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The Effect of Rehabilitation Exercises Accompanied by The Shock Wave Device on The Strength of Some Muscles and Chronic Lower Back Pain for Weightlifters

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Abstract: Athletes who engage in sports that demand the use of great force to overcome great resistance—like weightlifters—are subjected to various loads during training that place stress on their bodies, particularly the musculoskeletal system. As a result, it is common for these athletes to experience lower back pain. One of the most common consequences of spinal injuries that needs to be treated is chronic lower back pain. Natural therapeutic approaches are among the significant and secure approaches that the world has recently started to focus on with great strides, as contemporary methods and techniques have been applied, Physical therapy facilities have used a wide range of treatment techniques, but take caution Shockwave electrophoresis using the shockwave apparatus is an effective method that targets enhancing the muscles' capacity to resume their original function. The purpose of the research was to develop rehabilitation workouts that would work with the shock wave strength gadget. For weightlifters, some lower back stiffness and muscular soreness over time. Find out how exercise affects Treatment for persistent lower back pain with the shock wave gadget enhances muscular strength. For those who exercise weights in between pre- and post-tests. Using a single experimental group design, the researcher used the experimental technique to identify the research community. The Karbala Governorate is home to weightlifting athletes, five of them are wounded.

Keywords: Rehabilitation Exercises, Shock Wave Device, Weightlifters

Introduction

Huge changes have occurred in all facets of our modern lives as a result of the advancements occurring in all spheres of life and the emergence of modern scientific inventions. These advancements have opened up new avenues for research and knowledge as well as entered our daily lives, as physical education is now not only confined to the educational and sports sciences that deal with instructing and training athletes. It plays a significant and useful part in the traditional therapy regimen(Wieczorek, 2020).

and the integration of physical therapy techniques with rehabilitative activities.

The athlete is subjected to a variety of stressors during training, which puts stress on the body and may sometimes lead to sports injuries. This is particularly true of the motor system. A larger proportion of injuries occur in the muscle areas used primarily for

workouts and skill performance, particularly in sports activities where strong power is needed to overcome strong opposition. This also applies to weightlifters, since the majority of them report experiencing lower back discomfort as a consequence of the strain these exercises put on their backs(Bordoni & Simonelli, 2020).
using heavy weights, particularly while doing simple workouts. These aches are often caused by acute or long-term traumas that impact the spine's anatomy, or portions of it (ligaments, muscles, nerves, cartilage, vertebrae, and ligaments).
Pain in the lower back is among the fundamental indicators of a spinal injury.
Depending on how bad the discomfort is
Because it worsens with exertion and lessens with rest, persistent lower back pain is one of the most common consequences of spinal injuries and has to be treated in order to prevent performance issues(Dhaniwala et al., 2020).
Sometimes the athlete has no choice but to retire and stop competing.
Natural therapy techniques are among the significant and secure approaches that the world is starting to focus on extensively, since physical therapy techniques and modern methods have been widely adopted by society's segments and prepared in accordance with scientific foundations; these techniques include rehabilitative therapeutic exercises that aid in the treatment of pain, particularly pain. One prevalent health issue is chronic low back pain, sometimes known as low back pain in the spine. Lower back discomfort is one of the most common reasons why patients visit orthopedic and physical therapy clinics worldwide.
Exercises for rehabilitation are the primary emphasis and a typical component of injury treatment. Since they aim to restore the strength and flexibility of the muscles to their pre-injury levels while strengthening the weak muscles and ligaments around the injured region, they are regarded as the most significant and successful kind of movement. Additionally, they aid in the quickest possible restoration of the joints and muscles to their original functioning. Thus, workouts were used in this recovery procedure. In order to reap the benefits of this specialty, rehabilitation is a valuable strategy(Dhaniwala et al., 2020).
In physical therapy, it has also become imperative to use contemporary methods and strategies. Physical therapy centers have employed a variety of therapeutic techniques, but the researcher has selected electrical stimulation with shock waves via a shock wave device because he feels this approach enhances the muscles' capacity to regain function by stimulating the affected area. increases blood circulation and gets rid of deposits that have built up in muscle fibers(Dhaniwala et al., 2020).
Thus, it is crucial to do research before creating rehabilitation activities that use a shock wave device. Certain physiological factors and persistent lower back discomfort in weightlifters.

