

Research article

Traumatology and functional recovery of the shoulder specific to the game of Volleyball

Catalin Ionite¹, Ilie-Catalin Stirbu², Catalin-Mihaela Stirbu³, Iustina Condurache¹, Mariana Rotariu¹

1. Faculty of Medical Bioengineering, "University of Medicine and Pharmacy Grigore T Popa", Iasi, Romania
2. Faculty of Physical Education and Sports, Alexandru Ioan Cuza University, Iasi, Romania
3. Teaching Staff Training Department, Gh. Asachi Technical University, Iasi, Romania

Citation: Ionite C., Stirbu I.-C., Stirbu C.-M., Condurache I., Rotariu M. - Traumatology and functional recovery of the shoulder specific to the game of Volleyball . *Balneo and PRM Research Journal* 2022, 13(4): 531

Academic Editor(s):
Constantin Munteanu

Received: 15.11.2022
Accepted: 05.12.2022
Published: 15.12.2022

Reviewers:
Elena Valentina Ionescu
Gabriela Dogaru

Publisher's Note: Balneo and PRM Research Journal stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

* Correspondence: **Iustina Condurache**, avram.iustina@yahoo.com

Abstract: Worldwide, the game of volleyball is a very popular sport regardless of the demographic categories analyzed. In recent years, the dynamics of the game of volleyball is continuously increasing, notable increases being observed among the female gender. Shoulder injuries are common among athletes, for example in baseball, 12% to 19% of injuries encountered are located in the shoulder, while in swimming, the percentage of shoulder injuries is estimated to be between 23% and 38%. The research is based on the case study carried out on a 28-year-old male subject, with 15 years of sports experience, a volleyball player, with a previous history of shoulder joint through the presence of bicipital tendinitis, contractures in the trapezius muscle, as well as in the sternocleidomastoid muscle. The analysis of the dynamics of the evolution of the subject included in the research and the interpretation of the results led to the confirmation of the hypothesis, so that, reaching all the well-established recovery objectives, we can conclude that the symptomatology, in our case, rotator cuff muscle injury, can be combated by using kinetotherapeutic methods, which demonstrated the highest level of success achieved, when the subject can be taken even from the immobilization stage. Also, a much faster progress was observed from the point of view of socio-professional reintegration.

Keywords: Volleyball, Shoulder, Recovery.

1. Introduction

Volleyball is a very popular sport worldwide regardless of demographic categories. In the last few years, women's volleyball recorded a record increase of 17,780 athletes worldwide. The dynamics of the volleyball game has evolved in recent years as this sport has been promoted more and more in high schools. Sportsmen were also encouraged by a number of changes to the rules of the game such as the removal of the "following rule" (intended to reduce collisions between players on the field). Starting from the ever-increasing number of practitioners and from the changes made to the rules of the volleyball venue and the continuously changing sports culture, specialists believe that it would be very helpful to monitor the incidence of accidents and their impact on the population [1]. Shoulder injuries are common among athletes, for example in baseball, 12% to 19% of injuries encountered are located at the shoulder level, while in swimming, the percentage of shoulder injuries are estimated to be between 23% and 38% [2].

Athletes often perform shoulder movements at high speed and extreme range of motion, making them more susceptible to shoulder injuries. Changes in the athlete's shoulder can be observed not only after several years of training, but also after a single season of training. Some authors have estimated increases in external rotation, as well as decreases in

internal rotation and total range of motion in athletes practicing overhead sports. These changes tend to be associated over time with an increase in retroversion of the humeral head. Shoulder strength is another aspect that changes due to playing sports. Sectionalists have also observed a decrease in the ratio of external rotators/internal rotators in athletes practicing sports that involve movements above the head [3].

Scapular dyskinesia has been intensively pursued in the last few years due to its high prevalence among athletes who practiced sports involving overhead movements (61%) compared to athletes who did not practice these movements (33%) [4].

