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The Effect of Rehabilitative Exercises on Improving Physical Abilities in Individuals with Mild Shoulder Tendonitis among Wheelchair Tennis Players

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Abstract

Shoulder tendonitis is a common injury among wheelchair athletes, often occurring due to incorrect and unhealthy habits and movements. It is also frequently seen in sports that require overhead arm movements, leading to tendon weakness. The shoulder joint operates in all directions, and when the tendons surrounding the shoulder joint are weakened and subject to repetitive movement and muscle strain, it results in shoulder tendonitis. This condition requires a prolonged recovery period to return to athletic activities. Often, it keeps the athlete away from training exercises. Due to the limited variety of rehabilitative programs in therapeutic exercises for shoulder tendonitis, the researchers have developed diverse rehabilitative exercises for mild shoulder tendonitis, aiming to utilize them in improving physical abilities, enhancing recovery rates, and aiding therapists in preparing rehabilitative curricula. These exercises also employ the results for treating sports injuries of the upper limbs and reducing the incidence of injuries. The research aimed to develop rehabilitation exercises for individuals suffering from simple shoulder tendonitis to improve certain physical abilities for wheelchair tennis players. The experimental approach with a single-group design was adopted due to its suitability for addressing the research problem. The research sample was purposefully selected from individuals affiliated with the Iraqi Paralympic Committee, representing the same research community. The sample consisted of 6 injured individuals out of a total of 10. After multiple consultations with Dr. Safaa Haseeb, a specialist in joints and sports injuries, between December 1, 2022, and January 29, 2023, the researchers determined the severity of the injury to be of moderate degree. Based on the severity of the injury, rehabilitation exercises were tailored to each individual. The researchers examined the results of the study using statistical software (SPSS) and found that the diverse rehabilitation exercises had a positive impact and were effective in improving muscle strength, range of motion, and recovery. They concluded that the rehabilitation program had a positive effect on enhancing physical abilities, reducing pain, and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Good Health). and recommended a focus on rehabilitation exercises aimed at strengthening the shoulder joint muscles.

Keywords

Rehabilitation exercises, shoulder tendonitis.

Introduction:

Shoulder tendonitis is a common injury that frequently occurs in sports requiring overhead arm movements, such as wheelchair tennis, weightlifting, boxing, badminton, and volleyball. The repetitive stress and continuous pressure on the tendons can weaken them, leading to a decline in physical capabilities. Strength is a crucial physical attribute for athletes as it helps prevent injuries resulting from both external and internal

factors. As highlighted in a study by Al-Mudarris, the body's tissues are exposed to various internal and external influences that can lead to physiological and anatomical changes, weakening the affected organ and reducing its function (1). Rehabilitation exercises, including endurance and strength exercises, are among the most crucial exercises that can impact physiological variables and an athlete's physical

capabilities. As emphasized in a study by Hassoun, "Physical capabilities and body measurements, such as strength, arm length, and trunk length, are some of the most critical attributes and measurements needed by disabled athletes" (2). Additionally, a study by Dhafer Namooos and others pointed out that the shoulder joint is one of the most crucial joints for performing tasks, and rehabilitation includes exercises with and without weights, indicating a gradual progression in the intensity of the load (3). There are many Paralympic athletes who suffer from upper limb injuries and have not received sufficient attention. This research aims to elevate the category of disabled individuals, motivating the researchers to conduct this study to improve physical capabilities, enhance the recovery rate, and assist therapists in developing rehabilitation programs based on the results to serve sports-related upper limb injuries. The research aimed to develop rehabilitation exercises to improve some physical capabilities for individuals with simple shoulder tendonitis among wheelchair tennis players. The research also aimed to assess the impact of diverse rehabilitation exercises on enhancing certain physical capabilities for individuals with simple shoulder tendonitis among wheelchair tennis players. The research hypothesis stated that there would be statistically significant differences between the pre-test and post-test results of the research group in improving some physical capabilities for individuals with simple shoulder tendonitis of the shoulder joint among wheelchair tennis players. Research Domains: The human domain consists of a sample of individuals with

mild shoulder tendonitis among wheelchair athletes. The spatial domain is the Iraqi Paralympic Committee, Diyala branch, and Dr. Safaa Haseeb Mutheri's clinic. The temporal domain is from 1/12/2022 to 29/1/2023.

Method and Procedures:

The researchers used the experimental method with a single group design, as it suits the nature of the research. The study of the problem determines the precise method to be followed by the researcher to arrive at a set of solutions that serve the research. As indicated by the study of Hussein and Yaqoub, the study of the problem determines the selection of the appropriate method suitable for the nature of the study (4).

