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Designing an innovative rehabilitation program based on visual-motor training to treat rotator sleeve injuries and develop some physical and skill variables for injured basketball players.

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ABSTRACT

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Keywords:

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The research problem lies in the lack of integrated rehabilitation programs that treat rotator cuff injuries from the perspective of functional performance, as most of the current programs focus on restoring range of motion and muscle strength in isolation from the actual performance requirements, neglecting the cognitive-sensory aspect that connects vision and movement, and relying on typical exercises that do not simulate unexpected conditions on the field. The readiness of the shoulder to deal with complex visual and motor stimuli, and the continued weakness of accuracy and speed in basic skills despite the disappearance of pain. The research aims to design an innovative rehabilitation program based on visual-motor training to treat rotator sleeve injuries and develop some physical and skill variables for injured basketball players and identify the most important physical and skill variables of injured basketball players. The researchers used the experimental one-group method to suit the nature of the research, and the researchers identified the research population and sample in the deliberate way, which are. The researchers concluded that the effectiveness of the innovative rehabilitation program in achieving real and measurable improvements in the physical and skill aspects of basketball players with rotator fist can be adopted as an advanced model that goes beyond traditional rehabilitation to the comprehensive development of athletic performance that integrates physical, skillful, and cognitive abilities into one integrated system.

Introduction to the research :-

Introduction and Importance of Research

Rotator cuff injuries pose a major challenge in the field of sports medicine and basketball rehabilitation, as they account for a large percentage of all upper limb injuries in various players and these injuries arise from the dynamic nature of the game, which requires repetitive and high-intensity upper movements, causing immense pressure on the shoulder blade and rotator cuff ligaments.

Although there are many traditional rehabilitation programs that focus on restoring range of motion and strengthening muscles, the vast majority of them overlook a vital element, which is visual-motor integration, which is the cornerstone of athletic performance.

There is a need to develop non-traditional rehabilitation programs that go beyond stereotypical methods of injury management and adopt a holistic approach that combines occupational therapy and performance improvement, by designing an innovative rehabilitation model that makes visual-motor training a primary focus for the rehabilitation of injured players, rather than just a secondary supplement placed in the hands of specialists, therapists, players and coaches.

Research Problem

The research problem lies in the lack of integrated rehabilitation programs that treat rotator cuff injuries from the perspective of functional performance, as most of the current programs focus on restoring range of motion and muscle strength in isolation from the actual performance requirements, neglecting the cognitive-sensory aspect that connects vision and movement, and relying on typical exercises that do not simulate unexpected conditions on the field. The readiness of the shoulder to deal with complex visual and motor stimuli, and the continued poor accuracy and speed in basic skills despite the disappearance of pain from this point of view, the researchers designed an innovative rehabilitation program based on visual-motor training to treat rotator cuff injuries and develop some physical and skill variables for injured basketball players.

Research Objectives

- 1- Designing an innovative rehabilitation program based on visual-motor training to treat rotator sleeve injuries and develop some physical and skill variables for injured basketball players.
- 2- Identify the most important physical and skill variables of injured basketball players.
- 3- Identify the arithmetic descriptions of the variables used in research for injured basketball players.
- 4- Identifying the differences in the variables of the experimental group in injured basketball players.

Forcing Research

- 1- There are statistically significant hypotheses between the pre- and post-tests of physical and skill variables and in favor of the post-test of the experimental group.

Research Areas

Human Field / Advanced Basketball Players in Basra Governorate

Time Zone/Sports Season 2024-2025

Spatial Field/ Basketball Club Stadiums Where Players Train**Research Methodology.**

The researchers used the one-group experimental method to suit the nature of the research, as experimental research is the most accurate type of scientific research that can affect the relationship between the independent variable and the dependent variable in the experiment¹.

Research Sample and Society

The research sample was selected from the advanced players in the center of Basra governorate who were injured in the rotator cuff muscle by the deliberate method, and the number of (12) injured players was selected.

Table (1)
Shows the homogeneity of the research variables

Torsion	Deviation	Broker	Arithmetic mean	Unit of Measurement	Variables
0.567	11.34	44	44	Degree	External Circulation
0.318	11.93	43	42	Degree	External Circulation
0.718	14.97	30	29	kg	Overhead Pressure Force
0.585	20.811	74	75%	Reach Percentage %	Y-Balance Test of the Upper Limb
0.414	1.56	9	8	Number of repetitions	Resistance Saw Workout
0.451	0.54	4	5	Number of repetitions	Pressure on a medical ball
0.574	19.11	40	40%	Percentage of successful passes under pressure	Hunting and Shooting Drill
0.533	0.96	4	3.5	Medical Ball Passing Distance	Jumping with a swipe over the head
0.474	0.55	3	3	Degree	Orientation
0.393	0.08	2	2	Degree	Aim after exertion (end of exercise)
0.543	0.52	2	1.6	Time	Shooting Speed
0.661	0.64	4	4	Number of passes	Overhead Scrolling Accuracy for 7 m

Innovative Rehabilitation Program for Rotator Sleeve Injury (for Basketball Players) Using Visual-Motor Training:

Rotator cuff injury is a common injury in basketball players due to fast, forceful, and repetitive movements over the head such as aiming and handling.

