

FOLIA MEDICA CRACOVIENSIA

Vol. LVII, 1, 2017: 65–74

PL ISSN 0015-5616

Assessment of the impact of individual therapy on upper limb function in patients diagnosed with painful shoulder syndrome

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Abstract: **Introduction:** Functional disorders of the shoulder girdle affect 1/3 of the population. The diagnosis of “painful shoulder” or shoulder impingement syndrome is vague and imprecise. It can relay to soft tissue pathology as well as to limitation of mobility of the joint. In this case an appropriate diagnosis, followed by a quick and effective treatment, is crucial. A physiotherapy assessment, performed during an individual therapy session sets out a way forward for targeted rehabilitation.

Objectives and purpose of the article: The aim of this publication is to assess the impact of individual therapy on the function of the shoulder girdle in patients subject to health resort treatment. **Methods and materials:** The study included 30 patients diagnosed with shoulder joint conditions before and after individual therapy with a physical therapist. The clinical study involved basic measurements of the range of mobility and standardized functional tests. The patients were surveyed to evaluate changes in the performance of daily activities before and after the therapy. Pain assessment was conducted using the Visual Analogue Scale (VAS). The results were subjected to statistical analysis.

Results: The use of individual health resort treatment therapy significantly improved individual functional capacity of the patients. Self-evaluation of the patients on the performance of daily activities has shown improvement of the quality of those activities. According to VAS scale, a difference between the level of perceived pain before (mean = 6.2) and after physical therapy treatment (mean = 3.7) as well as an improvement of the range of mobility have been observed.

Conclusions: The results of the study confirmed that the treatment has significantly reduced the pain. Individual work with a physical therapist, focused on the improvement of the range of mobility of

the shoulder girdle and functional tasks, clearly reduces limitations of daily activities of the patients and can improve the quality of their life.

Key words: painful shoulder, individual therapy, functional movements.

Introduction

Pain in the shoulder girdle affects 1/3 of the population and accounts for the third, as to frequency, reason to see an orthopedic surgeon. Only 50% of cases end up with a total reduction of the pain and complete recovery within the following 6 months [1–3]. Even minor symptoms or the mobility range limitation may often lead to the reduction of daily activity of patients and detriment to their quality of life.

The diagnosis of “painful shoulder” or shoulder impingement syndrome is a vague and imprecise term of various etiology. The most common cause of it can be, inter alia, a local synovitis, leading to the adhesion of the bottom of the articular capsule and increased deposition of calcium in the area, damage to the rotator cuff, reduction of the subacromial space, degeneration of the articular surfaces, unsteadiness or accumulation of microtraumas and soft tissue overload [4]. Regardless of various causes, the most common changes affect the supraspinatus muscle. Before the beginning of the rehabilitation of the shoulder girdle area it is required to exclude any damage to the brachial plexus and the compression neuropathy, resulting from degenerative changes in the cervical spine [5, 6]. Numerous studies have also confirmed that the risk of pain of the shoulder girdle increases with age. The diagnosis of shoulder impingement syndrome affects 4% of adults aged 40–60 up to 54% of people over 60 [7]. In addition to the age, the negative predictive value is determined by such factors as: high rate of disability, long period of persistent pain, high pain irritation [8].

The researchers aim to highlight the issue related to diagnosing and classification in this area. An invalid diagnosis can lead to incorrect treatment, thereby extending the recovery period. Ambiguity in this field can also cause communication issues between doctors and physical therapists. However, in practice, apart from the physician’s diagnosis, the therapist often carries out independent clinical and functional tests in order to establish the direction of the therapy [9]. It has been confirmed that the patients with a specific thorough diagnosis recover faster than the patients with non-specific diagnosis [10].

The aim of the rehabilitation is to eliminate local dysfunction in the joint, reduce pain and get the patient back to work and active involvement in social life. Therapeutic exercises are aimed to restore the correct muscle balance, lost function, joint mobility and improve the posture [11]. Group exercises offered by health resorts give no possibility to focus on a specific medical condition or individual patient therapy.