1-2 Research problem

Through his experience weightlifting, the researcher saw cases of injuries, including lower back pain, that occurred in a startling way, with obvious negligence in the injury's rehabilitation, and because some players and coaches were unfamiliar with the injury's causes. The researcher attributes these injuries to fundamental reasons, the most important of which is the absence of integration in development training. Physical fitness components, a lack of harmony and coordination in the player's muscle group exercises, an inadequate warm-up, the outcome of lifting too much weight or performing the exercises incorrectly — either without help or without limiting the repetitions or weights—all contribute to the player's exhaustion. All of the muscles have the potential to cause this injury. This lower back muscle was injured as a consequence of neglect and weakness since it did not get enough exercise, which is why lower body discomfort often occurs. And being eligible As a result, the researcher made the decision to investigate this issue by testing rehabilitation exercises in conjunction with (SHOCK WAVE), which is based on the scientific underpinnings and methodology examined to qualify athletes with lower back pain and help them get back to their pre-injury level, which is a gain for them. Additionally, the game(Ahmed & Raya, n.d.).

1-3 Research objectives

preparing rehabilitation routines using the SHOCK WAVE gadget to help weightlifters with chronic back problems relieve part of their muscular soreness.

determining the impact of rehabilitation exercises combined with the SHOCK WAVE device on weightlifters' persistent lower back pain and the strength of certain muscles between pre- and post-tests(Martins et al., 2022).

1-4 research hypotheses

For weightlifters, there is a good correlation between pre- and post-test results regarding the strength of certain muscles and persistent lower back pain, using the SHOCK WAVE device used in conjunction with rehabilitation activities.

1-5 Areas of research

1 - Human field: weightlifters with chronic lower back pain.

2- Spatial area: Life Fitness Hall in Holy Karbala, Al-Hindiya General Hospital, and Al-Kafeel Hospital Educational.

3- The temporal field-20241515-2023 |10|16

1-6 Define terms

SHOCK WAVE gadget: The Shock Wave gadget was created lately in... Its original principle was to focus its waves on the circle containing the pain center, but as it developed This gadget transmits high-frequency waves that trigger the pain center directly. Quick healing, improvement after the first session, a progressive reduction in discomfort, and the need

for... The shockwave device is one of the greatest non-surgical choices for treating various disorders, and the number of sessions varies from three to five until the desired results emerge. It is a kind of very high-frequency wave that is produced when an object travels faster through the atmosphere than sound waves can. Since the therapy relies on the pain center itself to promote quick healing, it is used in physical therapy to address a wide range of issues(Riffitts et al., 2022).

Methodology

2-1 Research methodology

By creating a single experimental group with pre- and post-measurements, the researcher used the experimental approach. Since it fits the nature of the research methods, and the sample's experimental design is shown below.

2-2 The research community and its sample

The research sample consists of athletes from the Holy Karbala Governorate who lift weights for exercise and have injuries as a result of their activity. All eight of the reported injured persons were between the ages of 25 and 30. All save the ones with spinal deformities had chronic back pain(Edwards et al., 2021).

Additionally, the sample for the three people who were unable to adhere to the program was selected based on predetermined criteria, the most important of which was that the pain symptoms had to have begun at least three months before the sample selection date. The diagnosis of the sample was confirmed by the knowledgeable doctor from Al-Hindiyya Teaching Hospital - Joint Diseases Consultation. and orthopedic treatment in Karbala, the holy city. Consequently, all of the sample (100%) was selected. There are five infected people of the community of origin(Wood et al., 2022).

When selecting the study sample, the investigator took into account the following guidelines:

Level of harm: Each patient in the research sample is a person who does not need surgery.

Viewpoint on Magnetic Resonance Imaging: Resonance imaging To accurately diagnose a patient, a specialist doctor must see every member of the research sample in the magnetic field.

2-2-1 Sample homogeneity

To verify the normality of the study sample and the homogeneity of the sample, the researcher used the skewness coefficient in the measurements of age, height, and weight(Schache et al., 2019). As seen in Table (1)

Table 1. It shows the homogeneity of the sample in the research variables

Variables	measruing unit	Arithmetic mean	Mediator	standard deviation	Torsion coefficient	Coefficient of variation
height	Cm	179.4000	177.0000	6.02495	.700	3.358389
Bloc	Kg	77.4000	78.0000	4.21900	-.831-	5.450904
Chronological age	Year	27.8000	28.0000	1.92354	-.590-	6.919209

Table No. (1) makes it evident that all skewness coefficient values for the variables age, height, and weight fall within the range of... Show (1) illustrates the moderation of the normal distribution, or the homogeneity of the individuals in the study sample with respect to these factors(Qiu et al., 2023).

