Effectiveness of conservative treatment of multidirectional instability of the shoulder joint. Literature review and meta-analysis

ABSTRACT:

Introduction: Multidirectional shoulder instability (MDI) occurs when the shoulder is dislocating in at least two directions. The patient usually experiences pain with apprehension and a clicking sensation inside the joint. So far, a few classification scales of shoulder instability have been made. Despite this fact, MDI is highly problematic for clinicians in diagnosis and treating.

Aim: This article presents the current trends in the conservative treatment of multidirectional instability, assess effectiveness of rehabilitation and indicates the directions of MDI research.

Material and methods: In order to find current literature and conduct a critical analysis, the following scientific database was used: Cochrane Library, Physiotherapy Evidence Database (PEDro), MEDLINE and PubMed. We chose four articles which included a comparison of conservative and operative treatment, and four which evaluate the effectiveness of rehabilitation.

Results: Low quality evidence shows priority of surgical treatment over conservative treatment. The protocol developed by Watson obtains a statistically significant advantage over the Burkhead and Rockwood protocol.

Discussion: The effectiveness of rehabilitation reaches different levels. Rehabilitation should last from 3 to 12 months. If rehabilitation does not achieve a sufficient effect, arthroscopic methods of reducing the volume of the articular capsule should be considered. Due to the small number of scientific reports and their quality, the obtained data should be interpreted with caution. Much further research is required to create a precise and most effective algorithm.

Conclusion: Rehabilitation exercises play an important role in the treatment of multidirectional instability of the shoulder joint, especially when the patient has not had an injury. Exercise types and load should be dosed individually. At present, the protocol described by Watson is the most effective.

CONCLUSION: kinesiotherapy, multidirectional instability, rehabilitation protocol, shoulder joint, shoulder stabilization

ABBREVIATIONS

ER – external rotation
IR – internal rotation
MDI – multidirectional shoulder instability
RCT – randomized controlled trials

INTRODUCTION

Multidirectional shoulder instability (MDI) was first described by Neer and Foster [1], who defined it as a state of shoulder dislocation in more than one direction with little or no trauma. As a rule, MDI patients are young people who provoke a shoulder subluxation with their own habit. The leading symptoms include pain, upper limb instability and disability with an abnormal movement pattern. Multidirectional instability can be influenced by a number of coexisting anatomical factors. Neer and Foster [1] believe that the main cause of instability in an excessively large, loose joint capsule, while other authors also draw attention to morphological changes in the glenoidal cavity and failure of the glenohumeral ligament [2–4]. Ligamentous laxity, upon which this disease develops, may be congenital. In such case, the symptoms usually appear on both sides or are acquired through repetitive microtrauma during sports activities. Different classifications of instability have been developed during the last years. Initially, instability was distinguished only according to direction, i.e., one, two or three directions [5]. Later, a new classification of dynamic instability was introduced. Unidirectional or multidirectional instability with or without increased ligamentous laxity was distinguished [6]. This was followed by the establishment of the three-level Stanmore classification [7], which is complete and also takes into account the cause of instability (Fig. 1.). Type I are patients in whom trauma has...
caused structural damage to the joint. Type II includes patients who have organic deficits such as capsular length insufficiency and/or acetabular dysplasia. Type III applies to patients without significant structural defects, or rather, with an abnormal pattern of activity in the muscles of the shoulder girdle. The latest classification of functional instability was proposed by Moroder et al. [8] who distinguish two types of instability without structural change, i.e., positional dependent and positional independent. These two groups are then divided into controlled or uncontrolled, or dependent and independent on the will of the patient. Patients with multidirectional instability are characterized by an altered movement pattern, different neuromuscular control and different activation of the muscles that stabilize the shoulder girdle as compared to the healthy population [9–11]. In such cases, the scapula is usually positioned in downward rotation and its movement towards the upward rotation is significantly limited, with the result that the contact between the articular surfaces is reduced and the gliding movement of humeral head increases [12, 13]. We also know that patients with MDI have an altered structure of connective tissue and content of elastin fibers [14]. If no intervention is undertaken in the natural course of multidirectional instability, only 22.9% of non-traumatic patients can count on a spontaneous recovery or improved stability at 3 years of follow-up [15].