The sample was intentionally selected from wheelchair tennis players who suffered from simple shoulder tendonitis and were affiliated with the Paralympic Committee of Iraq, Diyala Branch. The sample consisted of six players who were examined by a specialized doctor to confirm the type of injury, and it matched the same degree of injury previously determined by the researchers. From previous studies that have emphasized the effectiveness of rehabilitation exercises and their positive role in improvement, Mustafa Muhammad's study suggested that "using exercises and resistance with different angles for rehabilitation can help individuals return to activity in the shortest possible time" (5). However, the exercises and program used for the shoulder had a positive impact on pain relief and improved range of motion. The importance of exercises in shoulder rehabilitation played a positive role in reducing pain intensity and improving muscle strength and flexibility.

Table .1 It shows the homogeneity of the research sample in terms of variables (chronological age, training age, and the duration of the injury)

Seq.	Variables	Measurement Unit	Arithmetic Mean	Median	Standard Deviation	Skewness Coefficient
1	Chronological Age	Year	29.83	30.000	0.7527	0.313

2	Training Age	Year	4.333	4.000	0.5164	0.968
3	Period of Injury	Day	4.166	3.555	1.602	1.354

Table (1) shows the mean, median, standard deviation, and coefficient of variation for the variables under study. The data appears to be normally distributed, as evidenced by the coefficient of variation ranging from 0.313 to 1.354. These values are within the range of 3+-, indicating the homogeneity of the selected sample.

The research utilized various tools and equipment for data collection, including a goniometer for measuring range of motion, a medical bed or examination table, elastic bands, a 5 kg weighted bar, a computer, a timer, 20 tennis balls, and a medicine ball weighing 1.5 kg. Data collection methods included both Arabic and foreign sources, international information networks (the internet), personal interviews, and statistical methods. The tests used in the research are important for evaluating the athletes' performance and determining the effectiveness of any sports program.

One of the tests used in the research is:

First: Medicine Ball Throw (3kg) with both hands from a seated position on the chair Fadhil and Aws (6) "As cited in the book by Qassim Hassan Al-Mandalawi and others (Tests, Measurements, and Evaluation in Physical Education) The purpose of the test: Measuring the explosive strength of the arms. Performance description: From a seated position on the chair with the trunk restrained, the subject holds the ball above the head and tries to throw it with maximum force. Recording: Three attempts are given to the subject, and the best attempt is recorded."

Second: Front Plank Arm Extension Test for 10 seconds (Luay Kadhum Mohammed) (7).

The purpose of the test: Measuring the distinctive strength of the arms.

Performance description: The player takes the front plank position with the body in a straight

line. Upon the signal, the subject extends the arms fully.

Recording: The number of correct repetitions within 10 seconds is recorded.

Pilot Study:

The rehabilitation unit for the sample individuals suffering from simple deltoid muscle tendonitis for the shoulder joint of the Iraqi Paralympic Committee in Diyala Branch, totaling six individuals, was conducted on Saturday, November 25, 2022, at 3:00 PM, to ensure their ability to perform the diverse rehabilitation exercises aimed at strengthening the joint. It aimed to identify the suitability of the tools and devices used, understand the duration of each test, and ensure the competence of the assisting team. The rehabilitation unit was executed with the assistance of the team members to discover any difficulties faced by the researchers and the team and find solutions.

The Pre-test:

The pre-test was conducted on the research sample on Tuesday, 29/11/2022, at 3 PM at the Iraqi Paralympic Committee, Diyala branch, where the tests were carried out.

The Main Experiment: The main experiment was conducted starting from Thursday, 1/12/2022, until Sunday, 29/1/2023, over (8) weeks, with a frequency of (3) rehabilitation units per week, amounting to a total of (24) rehabilitation units.

The researchers presented the rehabilitation program to experts and specialists in sports medicine and rehabilitation and orthopedic doctors. The program included specific exercises for strengthening the shoulder.

Post-test: The post-test measurements were conducted on Wednesday, 1/2/2023, at 3 PM. The same pre-test examinations were reapplied under the same conditions at the Iraqi Paralympic Committee, Diyala branch, with the assistance of the support team.

Statistical Tools: The SPSS statistical software package was used to process the test results.

Results:

Table .2 It shows the means, standard deviations, and standard errors.