2-3 Methods, devices and tools used in the research:

2-3-1 Research methods

Observation and experimentation.

Personal interviews (see Appendix 2)

The questionnaire.

Evaluation and quantification.

2-3-2 Devices and tools used in the research:

- camera Canon Japanese made(1)
- (1) Japanese-made Canon photography stand
- (1) Chinese-made LENOVO electronic computer
- An American-made device for measuring weight and height
- A dynamometer built in the United States to measure back muscle strength
- A sponge mat to perform the test on
- Measuring tape
- Electronic stopwatch (1)

2-4 Field research procedures

2-4-1 Determine search variables

After searching and referencing pertinent scientific publications, the researcher selected the degree of discomfort, the strength of the back muscles, and the strength of the abdominal muscles as the research's factors.

2-4-1-1 Determine the measurements and tests used in the research:

The researcher looked through pertinent references and scientific sources to choose the tests that would be used in the study. After doing so, the standard test, which is the Dynamometer test and the 20-second sit-up test to gauge abdominal muscle strength, was selected. to gauge the back muscles' strength, a technique that researchers have used in other related investigations.

2-4-1-1-1 Description of the sitting from lying down test on 20 Tha.

Goal of the examination:

Determine how strong your hip flexor and abdominal muscles are.

Tools: - A level surface or a clean stopwatch

Performance parameters: - The test subject lays flat on his back on a mattress, with his feet spread thirty (30) cm apart. As soon as the referee gives the go-ahead, the tester bends so that his palms touch his chest in front and his elbows are bent (a colleague... The assistant work team stabilizes the two men). He then repeats this maneuver as many times as possible in twenty seconds.

Recording: Count how many times, in twenty (20) seconds, the right performance is given.

2-4-1-1-2 Description of the back muscle strength test by (Hakim, 2004)

The test's objective is to assess the trunk and back extensor muscle strength..

Necessary tools - A dynamometer mounted on a suitable base for standing and the device is attached to a chain Iron, 60 cm long.

Description of the performance: - The tester assumes a standing position on the dynamometer, then bends the torso forward and down to grasp the barbell with his hands. Then he adjusts the length of the iron chain that connects the barbell to the dynamometer in a way that enables the tester to pull it upwards from the position of bending the torso and straightening the knees. When the signal is given, the tester pulls upward, as there is a pulling movement from the torso It is not from the legs and the pulling is done slowly to produce the maximum possible force.

2-4-1-1-3 Pain Degree Scale (Amin, 2021)

The trunk bend test (see Appendix 1) is a standardized test that measures how much an injured person can bend their upper body forward and downward to determine the amount of pain they feel. Researchers worked with supervisors to design a questionnaire to assess pain levels in injured individuals. Study samples were submitted to experts and expert groups in the fields of general medicine, sports injury rehabilitation, testing and measurement, and relative importance values (importance) were determined by combining half of the maximum expert consensus value with half of the area value in the table , blank data, statistically processed and extracted values. Calculate the percent importance value by multiplying the importance by the maximum match value and adding one hundred.

This can be explained as follows
Agreement maximum = number of experts x importance = 7 x 10 =70
Half of the protocol maximum value=70\2=35
Semi-importance range=10\2=5
Importance value = half maximum value + half range = 35 + 540 =
Importance score percentage 70/40 x 100 = 57.14%
After collecting the questionnaire and transcribing and processing the data, a scale was used to determine the level of pain, taking into account the patient's opinion, reaching values of importance (65) and (importance percentage 92.85%). (7) Experts and experts.
The tested sports areas are divided into ten levels, as follows:
The pain when the upper body is bent a distance (10 cm) is rated as 1 degree
Pain when bending the upper body + (9 cm) distance is 2 degrees
Pain when bending the upper body + (8 cm) distance is 3 degrees
Pain when bending the upper body + (7 cm) distance is 4 degrees
The pain rating for bending the upper body beyond a distance of + (6 cm) is 5.
The pain rating when bending the upper body beyond a distance of + (5 cm) is 6.
The pain level when the upper body is bent a distance + (4 cm) is level 7.
Pain level 8 when bending upper body (3 cm)
Pain level 9 when bending trunk + (2 cm)
Pain rating when bending trunk + (1 cm) is 10
Note: If there is no pain at any level, the range of motion is normal.