Currently, clinicians are looking for and testing prevention strategies to decrease the incidence of injuries and the loss of long periods of time with rigorous recoveries, thus resulting in improved performance [4].

Material and Methods

The research is based on the case study carried out on a 28-year-old male subject, with 15 years of sports experience, a volleyball player, with a previous history of shoulder joint through the presence of bicipital tendinitis, contractures in the trapezius muscle, as well as in the sternocleidomastoid muscle.

The research was carried out in the Transmed Expert Medical Center Iasi, ensuring optimal conditions for physical therapy.

Table 1. Patient presentation.

Name	Age	Sex	Practiced sport	Sports experience	Clinical diagnosis
S.M.	28 years old	M	Volleyball	15 years	Right shoulder rotator cuff injury

The research was carried out over a period of 6 months, being divided into 4 phases, respectively:

- the first stage (September 2018 – January 2019) summarized the theoretical documentation from the specialized literature, which included the collection, selection and study of the material regarding the methods and procedures necessary for recovery; contact with personnel specialized in medical recovery;
- the second stage (January – March 2019) consisted in choosing the topic of rotator cuff damage and applying research methods, preparing and establishing objectives, testing, evaluation and recovery plan, as well as recording the data obtained
- the third stage (March 2019 – May 2019) included the actual experiment in which we applied the kinetotherapeutic schemes, as well as their permanent completion with new elements or the replacement of rudimentary ones
- the fourth stage (May – June 2019) we carried out the graphic processing of the collected data in order to evaluate the parameters of the results obtained.

The hypothesis that was the basis of the research is the following: it is assumed that through early kinetotherapeutic intervention, through individualized programs in relation to the clinical picture, respectively post muscle injury in an athlete - volleyball player, we can contribute to reducing the time to restore shoulder functionality and ensure reintegration in sports activity

The patient assessment and measurement process will include:

- Inspection of the shoulder in order to establish the functional diagnosis, i.e. the existence of swelling processes of an inflammatory nature specific to muscle-tendinous lesions, muscle atrophy, in the present case of the deltoid muscles which quickly lose their volume due to muscle rest, but also at the level of the pectoral
 - Palpation will reveal the existence of edema, hypotonia characteristic of muscle atrophy at rest, painful points, changes in local temperature, the ratio of bone surfaces as well as joint mobility
 - The muscle balance will describe in numerical terms the result of the shoulder muscle strength testing, respectively the 0-5 muscle strength scale, on the basis of which the functional diagnosis will be established, as well as the schemes of the recovery program

- The articular balance regarding the measurement of joint mobility of the shoulder was performed with the help of goniometry by comparison with the measurement of the opposite upper limb. It numerically describes the specific shoulder movements of flexion, extension, abduction-adduction, abduction-horizontal adduction and internal-external rotation movements.

Functional tests specific to the shoulder:

The painful arc (Magee, 2002): the subject abducts the arm without resistance and actively. The test is positive if the pain occurs between 70° and 120°, indicating a pathology in the scap

Norwood test: the subject is supine with the arm in 80° abduction, 90° external rotation and elbow in 90° flexion. The examiner will bring the arm into horizontal adduction associated with 20° internal rotation with one hand, and stabilize the scapula with the other hand. The test is positive when the humeral head slides far posterior to the glena, indicating posterior instability.

Hawkins test: the subject in a sitting position, the examiner takes his arm in internal rotation, with the elbow flexed. The position of the limb - the great humeral tuberosity towards the acromion, trapping the supraspinatus tendon between them, producing pain in the case of pathologies of this muscle.

Neer test: the subject is in a sitting position. The examiner takes the arm into maximum flexion and internal rotation (elbow extended). This maneuver will produce pain in the shoulder, highlighting an "overuse" type injury in the supraspinatus, also observing the subject's face.

VAS visual analog scale is a pain assessment method, carried out on a 10 cm horizontal line marked from 0-10 where the patient will indicate the degree of pain at that moment. Regarding the systematization and application of recovery programs, the patient's reaction was followed throughout the entire research.