The treatment of choice in MDI, especially the first chosen option, should be mainly kinesiotherapy-based rehabilitation [16–19]. Rehabilitation protocols concentrate around stabilizing the scapula, improving neuromuscular activation and control, exercising proprioception, and modifying everyday activities. When the shoulder joint exhibits failure of static stabilizers, it appears reasonable to strengthen the rotator cuff and the periscapular muscles in order to compensate for the failing ligaments and joint capsule. Better stabilization can be obtained through to co-contraction exercises, balance between agonist-antagonist muscle pairs, which ultimately improves the contact of the humeral head with the acetabular cavity in various positions of the upper extremity in space. Since proprioception is compromised with muscle fatigue, increasing strength and endurance during proprioceptive exercise appears key in the treatment of MDI [20, 21]. Even if the patient requires surgery, long-term observation shows that the surgically decreased joint capsule still stretches over time, thus it seems justified to constantly exercise the muscles of the rotator cuff and all active shoulder girdle stabilizers [22].

SCIENTIFIC EVIDENCE OF THE EFFECTIVENESS OF CONSERVATIVE TREATMENT

Conservative treatment and surgery

In order to establish the correct treatment guidelines for MDI, several authors compared the results of conservative and surgical treatment. Tillander et al. [23] compared the effect of rehabilitation to open reduction of the volume of the axillary pouch. The rehabilitation protocol consisted of 4 phases which lasted 21 weeks. Patients strengthened the muscles of the rotator cuff and scapula stabilizers. The results showed that 55% of the patients were dissatisfied with the rehabilitation results, and 44% underwent surgery. After surgical treatment, almost 78% of patients achieved a satisfactory result. The authors concluded that patients with only pain features of MDI are difficult to treat, while those with pain and symptoms of instability exhibit a moderate response to exercise. Combined treatment, surgery and rehabilitation should be used when instability is the predominant symptom. Illyes et al. [24] found MDI in 130 patients. They divided these patients into two groups. The first group underwent only rehabilitation treatment, the second group underwent arthroscopic capsular replication and rehabilitation after surgery. The control group were healthy individuals. The rehabilitation protocol included proprioceptive exercises, neuromuscular re-education, correct movement pattern training, and exercises to strengthen the shoulder blade and shoulder joint in open and closed kinematic chains. Biological feedback in the form of mirrors was used to maximize the rehabilitation effect, and muscle activity was measured by EMG. Conservative treatment lasted for 24 weeks, during which the muscles of the rotator cuff, the pectoralis major, biceps and triceps muscles, and the deltoid muscle were strengthened. The conservative group achieved normalized muscle force, but not to the same extent as in the group supported by surgery, which obtained similar proper muscle activation as the control group [24]. Unfortunately, the authors did not disclose details about the type of exercise, frequency, and volume of training. The same group of authors [25] measured the scapulohumeral rhythm and displacement of the humeral head center of rotation in relation to the acetabulum in exactly the same experimental groups as above. The conclusion was similar as before. In order to achieve full physiological function of the complex, it was necessary to perform surgical treatment supplemented with rehabilitation. Ide et al. [26] tested a rehabilitation program for patients with MDI using a brace that placed the scapula in upward rotation. The experimental group consisted of 46 individuals who performed the exercises for 8 weeks. The mean value on the modified Rowe scale increased significantly from 51.9 to 74.9 points, the moment of external (ER) and internal (IR) rotation force also increased, and the ER/IR ratios decreased. Conservative treatment was unsuccessful in three cases after 7-year follow-up; therefore, the patients underwent surgery. To summarize, we can cite the results of a systematic review by Longo and colleagues [27] who analyzed 24 papers on the effectiveness of MDI treatment, and observed that the rate of recurrence of instability after surgical treatment is at the level of 10%, while after isolated rehabilitation treatment, it was 21%.