2-4-2 Exploratory experience

One of the most crucial steps a researcher performs before starting an experiment is the exploratory experiment. As a result, it is regarded as a practical training for the researcher to recognize the advantages and disadvantages that he personally experiences.
As experiments are being conducted to prevent it in the future, **(Saadoun, 2019)**
The exploratory experiment was carried out by the researcher on Sunday, December 13, 2023(Choy et al., 2023).
To brief the auxiliary work crew on their responsibilities and set up the necessary tools and equipment Means of measurement.

2-4-3 Pre-measurement:

The researchers carried out preliminary measurements of the following variables (pain level, back muscle strength, abdominal muscle strength) in time on Tuesday, December 5, 2023 AD at 12 pm in the stadium of the Institute of Sports Education and Sports Sciences - University of Karbala.

2-4-4 Main experiment

Following the completion of the processes that allowed the researcher to proceed with his primary experiment, the researcher performed rehabilitation activities at the Life Fitness Hall and Al-Kafeel Hospital with the sample members while using the Shockwave device. The trial lasted eight weeks and included twenty-four real therapy units split up into three units a week on Saturdays, Mondays, and Wednesdays. The rehabilitation program was put into place on Saturday, December 9, 2023, and ran until Wednesday, January 1, 2024. The primary experiment concluded on Wednesday, 1/31/2024 AD.

2-4-4-1 Implementing the rehabilitation program

The researcher implemented the rehabilitation program using rehabilitation exercises with the Shockwave device for the players People with chronic lower back pain for a period of (8) weeks, and (3) units are applied per week Qualifying and for one qualifying unit, (5) exercises are given, meaning the total number of units becomes from easy to difficult in order to help the injured person recover properly.

Note: At the beginning of each rehabilitation unit, warm-up exercises are given, including light jogging and exercises Stretch for (4) minutes.

At the end of each rehabilitation unit, (2) minutes of calming exercises (relaxation) are given.

2-4-5-Dimensional measurement:

On Thursday, 2024-1211 AD, the researcher took post-measurements of the study sample participants. In the pre-measurements, the researcher was eager to use the identical temporal and geographical settings and protocols.

2-5 Statistical methods used:

The data was processed by the researcher using statistical processing software (SPSS).

Result and Discussion

The findings from the research sample are presented, analyzed, and discussed in this part. gathering information, arranging, and classifying it into tables that provide context, and then statistically analyzing it to provide conclusions The ultimate aim is to accomplish the research goals and theories..

3-1 Presentation and analysis of the results of the pre- and post-measurement tests for the research group and their discussion

3-1-1 Presenting and analyzing the results of the pre- and post-measurement tests for the research group

Testing the research hypothesis is the goal. To determine the significance of the variations in the test findings, the researcher used the T-test. As shown in Table (2), the research sample was measured both before and after.

Variables	measruing unit	the test	S-	A	F-	Af	T value it Calculated	Moral level	Type of significance
brawn belly	several	Tribal	4.4000	0.54772	-8.00000-	1.87083	-9.562-	0.001	moral
		Al-Baadi	12.4000	2.30217					
brawn noon	kg	Tribal	23.0000	2.73861	-15.600000-	1.94936	-17.894-	0.000	moral
		Al-Baadi	38.6000	2.60768					
Degree of pain	degree	Tribal	5.8000	0.44721	4.60000	0.54772	18.779	0.000	moral
		Al-Baadi	1.2000	0.44721					

The statistical indicators of the pre- and post-test findings for the variables under investigation that the members of the experimental group were exposed to are shown in Table (2).

The findings demonstrated that the strength of the back and abdominal muscles was higher in the post-test than it was in the post-test. the pretest, and the results showed a substantial shift in favor of the posttest between the two assessments.

Additionally, the results demonstrated that there was a significant difference between the two tests in favor of the posttest, with the mean values for the pain degree variable being lower in the posttest than in the pretest. This is because the variable has an inverse value, meaning that the lower the mean, the better the level. The significance levels for correlated samples were determined by using the nonparametric statistical law (T), as all variables were less than a significance level (0.05). The two tests vary significantly from one another.