In this sense, the proprioceptive stimulations used to stimulate the nerve influx were performed and gently dosed, following the tissue response of contraction or relaxation using specific stretching techniques.

Facilitative and stimulating stretches were progressively repeated throughout the sessions until the desired response was obtained.

The sessions included sedative and decontracting massage procedures, postures, neuroproprioceptive facilitation techniques, passive, active and active physical therapy with resistance, as well as various types of contractions, among which we list isometric, isotonic and plyometric contractions

The general objectives of the physical therapy program aimed at:

- Combating pain by regulating neurovegetative function aimed at improving interstitial circulation and organic functionality
- Fighting muscle contractions and tissue tension
- Restoring and improving lost motor qualities: range of motion, mobility, stability, muscle strength.

Results and Discussion

Through the comparative application of the initial and final testing on the subject we can highlight the fact that at the end of the experiment, its evolution recorded a process of global functional recovery of both mobility and muscle strength as follows.

From the point of view of the efficiency of the drawn-up experiment program and by closely following the progress, by modifying and supplementing it, the subject presented a positive evolution of the final articular and muscular balance of the shoulder joint as follows:

According to graph no. 1, we can talk about a positive evolution in terms of pain reduction recorded by 7 in the initial stage until total disappearance in the final stage in all movement schemes.

Table 2. Pain testing.

Pain testing	Initial period	Final period
Pain intensity	7	0

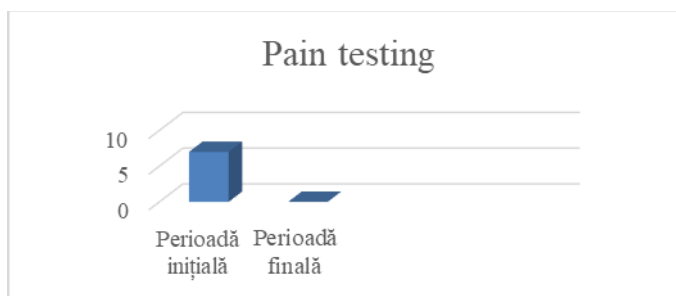


Fig 1. Pain testing.

According to graph no. 2, a favorable evolution can be described for joint testing, registering an important increase in joint amplitude for flexion, abduction, adduction movements, which in the final stage improved by 30°.

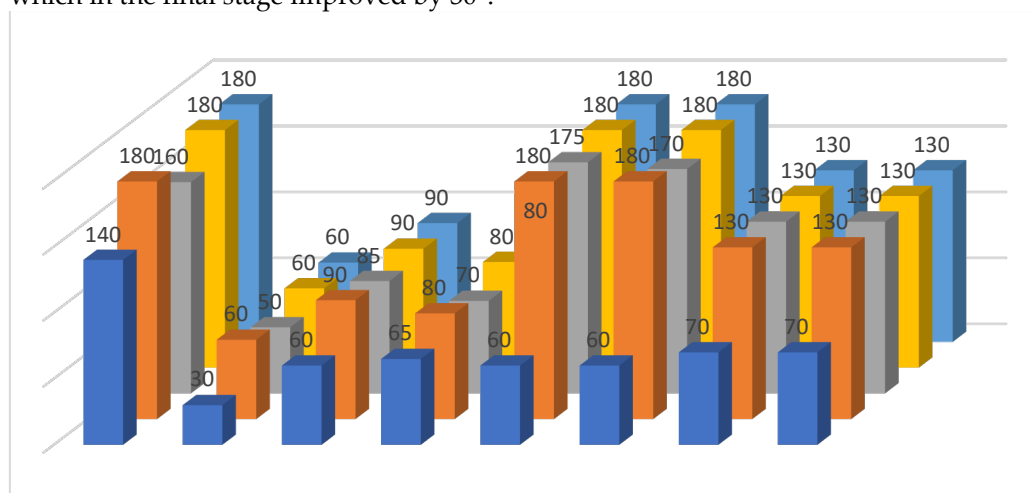


Fig 2. Articular testing.