Evaluation of the results of conservative treatment

There are not many studies assessing the effectiveness of rehabilitation treatment in non-traumatic patients presenting symptoms of multidirectional instability. In addition, authors’ results vary considerably. Warby et al. [28] believe that the essential reason for this may be the significant heterogeneity of patients and different methods of their assessment. The other parts are the low incidence rates of the disease, difficulty in putting together clinical groups and the lengthy follow-up of the relatively few cases. The existing papers represent overwhelming evidence of the poor-quality impact of rehabilitation on improvement in the Rowe score, muscle strength and kinematics of the shoulder and scapula.

Burkhead and Rockwood [17] described a rehabilitation protocol for posterior and multidirectional shoulder instability. The rehabilitation program was intended to last 3 to 4 months and was based on the principles of progressive resistance. It consisted of two phases. In the first phase, patients used 6 types of Theraband with increasing resistance. In the second phase, Therabands were
replaced with weights in similar exercises. The authors observed good or excellent Rowe scores in 88% of patients with non-traumatic MDI and no voluntary subluxation, and 100% good and excellent results in participants with MDI and arbitrary subluxation provided they had no psychological problems. Misamore et al. [29] tested the effectiveness of home exercises on a group of 64 patients with MDI. The rehabilitation program consisted of four phases, but the authors did not disclose any details about the type of exercise. The first phase aimed to reduce pain by relieving the upper limb of pain-inducing activities, use of painkillers, and gentle exercise. In the second phase, the patients performed exercises with a gradual increase in resistance in painless ranges for 15–20 minutes 3 times a day. The resistance exercises included external and internal rotation, flexion, abduction and extension of the arm. Movements of the shoulder blades were trained towards retraction, elevation and depression. Phase 3 additionally included functional exercises specific to a given sport discipline. In phase 4, the patient returned to active work and sports. Each participant was advised to continue the exercise program after completing rehabilitation to maintain the effect. At the beginning of the experiment, 5 patients opted out. Of the remaining 59, 20 had to undergo operative shoulder stabilization. Of the 39 patients, 19 had persistent pain and 18 still complained of symptoms of instability. Twenty-eight out of 59 patients subjectively felt better or much better after rehabilitation. In the final follow-up of even to 10 years, 2 patients were excluded from observation and 1 was operated on. This means that out of 57 cases, 36 were treated exclusively by rehabilitation, and 21 had to undergo surgery. Of the 36 conservative patients, 23 rated their shoulder good or excellent in terms of pain and 17 rated it good or excellent in terms of instability. On the modified Rowe scale, 5 out of 36 scored “excellent” and 12 scored “good”. The remaining 19 scored “poor”. Only 8 patients reported no symptoms of pain and instability. In summary, of the 57 patients assessed between 7 and 10 years after medical intervention, 17 scored “satisfactory” on the Rowe score, 23 had good or excellent pain management, and 20 subjectively rated their arm as good or excellent. It must be noted that the group consisted of active patients, working physically or practicing sports [29].

Bateman et al. [30] tested the effectiveness of their own program (Derby Shoulder Instability Rehabilitation Programme) in patients with chronic non-traumatic shoulder instability. The protocol is fairly well described and involves two phases. The first phase focuses on the speed of muscle activation, plyometric exercises, and a phase of inhibiting rapid movements until patients reach the set number of repetitions without too much fatigue. The second phase includes mainly proprioceptive, muscular balance and trunk stabilization exercises, also with a well-defined time objective. The experiment included 18 patients (3 MDIs, 1 case of posterior instability and 14 cases of anterior instability). In a relatively short follow-up (4.5 months on average), participants achieved an improvement of 16.67% on the OISS score and 36.76 on the WOSI score. No differences were observed for improvement between Stanmore Type II and Type III patients.

