

Ocena efektywności dwóch programów rehabilitacji u pacjentów z zespołem bolesnego barku

Evaluation of the effectiveness of two rehabilitation programmes for the patients with the shoulder impingement syndrome

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Streszczenie:

Cel pracy. Celem badań było porównanie dwóch programów rehabilitacji stosowanych u pacjentów z zespołem bolesnego barku oraz w jakim zakresie rehabilitacja refundowana jest w stanie przywrócić pacjentowi możliwość odzyskania funkcji w stawie barkowym w porównaniu do programu rehabilitacji utworzonego przez autorów badań.

Materiał i metodyka. Badania zostały przeprowadzone w dwóch grupach, w każdej po 7 pacjentów ze zdiagnozowanym zespołem bolesnego barku. Pierwsza grupa korzystała tylko z zabiegów refundowanych, natomiast druga grupa była prowadzona autorskim programem rehabilitacji dostosowanym do indywidualnych potrzeb każdego z pacjentów.

Wyniki. Po terapii u pacjentów z obu grup zaobserwowano zwiększenie zakresu ruchomości w stawie barkowym, zmniejszenie poziomu bólu w spoczynku, a także w trakcie wykonywania codziennych czynności ruchowych.

Wnioski. Autorski program rehabilitacji okazał się efektywniejszą metodą leczenia w dolegliwościach zespołu bolesnego barku.

Słowa kluczowe:

zespół bolesnego barku, rehabilitacja, sprawność

Abstract

Aim. The study aimed to compare two specific programmes of rehabilitation for patients with the shoulder impingement syndrome, as well as to assess to what extent the National Health Service refunded rehabilitation scheme was able to restore the possibility of recovering the function in a shoulder joint, in comparison to the programme of rehabilitation devised and developed by the Authors.

Material and method. The assessment embraced the two groups of patients, 7 in each, all diagnosed with shoulder impingement syndrome. The first group only used the refunded treatments, whereas the second group underwent the Authors' programme of rehabilitation specifically tailored to address the patients' individual needs.

Results. Having completed the course of respective rehabilitation programmes, the patients from both groups were found to have increased the range of motion in their shoulder joints, as well as experience an appreciably reduced level of pain when pursuing their daily activities, and also when at rest.

Conclusion. The Authors' rehabilitation programme proved an appreciably more effective procedure for tackling the shoulder impingement syndrome.

Key words:

shoulder impingement syndrome, physical therapy, efficiency

Introduction

Shoulder pain is amongst one of the most frequent ailments suffered by modern man. Pathologies of the soft tissues surrounding the glenohumeral joint affect almost one third of the population. [1, 2, 3, 4] The situation is aggravated by the fact that in recent years there has been a lowering of the age limit of patients presenting with shoulder dysfunctions and pains. There are a lot of causes for such a condition. In addition to

injuries and the effects of professional work and also sporting activity, attention should be paid to bad posture, deteriorating with age, and atrophy of the shoulder girdle muscles [5].

Although there are dozens of causes of shoulder pain, they are usually referred to as a shoulder impingement syndrome. However, such a diagnosis does not reflect the cause, but only informs about the location of the pain [6].

Therefore, the accurate and precise clinical diagnosis, treatment and the correct rehabilitation programme aimed at the specific cause of shoulder joint pain gives opportunities to restore the functioning of the shoulder joint, and to eliminate the pain in patients [6].

Aim

The aim of this study was to compare two rehabilitation programmes applied to patients with a shoulder impingement syndrome and the extent to which refunded rehabilitation is able to restore the ability to recover functions in the shoulder joint in relation to the rehabilitation programme created by the authors of the study.

Research material

The study comprised 14 persons: 6 women and 8 men. The patients were divided into two groups. The first group was subjected to the rehabilitation scheme proposed by the attending physician who had originally prescribed physiotherapy, which was within the remit of the National Health Service. The other group was treated in line with the proprietary rehabilitation plan, diligently applied in due consideration of the patients' individual needs, currently experienced medical conditions, and dysfunctions.

Anthropometric data are shown in Table 1.

