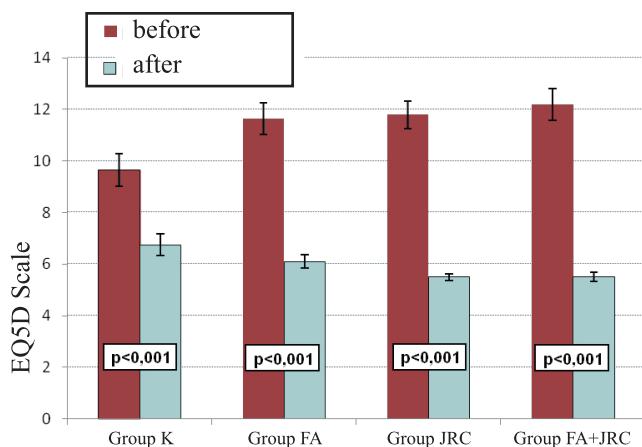
Fig. 8. Mean percentage changes in pain intensity in individual study groups as determined using the modified Latinen questionnaire in patients with lumbar osteoarthritis

The quality of life of patients with lumbar osteoarthritis as assessed on the basis of EURO QoL (EQ5D) is characterized by the differences in scores before and after treatment, i.e.: 5.55 ± 2.44 in the AW group; 6.30 ± 2.20 in the ICR group; and 6.7 ± 2.66 in the AW+ICR group.

Table 6. Results of the evaluation of the difference of quality of life before and after the three-week treatment with Euro QoL (EQ5D) by 5 criteria: mobility, self-reliance, daily activities, pain and anxiety in the individual treatment groups of patients with osteoarthritis of the lumbar spine with an assessment of statistical terms – K – kinesis

Life quality questionnaire EQ5D [points]	Group K (n=20)		Group FA (n=20)		% changes	Value	Group JRC (n=20)		% changes	Value	Group FA+JRC (n=20)		% changes	Value	ANOVA
	Mean	SD	Mean	SD	in rel. to K	p	Mean	SD	in rel. to K	p	Mean	SD	in rel. to K	p	p
Przed Before	9.65	2.78	11.65	2.78	21%	0.037	11.80	2.40	22%	0.020	12.20	2.76	26%	0.007	0.017
Po After	6.75	1.86	6.10	1.12	-10%	0.419	5.50	0.61	-19%	0.009	5.50	0.83	-19%	0.009	0.003
Różnica Difference	-2.90	1.97	-5.55	2.44		0.001	-6.30	2.20		<0.001	-6.70	2.66		<0.001	<0.001

K – group treated with simulated acoustic wave and kinesitherapy according to modified Mein's exercises, FA group treated with acoustic wave and kinesitherapy according to modified Mein's exercises, JRC – group treated with ion cyclotron resonanse and kinesitherapy according to modified Mein's exercises, FA +JRC – group treated with acoustic wave and ion cyclotron resonanse, p Anova indicates statistical significance at the level of significance – according to groups among themselves



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Fig. 9. Comparing the quality of life before and after the three-week treatment with Euro QoL (EQ5D) by 5 criteria: mobility, self-reliance, daily activities, pain and anxiety in the individual treatment groups

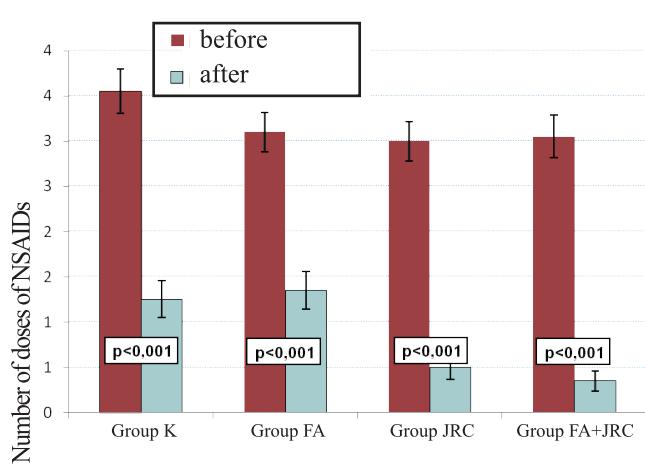
Fig. 10. The average percentage changes for each treatment group evaluation of the quality of life using the Euro QoL (EQ5D) according to five criteria: mobility, self-reliance, daily activities, pain and anxiety in the different treatment groups

In the assessment of the dynamics of NSAID intake in patients with lumbar osteoarthritis, positive effects of treatment were demonstrated in group ICR, with reduction in medication intake of 60% as compared to group K where sham exposure was used. Likewise, reduction NSAID intake was achieved in group AW-ICR by 72% as compared to group K. The respective p values were $p<0.006$ and <0.001 .