In 2016 Watson et al. [31, 32] published a detailed rehabilitation program for MDI. Excluding the program introduced by Burkhead and Rockwood in 1992 and the Derby Shoulder Instability Rehabilitation Program, it is the only protocol described in sufficient detail to be replicated by other clinicians or compared in studies. The rehabilitation protocol initially focuses on scapular stabilization exercises, and only after this is achieved, strengthening of the rotator cuff muscles and specific exercises for a particular job or sport are implemented. The protocol is divided into six phases. The authors called the first phase “scapula control and coronal plane control at 0° to 30° abduction”. It begins with the correct positioning of the scapula, which in turn forms the basis of the authors’ concept. Scapular stabilization is achieved by working on the upward rotation, elevation and posterior tilting, while progression is achieved through external resistance. In the next phase, proper control of the scapula allows to gradually increase the range of motion for abduction. Only then do the authors introduce exercises to strengthen the external, internal rotators and posterior muscles group to prevent posterior translation of the humeral head. Phase 3 involves work on controlling the flexion motion from 0 to 45°. The range of abduction and flexion up to 90° is achieved only in phase 4. Phase 5 involves specific exercises for particular parts of the deltidium, and phase 6 includes functional and sports adaptation exercises. Following the end of the program, patients are obliged to continue exercising on their own in order to consolidate the rehabilitation effect [31].

The rehabilitation program presented by Watson has been compared to that proposed by Burkhead and Rockwood in randomized controlled trials (RCT) [33]. Forty-one patients were randomized to one of the protocols. The results showed that patients in the Watson program group had better WOSI (33% after 12 weeks and 36% after 24 weeks) and MISS scores (33% after 12 weeks and 47% after 24 weeks) and improved symptoms and abduction after 24 weeks of rehabilitation than patients in the Burkhead and Rockwood group. It should be noted that up to week 6, there were no significant differences between the programs.

**DISCUSSION**

Analysis of literature may lead to finding certain indications in the rehabilitation procedure for patients suffering from multidirectional shoulder instability. Burkhead [17] claims that the best patient stability is obtained after 3 months of treatment, while Misamore [29] observed that the majority of patients who did not respond favorably to rehabilitation up to the third month showed no
improvement later as well. In turn, Illyes [24] believes that conservative treatment should be attempted for at least 6 months before the patient is qualified for surgery. Watson developed what seems to be the best rehabilitation protocol to date, lasting 24 weeks [31, 32]. The author recommends continuing exercises after the end of the program for 12 months, with follow-up every 3 months.

The rehabilitation effect varies significantly between papers. Some have achieved good or even excellent results, while the effects of others are poor. This is probably due to the variable characteristics of the participants, mainly age and level of sports activity [17, 23, 29]. There is also no consistency in the recommendations concerning home exercises in terms of type, volume and duration [29]. Additionally, the result will be influenced by the fact that some papers also included traumatic cases [11, 34]. Therefore, there is a need for considerable research in the field of MDI treatment in order to create a precise, most effective management algorithm. In view of the small number of such cases, it is extremely difficult to complete a homogeneous group of individuals. Although, according to Danzinger et al. [35] the distribution of functional instability in the young population is underestimated. The experiment conducted by Warbe et al. [33] has finally provided evidence that the type of rehabilitation has an impact on the outcome. Eshoj et al. [36] also conducted RCT which proved that an individualized rehabilitation program under the control of a physiotherapist gains an advantage over ordinary exercise at home. The experiment was carried out on trauma patients with first-time or recurrent anterior shoulder instability. The results of a superbly designed experiment by Anju Jaggi et al. [37] may prove to be a milestone. RCT involves patients with MDI who have arthroscopic evidence of damage to the capsular ligament apparatus. Patients are randomly placed in either the repair group or the no-surgery group. Next, all patients undergo the same rehabilitation protocol that lasts 6 months. Hopefully, the conclusions from this study will be available shortly and prove groundbreaking in the management of patients with multidirectional instability.

CONCLUSIONS

Rehabilitation primarily involves exercise plays a vital role in the management of multidirectional shoulder instability. It is recommended especially in cases where the patient has not suffered any previous injury. Types of exercises, training volume and load should be dosed individually, adequately to the current patient condition. If rehabilitation is not sufficient, arthroscopic methods of reducing the volume of the articular capsule should be considered.

Patients with multidirectional instability exhibit different movement patterns and altered muscle activity [11, 38], therefore they must undergo post-surgical rehabilitation to train the correct position of the shoulder blade, proprioception and neuromuscular control of the rotator cuff and periscapular muscles.

For the current moment, the rehabilitation protocol detailed by Watson is the most effective in treating MDI.

REFERENCES