Table 1. Anthropometric data of study groups

	Grupa I/Group I n=7	Grupa II/Group II n=7	p
Age (years)			
x±SD	44,6±7,7	40,1±11,5,	0,066
min-max	32-55	24-55	
Body weight (kg)			
x±SD	74,8±11,4	75,4±6,8	0,078
min-max	60-90	65-85	
Body height (cm)			
x±SD	169,6±9,1	171,2±9,8	0,082
min-max	158-183	160-186	
Dominant hand (%)			
Left-Right	0-100	0-100	

x – mean, SD – standard deviation, min – minimum value, max – maximum value, p<0.05

Research method

Each patient underwent tests that comprised the following:

- Physical examination consisting of an interview, a survey of own design and the 10-point Constant pain scale, taking into account the subjective criteria (pain and fitness) [7, 8].
- Function examination included: Neer and Welsh Test, Lock Test, Drop Arm Test, Ludington Test, Dega Test [9].
- Examination of the range of motion of the shoulder joint in three planes of motion using a goniometer [10].

All measurements were carried out before and after the rehabilitation in both study groups. In addition, each patient was instructed about the patterns of performing everyday tasks aimed at reducing the pain.

The selection criteria for testing were: medical diagnosis of a painful shoulder known as shoulder impingement syndrome, shoulder aches and pains limited to 1 joint, calendar age not exceeding 55 years of age, professional activity, participation in rehabilitation involving a 10-day treatment, no additional illnesses and injuries of the locomotor system, the persistence of pain from 2 weeks to 4 months prior to consulting a doctor.

During rehabilitation, the patients from both groups were subjected to physiotherapy treatments such as cryotherapy, electrotherapy (diadynamic, TENS), laser, Sollux lamp, which were prescribed for each of the patients.

All patients were treated in a non-public health care facility in Krakow.

Due to the small number of patients under assessment (7 observations in each of the groups), statistical analyses were conducted using the Wilcoxon test to compare the two dependent samples. The level of significance was assumed at $p < 0.05$.

The methodology of rehabilitation plans:

In the Group 1 (National Health Service rehabilitation), each of the patients performed non-weight-bearing exercises in which the movement was made on a horizontal plane, parallel to the ground. The suspensions completely held and disburdened the limb, the movement was performed as fully possible, painless range, at optimal pace, in two planes: sagittal and frontal. The rehabilitation was carried out on a daily basis for a period of two weeks, each of the exercises were performed by the patient for 10 minutes. A comprehensive exercise programme for each patient lasted 30 minutes.

In Group 2 (a customised rehabilitation scheme) patients performed the exercises specifically tailored to their individual needs, for 30 minutes a day, assisted by a physiotherapist throughout.

The proprietary rehabilitation programme comprised: teaching the centralisation of the head of the humerus, learning to adopt and maintain the correct body posture, active/passive exercises, PNF method (scapular posterior depression when lying on the healthy side, a physical therapist performed the posterior depression through rhythmic stimulation of movement, and a combina-

tion of isotonic contractions). In the case of a limited posterior depression, the following exercises were applied: post-isometric relaxation of the lower part of the Trapezius and the Levator Scapulae, active exercises, active exercises with resistance (using Thera-bands), and proprioception exercises.

Results

The data obtained demonstrates that in Group 1 the average range of flexion was 100.7° before the rehabilitation and 105° after the rehabilitation. In Group 2 the average range of motion during flexion before and after the rehabilitation was 116° and 130° respectively. In Group 1 the average range of abduction prior the treatment was 75°. After rehabilitation, it was 84.3°. In Group 2 the average value of abduction prior to the rehabilitation was 95°, while after the rehabilitation it was 107.1°.

In Group 1 the mean value of internal rotation prior to rehabilitation amounted to 33.6°, whereas after the rehabilitation it was 35.7°. In Group 2 the average was 41.4° before, and 47.1° after.

All the results of the measurements of the range of motion before and after rehabilitation were statistically significant in both groups.