Table 7. Comparison of the dynamics of NSAID intake – the number of tablets taken a day before and a day after the three-week treatment by the patients with lumbar osteoarthritis in individual study groups together with differences in the dynamics of medication intake as compared to kinesitherapy group K

number of doses of NSAID	Group K (n=20)		Group FA (n=20)		% changes in rel. to K	Value p	Group JRC (n=20)		% changes in rel. to K	Value p	Group FA+JRC (n=20)		% changes in rel. to K	Value p	ANOVA value p
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Przed Before	3,55	1,10	3,10	0,97	-13%	0,197	3,00	0,97	-15%	0,103	3,05	1,05	-14%	0,130	0,307
Po After	1,25	0,91	1,35	0,93	8%	0,700	0,50	0,61	-60%	0,006	0,35	0,49	-72%	<0,001	<0,001
Różnica Difference	-2,30	0,92	-1,75	1,12		0,124	-2,50	0,95		0,504	-2,70	1,08		0,273	0,058

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Fig. 11. The average percentage changes for each treatment group in consumption of non-steroidal anti-inflammatory drugs (NSAIDs) in patients with osteoarthritis of the lumbar spine

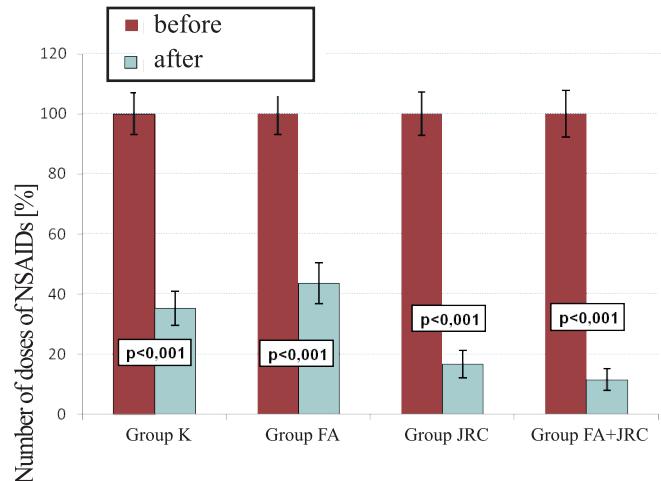


Fig. 12. The average percentage changes for each treatment group in consumption of non-steroidal anti-inflammatory drugs (NSAIDs) in patients with osteoarthritis of the lumbar spine

Discussion

Numerous methods are available for the treatment of lumbar osteoarthritis; the disorder is also very widespread, affecting 40% of the population [4]. Although the natural history may be acute, it is usually insidious and chronic, significantly affecting patient's quality of life. Despite the availability of established treatment methods, innovative methods that would bring relief to the constantly suffering group of patients are still being explored [5]. The assessment of the efficacy of methods used in this study, i.e. acoustic wave and ion cyclotron resonance, consisting in evaluation of spinal mobility within the sagittal plane using the Schober test and within the frontal plane using the Moll and Wright test as well as the visual analog scale (VAS) and modified Latinen pain questionnaire demonstrated the relevance of this direction for the treatment of lumbar spinal pain. Ion cyclotron resonance has been successfully used in restoration of peripheral nerves. The authors report significant promotion of restoration of radial nerve following a complicated fracture of humerus [6, 7]. Reports were also published regarding restoration of facial nerves following idiopathic damage or mechanical trauma [8]. Stenosis of the spinal canal or its lateral recesses affords a clinical presentation of lumbar dysfunction with pain and limited mobility [9]. This allows to associate the degenerative lesions within the lumbar pain with neurological symptoms in the region of the outlet of the sciatic nerve from the spinal canal and thus to use a similar method for the treatment of the neuralgic segment of the lumbar spine. Osteoarthritis requires a comprehensive treatment approach [10, 11]. In order to verify the efficacy of treating lumbar OA using acoustic wave and ion cyclotron resonance, the study involved combination of physical procedures such as exposure to acoustic waves with Mein's exercises; ion cyclotron resonance with Mein's exercise; as well as combination of acoustic waves, and ion cyclotron resonance. Verification of results included comparison with the group treated by sham acoustic wave and Mein's exercises on the lumbar spine. In line with the results of the cited papers, clear improvement was achieved in groups receiving comprehensive treatment, i.e.. AW, ICR, and AW+ICR for all exploratory tools used. The lowest results were obtained in the kinesitherapy group K which receiving exercises as monotherapy due to the "Sham" function being activated during physical procedures, thus confirming the advisability of comprehensive treatment. We attribute the high results obtained in the AW+ICR group to the synergic effect of the acoustic wave and ion cyclotron resonance. The beneficial effects of acoustic waves add to the established biological effects of ion cyclotron resonance including cell nutrition and growth, regeneration and normalization of cell membrane potentials, and increased enzymatic activity. Acoustic waves have impact on muscle relaxation and increased circulation of blood and lymph. It also positively affects the autonomic nervous system. Studies conducted by Russian researchers confirmed the usefulness of acoustic waves in the treatment of bone fractures, injuries, contusions, hematomas, wounds and pains of rheumatic or degenerative origin [12, 13].

Conclusions

1. Ion cyclotron resonance and acoustic wave combined with ion cyclotron resonance reduce the perception of pain and increase the range of motion within the lumbar spine. Combined application of ICR and AW exerts a stronger analgesic effect as compared to other treatments of patients with lumbar OA.
2. In the quality of life assessments, combination of ion cyclotron resonance and kinesitherapy is comparable to the combination of cyclotron resonance, acoustic wave and kinesitherapy.
3. The use of ion cyclotron resonance as well as the use of the combination of acoustic wave and ion cyclotron resonance reduces the demand for non-steroidal anti-inflammatory drugs.
4. Combination of acoustic wave and ion cyclotron resonance in lumbar OA treatment has a synergistic effect of maximizing therapeutic benefits.

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