The purpose of this study is to evaluate the impact of individual therapy on functional mobility of the shoulder girdle in patients diagnosed with “shoulder impingement syndrome”.

Methods and materials

The study included 30 patients diagnosed by a general practitioner with “shoulder impingement syndrome” before and after rehabilitation treatment. The study group consisted of 20 women (66.7%), median age 63.1 (SD = 10.6) and 10 men (33.3%) median age 61.7 (SD = 6.6). The BMI of the patients was calculated, based on the anthropometric data, and 28.3 (SD = 4.4) was the mean score. The calculations and therapy were carried out at the turn of 2015/2016 in Krakow Swoszowice health resort. Characteristics of the patients are presented in Table 1.

Table 1. Characteristics of the test group.

Variable		n	%
Gender	Female	20	66.7
	Male	10	33.3
Age	≤60	10	33.3
	>60	20	66.7

Patients participation in the study was determined by the following criteria: the diagnosis of “painful shoulder syndrome” in at least one limb, current pain, and also involvement in a three-week rehabilitation camp which included the target individual therapy. The principle of the exemption was the pain in the shoulder joint occurring as a secondary problem which may have originated from damage to other structures located beyond the shoulder complex, possible neurological disorders, cancer or its suspected occurrence.

To participate in the study, every patient expressed their informed consent and completed the required documents. The study was conducted in compliance with the ethical principles of the Helsinki Declaration, taking into account any rights of the study subjects.

The clinical study involved a researcher-designed survey questionnaire focused on the duration of the pain and the patients’ self-evaluation of barriers arising while performing daily life activities. The survey was based on Michener and Leggin publication reviewing available shoulder joint functional assessment scales [12]. The survey contained questions about 7 daily life activities (dressing up, bathing, combing hair, using the toilet, lying on the painful upper limb, activities that require elevation

of the arms above shoulder level, activities that require lifting some loads). The subject was requested to select a number from 0 to 3, depending on the difficulty, where 0 was the inability to perform the task, 1 — the task extremely difficult to perform, 2 — quite difficult and 3 — not difficult at all.

Table 2. Daily life activities questionnaire.

Activity	Right upper limb	Left upper limb
dressing up (i.e. outwear)	0 1 2 3	0 1 2 3
Bathing (reaching out to the back)/putting on a bra	0 1 2 3	0 1 2 3
Combing hair	0 1 2 3	0 1 2 3
Using the toilet	0 1 2 3	0 1 2 3
Lying on the painful upper limb	0 1 2 3	0 1 2 3
Lightweight activities requiring the arms to be lifted above shoulder level	0 1 2 3	0 1 2 3
Activities requiring the arms with a load >3 kg to be lifted above shoulder level	0 1 2 3	0 1 2 3

As a second step, the manual therapist performed an assessment of the patient using functional tests. After analysis of available literature, 5 tests showing high reliability and repeatability were selected [13]. The assessment focused on possible damage to such structures as: supraspinatus muscle (Jobe test), other structures of the rotator cuff (the subscapularis muscle and the infraspinatus muscle) through internal and external rotational motion with resistance, the subacromial impingement symptoms (Neer test) and the stability of the shoulder joint (anterior and posterior drawer test).

In addition, the assessment included the pain intensity test using VAS scale and the range of mobility test.

The first assessment was conducted at the admission of the patients to the rehabilitation camp and the next after 3 weeks.

The results were subjected to statistical analysis using Statistica 12 PL software. The value of $\alpha = 0.05$ served as the level of statistical significance. For the description of the statistical analysis of quantitative variables, in order to obtain the most transparent results, average values with the standard deviation were applied. Differences in functional test results before and after rehabilitation treatment were compared using McNemar's test. The results of the survey questionnaire referred to daily life activities, compared using the Wilcoxon signed-rank test to analyse each separate activity and using student's t-test to analyse the sum of the questionnaire.

Results

Each of the patients was diagnosed with a “shoulder impingement syndrome”. The clinical study allowed to distinguish two main pain locations reported by the patients — the pain radiating to the elbow or shoulder, as well as the pain located on the top of the joint. Moreover, the level of perceived pain was much lower after an individual therapy with a physical therapist.