The average pain level was 7.1 points. Individual indicators were in the range from 4 to 10 points. After the rehabilitation, the mean level of pain was 5.2 points. Extreme results of pain levels ranged from 1 to 8 points.

In Group 2, the level of pain before the rehabilitation averaged at 7.4 points. Individual indicators of the level of pain ranged from 3 to 10 points.

The level of pain after rehabilitation was, on average, 3.1 points. Individual perceptions of patients were in the range between 1 and 6 points. There was no statistically significant difference between the results of the Constant scale in both groups under assessment (Table 2.).

Table 2. Results of the measurements of the range of motion in the shoulder joint and the Constant scale before and after rehabilitation in both study groups.

	Group I	Group II	p
Flexion [°]			
Before-After, x (SD)	100.7 (23.9)-105 (5.6)	116.4 (23.4)-130 (19.4)	0.004
Abduction [°]			
Before-After, x (SD)	75 (17.8)-84.3 (21.3)	95 (30.7)-107.1 (28.5)	0.048
Internal rotation [°]			
Before-After, x (SD)	33.6 (15.7)-35.7 (15.9)	41.4 (14.6)-47.1 (11.1)	0.003
Pain scale (punkty/points)			
Before-After, x (SD)	7.1 (2.5)-5.2 (2.36)	7.4 (2.6)-3.1 (2.1)	0.89

x – mean, SD – standard deviation, Before – before the rehabilitation, After – after the rehabilitation

The results show that in 100% of patients the right hand was the dominant one. The soreness of the joint was 92.85% for the right limb, and 7.15% for the left one (Table 3).

Table 3. The percentage relationship of shoulder soreness.

Upper Limb	Right	Left
Painful	92.85%	7.15%

In Group 1, the level of slight pain occurring during performing everyday activities decreased by 14%, whereas the percentage of patients who did not feel pain at all - increased. The percentage of patients who experienced significant or moderate pain did not change.

The percentage of patients whose work was hindered by moderate pain dropped by 14%, whilst of those experiencing slight pain rose by 28%. In the case of significant pain and a complete absence of pain, the percentage did not change.

With regard to the actual impact of pain on limiting any leisure time or recreational type activities, this percentage remained unaltered.

Significant pain occurring at night decreased by 28%, whilst the number of patients who did not feel pain at all increased by 14%. In the case of moderate and slight pain, this percentage remained unaltered (Fig. 1. and 2.).