3-1-2 Discussing the results of the pre- and post-measurement tests for the research group

The qualifying exercises, which the researcher prepared and which included standardized repetitions, groups, and rest periods in a manner consistent with the research sample, are credited by the researcher for the reason behind the improvement in the post-test compared to the pre-test. These exercises also had a positive effect on improving the flexibility of the spine and strengthening the back and abdominal muscles. an increase in the level of discomfort(Webster et al., 2019).

The researcher also credits the sample's compliance with the program's vocabulary rehabilitation and ongoing follow-up in collecting the study sample to get strength workouts for these variations in the development of abdominal muscular strength.

This is supported by Matthews and Fox, who state that consistent effort or the usage of muscles in a structured training program may provide a person with the motivation to enhance their power level **(Matthews, 1981)**

This agrees with Issam Al-Hasanat, as increasing muscle strength helps to bear the burdens placed on them Muscle **(Hasant, 2008)**

This was confirmed by the results of a study by Azza Fouad Al-Shouri (2006), Hisham Muhammad Abbas (2004) and Samia Abdel Rahman (2004) that practicing rehabilitation exercises on a regular basis has a positive and effective effect on improving and increasing the strength of the muscles of the back, abdomen and legs, which helps to strengthen the muscles of the lumbar region and relieve pain. lower back. **(Din, 2004)**

The designed program and its contents are credited by the researcher as the cause of the increase in back muscular strength. Exercises for strengthening the back and abdominal muscles during strength rehabilitation are crucial since building muscle mass The development of a muscular corset that lessens lower back discomfort was beneficial in the rehabilitation of sports injuries(Gmez-Portes et al., 2021). It applies pressure to the spine and aids in the healing process(Zhang et al., 2023).

This is what was confirmed by Abd(Abdul, 2013)

It also agrees with the study of (Majid) Muhammad Amin, in which he believes that a person must have a good degree of strength For the body's muscles, especially the abdominal muscles and back muscles, so that it can manage various movements easily and with minimal effort without being accompanied by pain. Building strength does not come from itself, but rather from the combination of several factors, including exercises. Of various types, the best of these exercises are those performed in the swimming pool, especially exercise Swimming **(Amin, 2017)**

She also agrees with (Williams) that the reason for these differences is the rehabilitation curriculum that included exercises to strengthen the muscles and ligaments of the spine, as "strengthening the back muscles is one of the factors in avoiding back pain." **(Williams, 1991)**

This is what researchers and experts agree with: "The positive effects of therapeutic exercises included in the therapeutic approach used, as it included stretching exercises and developing the flexibility of static, moving, and mixed strength" of the lower back muscles (muscular girdle of the abdomen and torso), which had a role in reducing the degree of muscle pain, improving ranges of motion, and reducing stiffness. Motor determination, force development and extension **(Sultani, 2006)**

The shock wave device is the cause of the development in the reduction in the pain degree variable, according to the study. Shock wave treatment is employed because it was effective in lowering the level of discomfort. Wave therapy is an additional physical therapy activity

that is used in conjunction with manual treatment approaches. Trauma facilitates faster healing and better physical mobility for the patient, as well as the treatment of ailments. Currently, physical therapy for muscle and tendon fibrosis uses a variety of pain management techniques that result in either acute or chronic pain. painful areas as a result of deposits dissolving and calcifying, which increases blood flow in the treated region, etc. What sets it apart is that the therapy targets the pain core directly, promoting quick healing. Shock waves (Ching Jen, 2012)have been demonstrated in piezoelectric technology, consisting of the discharge of a large number (often over 1000) of spiral crystals installed in the field and receiving a rapid current, triggering a pulse. The pressure in the environment causes the shock wave to sink quickly and deeply, and the arrangement of the crystals causes the wave to self-focus towards the center of the target area, resulting in very precise focus and high energy within a given axial volume, and this high energy is directed to the affected area, eliminating calcification and fibrosis and stimulating tissue renewal of damaged cells(Funaro et al., 2022). Researchers believe that the standardized physical rehabilitation exercises on which the program was based, as well as the use of a shock wave machine, one of the rehabilitation methods, played a crucial role in achieving positive improvements. The spinal muscles are significantly lengthened, which in turn leads to a positive improvement in range of motion and therefore spinal pain(Tramontano et al., 2021). Ahmed Al-Sayyid 2004, Howayda Al-Asr, Sanaa Mamoun 2006, Jassim Mohsen 2012 confirmed this: “Exercises of range of motion exercises can improve the range of motion of the spine and pelvic joints and enhance the range of motion of the spine and pelvic joints. Back and abdominal muscles,” in addition to relieving low back pain(Nepomuceno et al., 2024).