Variables	The Tests	Arithmetic Mean	N	Standard Deviation	Standard Error
Medicine Ball Throw	Pre-Test	4.587	6	0.538	0.220
	Post-Test	7.053	6	0.936	0.382
Variables	Pre-Test	8.167	6	1.472	0.601
	Post-Test	15.500	6	2.588	1.057

Table .3 It shows the mean of differences, standard deviation of differences, the t-value, and the Error Percentage

Variables	Mean of differences	Deviation of differences	Arithmetic mean -differences	T-value	Error Percentage
Medicine Ball Throw	-2.467	1.55	0.471	5.232	0.003
Frontal Arm Stretch and Flexion	-7.333	1.211	0.494	14.832	0.000

Discussion:

The results of the tests in tables (2) and (3) indicate significant statistically meaningful differences between the pre-test and post-test in favor of the post-test. The researchers attribute the observed changes between the pre-test and post-test to the inclusion and diversification of exercises (strength, flexibility, and resistance) within the rehabilitation program for the shoulder joint. This highlights the effectiveness of the prepared program and the significant positive impact of the utilized exercises. The designed exercises contributed to an increase in muscular strength, and pain reduction, are indicative of the healing process. Improving shoulder joint muscular strength helps alleviate pain, as emphasized by McKenzie, who states that "exercises should be carefully performed to include levels that prevent pain" (8). As indicated in the study by Iman Kadhum, it is not possible to establish a fixed rule for every rehabilitation program. Instead, each medical case should have a tailored program, considering the composition of the rehabilitation content and the progression in exercises (9). Gradual progression in providing resistance contributes to increasing muscular strength and improving the range of motion, as

mentioned by Athraa and Suaad: "Planning the rehabilitation program and gradually increasing resistance had a significant impact on improving the range of motion" (10). Gradation in exercises serves as a preventive measure against changes and disruptions that occur within ligaments and joints. Exercises should be graduated according to the player's condition, starting from negative and assistive exercises, gradually progressing. Wheelchair tennis, like other sports, requires various capacities (physical, skill-based, and motor skills). This is in line with a study by Zainab and Widad, which emphasized the importance of the integration of physical capacities in players, particularly the arm muscles, to achieve good results (11). Additionally, the study by Alaa and Suaad highlighted the positive impact of using static stretching exercises on developing the range of motion, as gradual increases contribute to increased muscle strength and enhance endurance capacity. Furthermore, these exercises did not leave any negative effects; instead, they yielded positive results (12). Therefore, diversity in the training program and the adoption of modern methods, in line with the latest developments, significantly contribute to improving various

physical and skill-based indicators. The researchers believe that diverse rehabilitation exercises have played a crucial and effective role in enhancing the physical capabilities of those suffering from shoulder tendonitis, increasing strength, and alleviating pain.

Conclusions:

In light of the research objective, hypotheses, and procedures, the researchers have concluded the following:

1. The varied rehabilitation exercises used in improving physical capabilities and speeding up the recovery of shoulder tendons had a significant positive impact.
2. The effectiveness of practicing the prepared rehabilitation exercises resulted in a positive effect on the speedy recovery of the injured tendons and an improvement in the group members' condition.
3. The diversity of rehabilitation exercises, whether they were physical, skill-based, or movement-based, favored the enhancement of capabilities.

Recommendations:

1. It is essential to utilize exercises to enhance physical capabilities.
2. Emphasize the development of rehabilitation programs based on scientific principles that prepare athletes physically, kinetically, functionally, and psychologically.

Author's declaration:

Conflicts of interest: None

We confirm that all tables and figures in this article are ours and written by the researchers themselves.

Ethical-Clearance: this manuscript approved by local ethical committee of physical education and sport sciences college for women on (October /2023)

Author's contributions:

All contributions of this study were done by the researchers (A.H. and L.A.) who get the

main idea and work on writing and concluding also with number of experts, Hussein Hamza Al-Ibady (Ministry of Education/ Babil education directory) in Statistics, Stuart Biddle in revision, Inaam Ghalib in translating, Haifaa Ahmed in proofreading

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Appendix (1)

Names of experts and specialists whose opinions were surveyed regarding the most suitable test fixation

Seq.	Name	Academic Title	Workplace
1	Prof. Dr. Basel Abdul Sattar	Professor	College of Physical Education and Sport Sciences, Diyala University
2	Dr. Safaa Haseeb Mutheri	Doctor	Baqubah General Hospital
3	Dr. Oras Adnan	Professor	The Paralympic Committee
4	Dr. Ali Hussein Al-Awadi	Professor	Al-Qadisiyah University

Appendix (2)

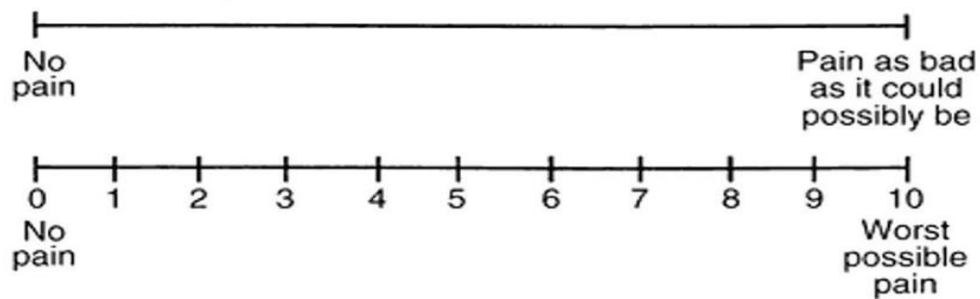
Some of the Used Rehabilitative Exercises