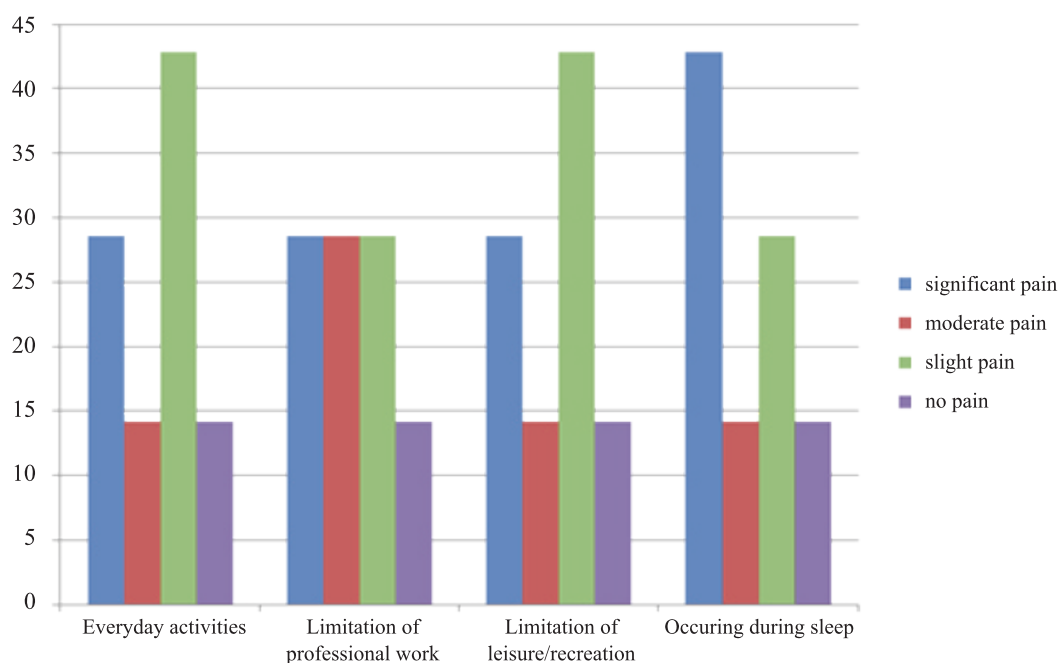


Fig. 1. The percentage of patients and their level of pain in relation to everyday activities in the Group 1 before rehabilitation

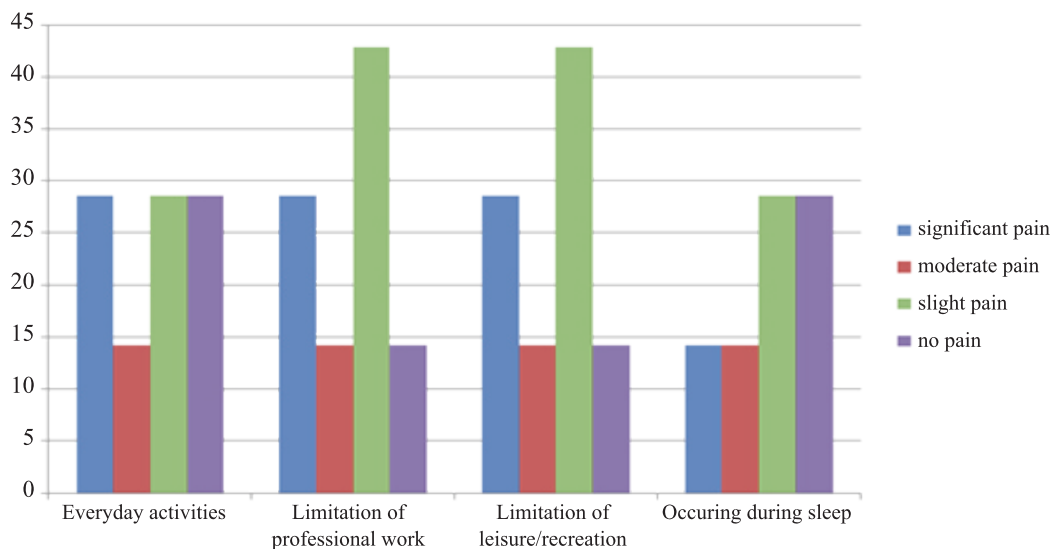


Fig. 2. The percentage of patients and their level of pain in relation to everyday activities in the Group 1 after rehabilitation

In Group 2, after rehabilitation the moderate level of pain during everyday activities had declined by 28%, the number of patients with slight pain increased, and the percentage of patients with a lack of pain rose by 14%. The number of patients with significant pain remained unaltered.

In terms of causing any limitations in performing professional work, the significant level of pain decreased by 14%, whereas the number of patients experiencing no pain increased by 14%. In the case of moderate and slight pain, the level of pain remained unaltered.

The impact of pain on recreational activities in the patients with significant pain dropped by 44%, and the percentage of those experiencing slight pain increased by 44%. The percentage of patients with moderate pain occurring during recreational activities remained unaltered (Fig. 3. and 4.).