Conclusion

1. The results of rehabilitation exercises with the shock wave device show that variables (abdominal muscle strength, back muscle strength) are significantly improved, which is beneficial to size measurement
2. Rehabilitation exercises that accompany a shock wave device help reduce pain levels, which is the most important factor in an injured person's ability to meet the daily demands that impact their life. Sporty.

Based on the researchers' conclusions, they recommend the following:

1. It is recommended that patients with back pain use rehabilitation exercises with a shock wave device during their rehabilitation.

2. Conduct research. The current study includes other infections of physical contact, as well as other samples from men and women.
3. Implement such programs in hospitals, treatment centers and gyms

References

Abdul Al-Razzaq Kazem, S. A. K. (2013). The effect of a training program for special muscular strength in developing the level of skill performance for front and back ascent with angular support on the throat device. In Scientific Conference The First International. University of Baghdad.

Ahmed, M. I., & Raya, A. R. (n.d.). Physical rehabilitation criteria throughout the stages of therapeutic exercises program for functional disabilities resulting from accident injuries. Journals.Ekb.Eg. https://journals.ekb.eg/article_70111_f3ce9bd426c4c5a58e708443934c8f4c.pdf

Al-Hakim, A. S. (2004). Tests and Measurement. Baghdad: National Library.

Al-Hasanat, E. (2008). Health and Sports Science. Samaha Publishing and Distribution House.

Al-Sultani, A. H. O. (2006). The effect of a rehabilitation approach in treating chronic lower back pain for weightlifting, bodybuilding, and physical strength players. Babylon: University of Babylon, College of Sports Education.

Amin, M. M. (2017). The effect of two rehabilitation programs using freestyle and backstroke on the thickness and strength of some muscles for those with chronic low back pain. University of Karbala, Karbala.

Amin, M. M. (2021). The effect of free swimming exercises using a device designed to improve the flexibility of the spine, the strength of some working muscles, and the degree of pain for athletes with a herniated lumbar disc. University of Karbala, College of Physical Education, Karbala.

Bordoni, B., & Simonelli, M. (2020). Chronic Obstructive Pulmonary Disease: Proprioception Exercises as an Addition to the Rehabilitation Process. Cureus. https://www.cureus.com/articles/31980-chronic-obstructive-pulmonary-disease-proprioception-exercises-as-an-addition-to-the-rehabilitation-process.pdf

Ching-Jen, W. (2012). Extracorporeal shockwave therapy in musculoskeletal disorders. Journal of Orthopedic Surgery and Research.

Choy, J., Pourkazemi, F., Anderson, C., & Bogaardt, H. (2023). Dosages of swallowing exercises prescribed in stroke rehabilitation: a medical record audit. Dysphagia. https://doi.org/10.1007/s00455-022-10500-x

Dhaniwala, N. K. S., Dasari, V., & ... (2020). Pranayama and Breathing Exercises-Types and Its Role in Disease Prevention &Rehabilitation. Journal of Evolution of …. https://www.researchgate.net/profile/Nareshkumar-Dhaniwala-2/publication/345310834_Pranayama_and_Breathing_Exercises_-

Types_and_Its_Role_in_Disease_Prevention_Rehabilitation/links/5fa2b5fd92851cc286937fcf/Pranayama-and-Breathing-Exercises-Types-and-Its-Role-in-Disease-Prevention-Rehabilitation.pdf

Edwards, P. K., Kwong, P. W. H., Ackland, T., & ... (2021). Electromyographic evaluation of early-stage shoulder rehabilitation exercises following rotator cuff repair. … Journal of Sports …. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8637301/

El-Din, M. S. (2004). The effect of a rehabilitation program accompanied by some means to help relieve lower back pain in sitting volleyball players. In Sports Injuries and Physical Rehabilitation. Cairo: Suez Canal University, p. 579.