Table 3 presents the results of the functional tests before and after rehabilitation treatment. Statistical analysis of the results of functional tests in the subject group points to the conclusion that the treatment had a statistic impact on the health of the patients with a positive result in Neer impingement test ($p = 0.013$).

Table 3. Comparison between proportions of the results of the diagnostic tests before and after the treatment.

Test	Before treatment		After treatment	
	n	%	n	%
Jobe Test (supraspinatus muscle)	18	60.00	17	56.67
Subscapularis muscle test	8	26.67	5	16.67
Infraspinatus muscle test	9	30.00	6	20.00
Neer impingement test*	19	63.33	11	36.67
Anterior and posterior drawer test (instability)	5	16.67	4	13.33

* $p < 0.05$ statistically significant value compared with the result after rehabilitation treatment; McNemar's test ($p = 0.013$)

The study showed that after three weeks of individual therapy, the greatest improvement was observed among patients with initial symptoms of subacromial impingement (8 people reported significant pain reduction). The evidence of the above statistical analysis is a nearly double reduction of the positive result of the impingement test in patients subject to a three-week treatment.

In patients suffering from the rotator cuff problems, the biggest change was observed in participants whose major condition was located in the subscapularis and infraspinatus muscles. The least significant improvement was observed in patients with the positive overload supraspinatus muscle symptom, and it accounted for approximately 10%.

The results of the functional self-assessment survey questionnaire showed significant improvement in the patients. The most difficult task to perform before the therapy was raising the arms under the load, which most of the patients considered as impossible or extremely difficult to perform (82%). After the period

of individual therapy, the vast majority of the patients considered this task as quite difficult (70.1%). The summary of results is presented in Table 4. To best illustrate the analysed parameters, the average value and the standard deviation were applied, while the distribution of the tested variables did not comply with the normal distribution.

Table 4. Results of the functional assessment of the upper limb mobility before and after rehabilitation treatment.

Activity	Before treatment		After treatment		p
	Average	SD	Average	SD	
Dressing up (i.e. outwear)	1.97	0.61	2.60	0.49	<0.00*
Bathing (reaching out to the back)/putting on a bra	1.03	0.89	1.73	1.08	
Combing hair	2.13	0.94	2.67	0.80	
Using the toilet	2.87	0.57	2.93	0.25	
Lying on the painful limb	1.60	1.10	2.40	0.81	
Lightweight activities requiring the arms to be lifted above shoulder level	1.57	0.97	2.26	0.87	
Activities requiring the arms with a load >3 kg to be lifted above shoulder level	0.73	0.83	1.20	0.71	
TOTAL **	11.90	3.99	15.83	3.31	

* p <0.05 statistically significant value compared with the result after rehabilitation treatment; Wilcoxon signed-rank test

** student's t-test.

Functional assessment results showed significant improvements during the performance of all the evaluable tasks.

Discussion

Limitation of the normal function of the shoulder joint is the cause of one out of three visits to the specialist's. Data on the prevalence of this condition is comparable throughout the world. Such an impairment may significantly reduce the quality of life of patients and their participation in the activities of everyday life [14–16].

The first and most important issue, which is currently a matter of international discussion is getting an accurate diagnosis of the shoulder girdle conditions. The absence of effective and consistent methods of treatment may result from inaccurate understanding of the condition and naming disparities in diagnosing [17].

The study focused on the analysis of selected patients with a general diagnosis of "painful shoulder" syndrome. Most of the subjects could not clearly recall the early

occurrence of pain, thus pointing to a long-standing disease process and the absence of a clear harmful factor. Only four patients reported a sudden, traumatic onset of the condition. The absence of a specific diagnosis postponed the targeted actions aiming to improve patients' clinical condition.

Among the available scientific research studies, there are several known factors predetermining the emergence of the limitations in the function of the shoulder girdle, such as: age, female gender, metabolic diseases (diabetes, hypothyroidism), type of work performed (work at the computer or one that requires frequent lifting of the arms above the shoulder level), physical activity (swimming, volleyball) [18–20]. Such potential factors as mental or genetic predispositions have also been analysed but no significant correlation has been found [21]. The study also confirmed no such dependencies.