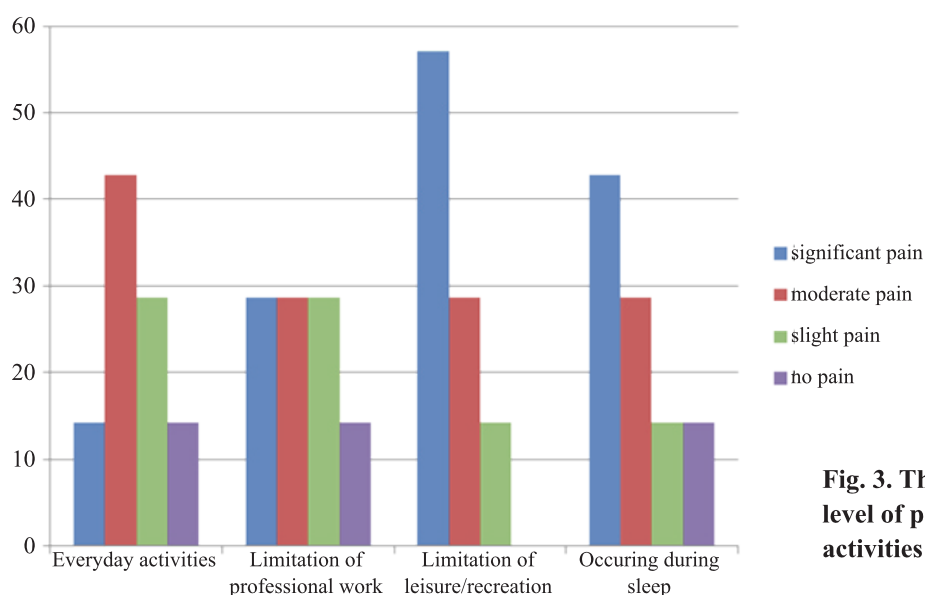


Fig. 3. The percentage of patients and their level of pain in relation to everyday activities in Group 2 prior to rehabilitation

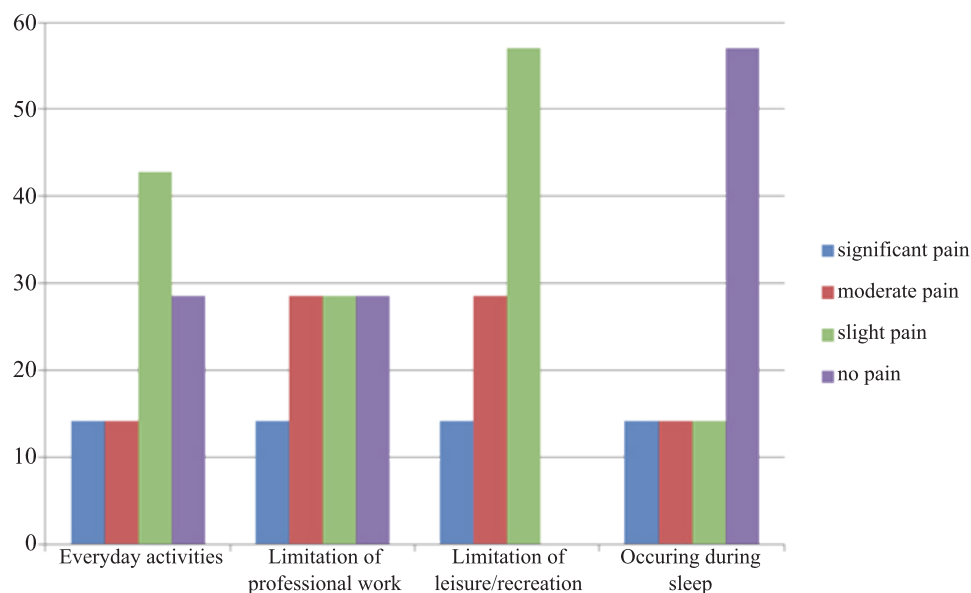


Fig. 4. The percentage of patients and their level of pain in relation to everyday activities in Group 2 after rehabilitation

Discussion

The shoulder impingement syndrome is one the biggest challenges for a physiotherapist. Shoulder dysfunctions are the third highest cause of pain ailments of the locomotor organ after the cervical and lumbar spine pain syndromes [7]. This disorder is resultant from a wide variety of causes. Every year there are more and more patients suffering from dysfunctions of the shoulder joint. Generally, the main problem is the occurrence of pain at night, in addition to limited mobility in the shoulder joint, which make performing everyday activities a challenge [11, 12].