Regarding muscle strength, in the first stage it could not be recorded due to pain, but we can describe an improvement in muscle strength acquired during the recovery program, but which does not reach the maximum values, thus the kinetotherapeutic program will continue, but we note a increase in muscle mass with average resistance for each muscle group.

Table 3. Articular testing.

Mouvement	Initial testing		Final testing	
	Right shoulder	Left shoulder	Right shoulder	Left shoulder
Flexion	140°	180°	170°	180°
Extension	30°	60°	50°	60°
Internal rotation	60°	90°	85°	90°
External rotation	65°	80°	70°	80°
Abduction	60°	90°	90°	90°
Adduction	60°	90°	90°	90°
Horizontal abduction	70°	90°	90°	90°
Horizontal adduction	70°	90°	90°	90°

Table 4. Muscular testing.

Mouvement	Muscle strength				
	Initial testing		Final testing		
	Right shoulder	Left shoulder	Right shoulder	Left shoulder	
Flexion	-	F5	F4+		F5
Extension	-	F5	F4+		F5
Internal rotation	-	F5	F4+		F5
External rotation	-	F5	F4+		F5
Abduction	-	F5	F4+		F5
Scapula elevation	-	F5	F4+		F5
Scapula descendent	-	F5	F4+		F5
Scapula abduction	-	F5	F4+		F5
Scapula Addction	-	F5	F4+		F5

Table 5. Specific functional tests.

Test	Initial period		Final period	
	Right shoulder	Left shoulder	Right shoulder	Left shoulder
Painful arch	+	-	-	-
T. Norwood	+	-	-	-
T. Hawkins	+	-	-	-
T. Neer	+	-	-	-

According to table no. 5, respectively the specific functional tests, it can be noted the absence of pain and joint limitation in the final stage, corresponding to each individual test.

Conclusions

The analysis of the dynamics of the evolution of the subject included in the research and the interpretation of the results led to the confirmation of the hypothesis, so that, reaching all the well-established recovery objectives, we can conclude that the symptomatology, in our case, rotator cuff muscle injury, can be combated by using kinetho-therapeutic methods, which demonstrated the highest level of success achieved, when the subject can be taken even from the immobilization stage. Also, a much faster progress was observed from the point of view of socio-professional reintegration.

The intervention methodology within the recovery program in the case of the present research was selected and applied according to the clinical picture of the subject and respectively in relation to its functional possibility and its level of recovery.

The recovery of the shoulder took into account the age of the injury as well as the associated conditions, the cause of the damage, the level of reactivity regarding the muscular, joint and kinetic system to the methods, means and procedures used for therapeutic and restoration-recovery purposes.

Restoring the functionality of the shoulder joint allows the subject to resume specific training in order to train the sports activity of volleyball.

Author contributions.

All the authors have equal contribution.

References

- Chandran A, Morris SN, Lempke L et al. Epidemiology of Injuries in National Collegiate Athletic Association Women's Volleyball: 2014–2015 Through 2018–2019. *J Athl Train.* 2021; 56(7): 666–673.
- Shanley E, Kissenberth MJ, Thigpen CA, et al. Preseason shoulder range of motion screening as a predictor of injury among youth and adolescent baseball pitchers. *J Shoulder Elbow Surg.* 2015;24:1005-1013.
- Tooth C, Gofflot A, Schwartz C et al. Risk Factors of Overuse Shoulder Injuries in Overhead Athletes: A Systematic Review. *Sports Health.* 2020; 12(5): 478–487.
- Hibberd EE, Laudner KG, Kucera KL, Berkoff DJ, Yu B, Myers JB. Effect of swim training on the physical characteristics of competitive adolescent swimmers. *Am J Sports Med.* 2016;44:2813-2819.