Funaro, A., Shim, V., Crouzier, M., Mylle, I., & ... (2022). Subject-specific 3D models to investigate the influence of rehabilitation exercises and the twisted structure on achilles tendon strains. … in Bioengineering and …. https://doi.org/10.3389/fbioe.2022.914137

Gmez-Portes, C., Castro-Schez, J. J., Albusac, J., & ... (2021). A fuzzy recommendation system for the automatic personalization of physical rehabilitation exercises in stroke patients. Mathematics. https://www.mdpi.com/2227-7390/9/12/1427

Hassanein, M. S. (2001). Measurement and Evaluation in Physical Education and Sports. Cairo: Dar Al-Fikr Al-Arabi for Printing and Publishing.

Martins, C., Sayegh, S., Faundez, A., Fourchet, F., & ... (2022). Effectiveness of a group-based rehabilitation program combining education with multimodal exercises in the treatment of patients with nonspecific chronic low …. Biology. https://www.mdpi.com/2079-7737/11/10/1508

Matthews, J. (1981). The Physiological Basis of Physical Education and Athletics. Philadelphia: W.B. Saunders Company.

Nepomuceno, P., Souza, W. H., Pakosh, M., & ... (2024). Exoskeleton-based exercises for overground gait and balance rehabilitation in spinal cord injury: a systematic review of dose and dosage parameters. … and Rehabilitation. https://doi.org/10.1186/s12984-024-01365-2

Qiu, J., Zhou, T., Jin, H., Pan, Y., Qian, T., Xue, C., & ... (2023). Effect of adding hip exercises to general rehabilitation treatment of knee osteoarthritis on patients' physical functions: a randomized clinical trial. … and Rehabilitation. https://doi.org/10.1186/s13102-023-00772-7

Riffitts, M., Cook, H., McClincy, M., & Bell, K. (2022). Evaluation of a smart knee brace for range of motion and velocity monitoring during rehabilitation exercises and an exergame. Sensors. https://www.mdpi.com/1424-8220/22/24/9965

Saadoun, A. R. (2019). The effect of muscle balance exercises using a proposed device on indicators of electrical activity and strength Maximum leg muscles and some over-the-chest throwing catches for young Romanian wrestlers. University of Karbala, College of Physical Education and Sports Sciences, Karbala.

Schache, M. B., McClelland, J. A., & Webster, K. E. (2019). Incorporating hip abductor strengthening exercises into a rehabilitation program did not improve outcomes in people following total knee arthroplasty: a …. Journal of Physiotherapy. https://www.sciencedirect.com/science/article/pii/S1836955319300554

Science, P. E. a. E. (2018). Indicators of improvement in lower back pain for women as a result of practicing exercises with the Swiss ball. Egypt: Helwan University.

Shultz, S. J. (2005). Examination of Musculoskeletal Injuries. America: Human Kinetics.

Tramontano, M., Angelis, S. De, Galeoto, G., Cucinotta, M. C., & ... (2021). Physical therapy exercises for sleep disorders in a rehabilitation setting for neurological patients: a systematic review and meta-analysis. Brain Sciences. https://www.mdpi.com/2076-3425/11/9/1176

Webster, A., Poyade, M., Rea, P., & Paul, L. (2019). The co-design of hand rehabilitation exercises for multiple sclerosis using hand tracking system. Biomedical Visualisation: Volume 1. https://doi.org/10.1007/978-3-030-06070-1_7

Wieczorek, M. P. (2020). … of the upper limb rehabilitation programme in patients after ischemic stroke, supplemented with virtual reality exercises comprising biological feedback-report …. Medical Rehabilitation. https://bibliotekanauki.pl/articles/1790785.pdf

Williams, J. (1992). Body Fatness Risk for Elevated Blood Pressure, Natl Cholesterol & Serm Lipoprotein Ratio in Children & Adolescents. American: American for Public Health.

Wood, D. S., Jensen, K., Crane, A., Lee, H., Dennis, H., & ... (2022). Accurate prediction of knee angles during open-chain rehabilitation exercises using a wearable array of nanocomposite stretch sensors. Sensors. https://www.mdpi.com/1424-8220/22/7/2499

Zhang, J., Weng, J., Yuan, M., Shen, X., & ... (2023). Effects of traditional Chinese exercises on cardiac rehabilitation in patients with myocardial infarction: a meta-analysis of randomized controlled trials. Frontiers in …. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10577298/