Based on the studies conducted to date, it has been proven that the age limit of the patients suffering from chronic shoulder pain is decreasing. This applies not only to older people with a degenerative disease, but also to those involved in doing hard physical work. More and more patients performing non-physical work or jobs characterized by repetitive low amplitude movements are presenting to clinics due to suffering the shoulder pain [11].

One of the problems that must be faced is diagnostics. Defining the shoulder impingement syndrome as a cause is insufficient for offering a proper therapy, although it is with this specific diagnosis that the patients usually report to the rehabilitation centres. A physical therapist, making considerate use of select methods, has to independently identify the cause of the dysfunction. Regretfully, this is not always possible, as in many cases additional examinations such as ultrasonography and X-ray are required, as well as close cooperation between an attending physician and a physiotherapist [13].

Most patients with the shoulder impingement syndrome make

use of outpatient rehabilitation. However, its duration and the actual waiting time leave a lot to be desired. Treatment of this type of medical condition requires not only a quick diagnosis and rehabilitation, but also a longer course of treatment in comparison with the one presently proposed by the National Health Service, where the waiting time for the treatment at specific centres varies from 2 up to 6 months. The duration of the rehabilitation treatment is 10 days, the exercises refunded by the National Health Service last 15 minutes, being comprised of the following types: passive, active/passive, isometric, active and active with resistance [14].

Studies on the various available methods and options for treating the shoulder impingement syndrome can be found in contemporary literature on the subject. The most frequently assessed aspects of these methods is their efficacy in increasing the range of motion in the joints, pain relief, restoring functions during the everyday activities, application of individual physical therapy treatments, let alone overall significance of a comprehensive, individual approach to a patient [15, 16, 17, 18, 19].

The study by Ainsworth et al [7], compared the results of the rehabilitation of the shoulder aimed at individual needs of the patient, and the classic scheme of therapeutic procedures. The first group of patients were subjected to physiotherapy treatments only (ultrasounds), and steroid injections. In the group of patients with extended rehabilitation, the exercises strengthening the shoulder girdle muscles, proprioception exercises, and postural re-education were used in addition to the ultrasounds. The Oxford Shoulder Score (OSS), the SF-36 Questionnaire, and the measurements of the range of motion were used to assess the results. The results of the research unequivocally demonstrated that better functional results and pain alleviation occurred in the patients who were subjected to an individualised rehabilitation programme.

Conroy and Hayes [11], obtained similar results by comparing the comprehensive physiotherapy with the treatment accompanied by joint mobilisation. In both groups of patients there was no difference in terms of the range of motion, although the group with an additional manual therapy felt less pain after the completion of the rehabilitation programme.

These reports corroborate the results yielded by personal research, which show that in the patients who performed the non-weight-bearing exercises only (the National Health Service programme), upon completion of the rehabilitation the average range of motion in all planes improved slightly in relation to the results obtained by the patients performing the exercises in line with to the proprietary rehabilitation plan.

The research also demonstrated that after rehabilitation the level of pain in Group 1 decreased on average by 1.9 points, whereas in Group 2 it decreased by an average of 4.3 points.

The level of pain was also tested before and after the rehabili-

tation with a survey. Patients answered questions about the extent to which the pain limited their everyday activities; work, leisure and sleep etc.

The results of this study have shown that in patients subjected to an individualised rehabilitation programme there was a significant decrease in pain. They also felt a lesser degree of pain whilst performing everyday motor activities.

Such results of personal research are the evidence for the need of extending a rehabilitation programme for patients with shoulder pain.

In their studies, Wajdeczko and Szczygieł [15], compared the Mulligan's mobilisation with movement technique combined with medical taping and physical therapy. They used mostly techniques and medical taping with the first group. The second group, however, was subjected to laser treatments, ultrasounds, cryotherapy, magnetic field and TENS (40%). The results showed that in the group subjected to the mobilisation with movement technique, there was a significant reduction in pain sensations, as well as the biggest increase in the range of flexion motion. It was also found that physical therapy, as the only way to fight pain and improve the range of mobility, is not effective.