Accurately selected therapeutic measures require careful interpretation of the problem. The study used a survey questionnaire self-evaluation of the patients' activities as well as functional diagnostic tests based on the available studies confirming the effectiveness of selected methods [22]. Survey questions concerning the daily activity of the patients inquired about functional activity of the selected indicator muscles or mobility limitation, i.e. problems with closing a bra shall imply suspicion of limited and painful internal rotation, and consequently, inadequate work subscapularis muscle. The biomechanics of the function of the shoulder girdle is complex and requires an overall assessment, taking into account the function of the scapula and the mobility of the clavicle [23]. After an accurate specification of the problem, the patients were subjected to individual manual therapy treatments and exercises for a period of three weeks.

An accurate analysis of the source of the problem, associated with pain or limitation of mobility of the shoulder girdle shall imply appropriate actions. A comprehensive meta-analysis on the subject performed by Kelley *et al.* [24] attempts to provide a clear and legible procedures. The authors highlight the lack of standardized test methods for diagnosing patients and the non-use in medical practice of international standardized tests to assess their functional condition. There are also no available materials for the patients which would describe possible therapies and prevention methods.

In the case of most of disorders of the shoulder complex, the most common treatment is physical therapy. There is a current rehabilitation code of conduct for subacromial impingement syndrome, rotator cuff damage or contracting capsular inflammation [25–28]. Before initiating the study, the researchers acquired information about the available treatment methods and some of them were used during the patients' therapy. The effects of the physical therapy showed an improvement in performance of most of the functional tests, which arguments for a good direction of the selected rehabilitation methods and activities. A three-week period of therapy, however, limited the possibility of the complete recovery. According to American

scientists, a full recovery period allowing the patient to return to normal everyday activity, would require at least 10 weeks of therapy. Functional rehabilitation program draws attention to the holistic approach towards the patient. The exercises have to be aimed at restoring the correct biomechanics of the closest parts of the body first and the remote parts of the body next [29]. The present study applied the above therapeutic scheme. Firstly, the researchers focused on restoring the proper operation of the scapula and its stable position, and at the further stages — on the strengthening of the relevant muscles of the arm and forearm. The effects were every time controlled through a functional test and an evaluation of mobility of the patient.

Research studies suggest that treatment programs which do not include manual therapy are inefficient. Numerous studies compared the effects of the therapy, where the subjects performed only indicated therapeutic exercise on their own behalf, with the effects of the group whose exercises were combined with a soft tissue therapy and joint mobilization therapy [30, 31]. This explains the choice of therapeutic measures in the own study. Physical therapy treatments, selected by the person carrying out the test were used as an addition to the above methods. To maximize the effects of the therapy, the researchers also applied such measures as: laser biostimulation treatments, ultrasound, or cryotherapy, whose beneficial effect has been confirmed in other studies [32, 33]. According to the authors, the combination of all the aforementioned methods represented an effective therapeutic approach in their own work, and resulted in positive test results.

Patients who did not observe any significant improvement were re-referred to a doctor. In the hard-to-cure cases, it is necessary to perform a steroidal injection directly into the joint, which should be monitored using an ultrasound scan. This method is more recommended and has documented better effects than long-term medication on non-steroidal anti-inflammatory drugs [34].

The above results of the study argument for the use of functional assessment of patients, in order to develop an appropriate treatment program including soft tissue therapy, joint mobilization, therapeutic exercises and physical therapy sessions. A holistic approach and a quick, accurate diagnosis shall reduce pain symptoms and provide for a speedy recovery and return to the full daily life activity.

Conclusions

1. Pain and limited mobility in the shoulder joint clearly disturb functional condition of patients.
2. An accurate individual therapy program shall reduce the period of full recovery.
3. The results of the study indicate deficiencies in the proper diagnosis of the shoulder girdle conditions, therefore it requires extra time to take appropriate therapeutic measures.

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