Unit	Exercises	Time	Repetition s	Rest	Rest between each set
First	Lifting a rod with both hands from a lying down position from below and returning it upwards.	6 seconds	8	5 seconds	2 30 seconds

	Holding the rod and extending one arm with the elbow bent at a 90-degree angle.	6 seconds	8	5 seconds	2	30 seconds
	From a side-lying position, extend the lower part of the arm above the head.	6 seconds	8	5 seconds	2	30 seconds
	From a prone position on top of the table, extend the arms and rotate them.	6 seconds	8	5 seconds	2	30 seconds
Second	Pulling the elastic band from a sitting position.	6 seconds	8	5 seconds	2	30 seconds
	Pulling the elastic band and rotating the shoulder outward.	6 seconds	8	5 seconds	2	30 seconds
	Lift the arm to your side and turn the palm upwards, ensuring that the arm does not rise above shoulder level.	6 seconds	8	5 seconds	2	30 seconds
Third	Holding the medicine ball above the head and then lowering it.	6 seconds	8	5 seconds	2	30 seconds
	Spreading the arms to the side by holding dumbbells.	6 seconds	8	5 seconds	2	30 seconds
	From in front of the chest, extend the arms holding the weight and pull it up behind the head.	6 seconds	8	5 seconds	2	30 seconds

Appendix (3) Pain Assessment Form

Visual Analogue Scales



تأثير التمرينات التأهيلية في تحسين بعض القدرات البدنية للمصابين بالتهاب اوتار الكتف البسيط للاعبين تنس الكراسي المتحركة

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التهاب الاوتار في الكتف من الإصابات الشائعة للاعبين الكراسي المتحركة والتي تحدث نتيجة للعادات والحركات الخاطئة والغير صحيحة وتحدث ايضاً بشكل متكرر في الرياضات التي تتطلب تحريك الذراع فوق الرأس مما يؤدي الى اضعاف الوتر اذ ان مفصل الكتف يعمل في كل الاتجاهات عندما تعاني الأوتار المحيطة بمفصل الكتف من الضعف وكثرة تكرار الحركة والضغط المسلط على العضلة اذ يطلق عليه التهاب اوتار الكتف والتي تحتاج الى فترة طويلة للشفاء للعودة للممارسة النشاط الرياضي وفي اغلب الاحيان تبعد اللاعب عن ممارسة التمارين وبسبب قلة تنوع البرامج التأهيلية في التمرينات العلاجية للتهاب اوتار الكتف ارتأت الباحثتان لأعداد تمرينات تأهيلية متنوعة لإصابة التهاب اوتار الكتف البسيط محاولتا الإفادة منها في تحسين القدرات البدنية وتعزيز نسبة الشفاء ومساعدة المعالجين لإعداد المناهج التأهيلية وتوظيف نتائجها لخدمة الاصابات الرياضية للأطراف العليا للحد من الإصابة اذ هدف البحث الى اعداد تمرينات تأهيلية للمصابين بالتهاب اوتار الكتف البسيط في تحسين بعض القدرات البدنية للاعبين تنس الكراسي المتحركة وقد تم اعتماد المنهج التجريبي بتصميم المجموعة الواحدة نظرا لملائمته لطبيعة المشكلة وتم تحديد عينة البحث بالطريقة العمدية وهم من المصابين في اللجنة البارالمبية العراقية والذي يمثلون مجتمع البحث نفسه البالغ عددهم (6) مصابين من اصل (10) وبعد عدة مراجعات قامت بها الباحثتان لعيادة الدكتور صفاء حسيب أخصائي المفاصل والإصابات الرياضية بتاريخ 1/12/2022 الى 29/1/2023 تم تحديد درجة الإصابة وهي من الدرجة المتوسطة اذ تم وضع التمرينات التأهيلية على اساس درجة الإصابة وقد تحققت الباحثتان من نتائج الدراسة باستعمال الحقيبة الاحصائية SPSS حيث اثبتت النتائج ايجابية التمرينات المتنوعة ومدى فعاليتها في تحسين القوة العضلية ومدى الحركي والشفاء وكما توصلتا الى عدة استنتاجات وكانت أهمها: ان البرنامج التأهيلي كان له اثر ايجابي في تحسين القدرات وتخفيف الألم، وهذا ما يحقق احد اهداف التنمية المستدامة للامم المتحدة في العراق (الصحة الجيدة). وتوصي الباحثتان بضرورة الاهتمام بالتمرينات التأهيلية التي تهدف الى تقوية عضلات مفصل الكتف .