The results obtained by Wajdeczko and Szczygieł [15] are confirmed in personal studies where special methods of the shoulder impingement syndrome therapy have also proven to be more effective than traditional exercises. However, manual therapy is not the only promising method of treating the shoulder impingement syndrome. An individual approach to a patient also seems essential, especially in the treatment of such difficult cases of ailments related to the shoulder impingement syndrome. Sipko [16] conducted research on the effectiveness of individual programmes on a group of 20 patients suffering from typical ailments associated with the shoulder impingement syndrome. The 5-day individual therapy comprised of the lowering of the scapula, improving and stabilising the body posture, as well as the exercises on the posterior depression of the scapula. Techniques of rhythmic movement stimulation and a combination of isotonic contractions were also used. The results obtained by the author demonstrated a significant reduction in pain after therapy where 35% of patients identified their level of pain as 1. There was also some improvement in scapular mobility during abduction (55%) and adduction (40%).

These findings were also corroborated by the author's own research, in which an individual therapy had proven far more effective than a collective therapy, and gave better prospects for the treatment of a painful shoulder.

In the tests carried out by the Philadelphia Panel on the clinical practice guidelines on selected rehabilitation interventions for the management of shoulder pain, it has been shown that the main problem in determining the effectiveness of rehabilitation interventions is the lack of well-designed control trials. There is a need for studies verifying whether the applied

rehabilitation interventions are effective in fighting pain, as well as research on their long-term effects. [20]

As the studies presented in the literature show, there is no singularly effective method in the treatment of the shoulder impingement syndrome. However, the use of methods aimed at individuals and a comprehensive approach to the problem most certainly offers a good prospect for the future of treating this increasingly frequently occurring dysfunction. One problem, amongst other things, is the significant age diversity, as well as the multitude of coexisting dysfunctions of, inter alia, the shoulder joint (impingement syndrome, osteoarthritis, etc.), that do not allow the implementation of the appropriately designed physiotherapy procedures. [21]

As the results of this study demonstrate, there are difficulties in the treatment of patients with the shoulder impingement syndrome with a different stage of dysfunctions within the shoulder joint. A greater number of study groups would give more reliable results, but due to the age of the patients, which was one of the qualifying criteria, older people were excluded from the study, as generally their shoulder pain was often the result of a degenerative disease.

From the results of personal research it can be concluded that in comparison to the available National Health Service treatment, the rehabilitation programme based on an individual approach to a patient; stimulating him/her to exercise, as well as giving him/her a scope of appropriate exercises to carry out at home, combined with specific advice on how to maintain the correct body posture, has significantly improved mobility, enhanced pain relief, and diminished its level during everyday activities. The effectiveness of the physical treatments that the patients were subjected to was not directly assessed in the course of rehabilitation, but they evidently led to additional relaxation of muscles and a reduction of pain felt by the patients, thereby positively affecting the process of comprehensive rehabilitation.

The results of research on the proprietary rehabilitation programme are in conformity with the results of the studies presented by other authors, taking into consideration the aspect of individual, needs-based work with a patient [15, 16]. The therapy not only appreciably contributes to an increase in the range of motion, pain relief, and improvement in the execution of the everyday activities, but also a patient's mental health and wellbeing.

Individual rehabilitation and active support for the patient makes the treatment easier and more fun, and most importantly, it provides better results along the way to regaining full functionality in the shoulder joint.

Conclusions

1. The proprietary rehabilitation plan that adopts an individual, needs-based approach to a patient, proved more effective in increasing the range of motion in the shoulder joint affected by the shoulder impingement syndrome.

2. It contributed to alleviating pain, and in some cases accounted for even a complete relief from pain in some patients, in comparison to the self-assessment of pain made by the patients offered the National Health Service programme.
3. Following completion of the course of proprietary rehabilitation programme, the values of the indicators under assessment improved significantly, as compared to the results yielded by the rehabilitation scheme based exclusively on the application of the non-weight-bearing exercises.

Implications

1. In the treatment of patients with the shoulder impingement syndrome, it is highly recommendable to make use of an individually tailored, needs-based, rehabilitation programme.
2. The rehabilitation programme should comprise both a range of motion exercises in addition to specific instruction on the centralisation of the head of the humerus, promote awareness of the necessity to learn to adopt and maintain the correct body posture, and also regularly pursue the exercises recommended within the special methods scope.

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Piśmiennictwo/ References

1. Ainsworth R, Lewis JS. Exercise therapy for the conservative management of full thickness tears of the rotator cuff: a systematic review. *Br J Sports Med*, 2007; 41:200–210.
2. Lewis JS. Rotator cuff tendinopathy. A review. *Br J Sports Med*, 2008; doi:10.1136/bjsm.2008.052175
3. Lewis JS. Rotator cuff tendinopathy/subacromial impingement syndrome: is it time for a new method of assessment? *Br J Sports Med*, 2009;43:259–264.
4. Lewis JS, Raza SA, Pilcher J, Heron C, Poloniecki JD. The prevalence of neovascularity in patients clinically diagnosed with rotator cuff tendinopathy *BMC Musculoskeletal Disorders*, 2009;10:163.
5. Szapel K. The shoulder impingement syndrome – diagnosis and therapy. *Young Therapist*, Warszawa 2007
6. Dziak A., Gawroński W., Trzaski T. Rehabilitation in shoulder and knee injuries. *Medicina Sportiva*, 2003;2:77-92.
7. Ainsworth R., Lewis J., Conboy V. A prospective randomised placebo controlled clinical trial of a rehabilitation programme for patients with a diagnosis of massive rotator cuff tears of the shoulder. *Shoulder & Elbow*, 2009;1:55–60.
8. Constant C., Murley A. A clinical method of functional assessment of the shoulder. *Clinical Orthopaedics and Related Research* 1987;214:160
9. Neer C. Welsh RP. The shoulder in sports. *Orthop Clin North Am*. 1977 Jul;8(3):583–591.
10. Riddle D., Rothstein J., Lamb R. Goniometric Reliability in a Clinical Setting. *Shoulder Measurements. Phys Ther* 1987; 67: 668-673
11. Solem Bertoft E. the shoulder impingement syndrome from physiotherapeutic point of view – systematic review. *Rehabilitacja Medyczna*, 2002;6:55-58.
12. Tylman D., Dziak A. Musculoskeletal traumatology. Medical Publishing House PZWL, Warszawa, 1993.
13. Lesiak A. The shoulder impingement syndrome – pathogenesis, clinical presentation and treatment. *Rehabilitacja Medyczna*, 2002;6:26-31.
14. Ordinance No. 60/2007/DSOZ President of the National Health Service of 19 September 2007. On determining the conditions for the conclusion and execution of contracts concerning therapeutic rehabilitation.
http://www.nfz.gov.pl/new/art/2832/60_2007_zal_6.pdf
15. Wajdeczko M., Szczygieł A. Comparison of the effectiveness of treatment of patients with the shoulder impingement syndrome using the techniques of Mulligan concept in combination with kinesiotaping and modalities treatments only. *Medycyna Manualna*, 2011;3:5-12.
16. Sipko T. An attempt to use PNF method in the treatment of the shoulder impingement syndrome. *Fizjoterapia Polska*, 2005;5(1):41-47.
17. Kuciel-Lewandowska J. The effectiveness of comprehensive physiotherapy in the shoulder impingement syndrome. *Annals of the Pomeranian Medical University w Szczecinie*, 2010;56 (3):121-125.
18. Przekwas P. The usefulness of physical stimuli in the treatment of pain of the shoulder impingement syndrome. *Fizjoterapia Polska*, 2003;3(1):76-84.
19. Krukowska J., Zbrzezna B., Czernicki J. The influence of cryotherapy on the results of physiotherapy in patients with the shoulder impingement syndrome. *Fizjoterapia*; 2009;17(4):19-27.
20. Members of the Philadelphia Panel. Developed by the Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions in shoulder pain. *Rehabilitacja Medyczna*, 2002;6:83-92.
21. Weber K. A Seven-point programme of treatment of disorders of the shoulder joint. *Rehabilitacja Medyczna*, 2003;7(1):45-48.