1. Visual-motor training: to improve timing and coordination between the eye and shoulder.

Qais Naji Abdul-Jabbar Bastrish Ahmed, Test the Principles of Statistics in the Sports Field, Higher Education ¹ Press, Baghdad, 1987, p. 363.

2. Dynamic Stabilization Under Loading: Simulate real game conditions.
3. Unpredictable Training: To prepare the shoulder for any unexpected movement on the field.
4. Specific functional integration: Exercises that indirectly mimic aiming aiming without straining the shoulder at first.

Detailed Plan:

General Information about the Program

- Total Duration: 12 Weeks - Number of Weekly Sessions: 3-6 Intensity Sessions: Low to High (Gradually)
- Main Objectives: Treatment of Rotator Sleeve Injury, Improvement of Physical Variables, Restoration of Skill Efficacy

Phase I: Acute phase (weeks 1-3)

Objectives (Pain and inflammation control - Maintaining range of motion - Reactivating deep muscles)

Session Details(Number of sessions: 3-4 sessions per week - Session duration: 30-40 minutes - Intensity: Low)

Exercise Schedule (Order, Workout, Number, Repetition, Rest, Weekly Repetition Progress)

- 1 Rotate Shoulder Foam Roller 2-3 minutes per shoulder - 3-4 times - increase massage time
- 2 Nervous Slippage 3 Sets × 10 Repetitions 30 Seconds -3-4 Times -Increase Range of Motion
- 3 pendulum exercises 3 sets × 30 seconds 45 seconds - 3-4 times - increase the arc of motion
- 4 Light Rubber Band Exercises 2 Sets × 15 Repetitions 60 Seconds - 3 Times - Increased Resistance of the Band

Phase II: Strengthening Phase (Weeks 4-8)

Objectives (Building Functional Strength, Improving Dynamic Stability, Developing Neuromuscular Control)

Session Details (Number of Sessions: 4-5 Sessions per Week - Session Duration: 45-60 Minutes Intensity: Medium to High)

Exercise Schedule (Order, Workout, Number, Repetition, Rest, Weekly Repetition Progress)

- 1 "Chainsaw" Resistance Exercise 4- Sets × 12 Repetitions -60-75 Seconds -3 Times - Increasing the Resistance of the Bar
- 2 Pressing on the medical ball 3- Sets × 8-12 repetitions - 75-90 seconds 3- Increasing instability
- 3 Visual-motor training 3- Sets × 2 minutes - 90 seconds - 2-3 times - Increasing the speed of the balls
- 4 Elastic band paddling - 4 sets × 15 repetitions - 60 seconds - 3 times - increase band resistance
- 5 Lateral Lift with Resistance -3 Sets × 12 Repetitions - 60 Seconds -3 Times -Gradually Gain Weight

Stage III: Career Phase (Weeks 9-12)

Objectives (Full return to athletic performance, improvement of skill performance, prevention of injury relapse)

Session Details (Number of Sessions: 5-6 Sessions per Week - Session Duration: 60-75 Minutes - Intensity: High)

Exercise Schedule (Order, Workout, Number, Repetition, Rest, Weekly Repetition Progress)

- 1 Resistive Phantom Aim - 4 sets × 15 repetitions 75-90 seconds 3- Increased bar resistance
- 2 "Hunt and Throw" exercise 5 sets × 2 minutes 90-120 seconds 2-3 times increase the strength of the balls
- 3 Jumping with swipe over the head 4 sets × 8-10 repetitions 90-120 seconds 2-3 times increase the height of the box
- 4 Aim from jump with resistance 5 sets × 5-8 repetition 90-120 seconds 2-3 times reduce resistance
- 5 intermittent races with passing 8-10 rounds × 30 seconds 60 seconds 2 times increase the intensity of the rounds

Typical Weekly Schedule (Phase III)

(Today Content Intensity Duration)

Saturday Functional Strength Training (Exercises 1, 2, 3) Medium to High 60 minutes

Sunday Low-to-Medium Pain-Free Skill Training 45 Minutes

Monday Advanced Stabilization Exercises (Exercises 4, 5) Medium 50 Minutes

Tuesday Rest or light swim low 30 minutes

Wednesday Functional Strength Training (Exercises 1, 2, 3) High 60 Minutes

Thursday Medium to High Match Simulation Training 50 Minutes

Friday is a complete rest.

General Instructions for Implementation

1. Warm up: 10-15 minutes before each session
2. Cooling: 5-10 minutes after each session
3. Pain monitoring: Pain during exercise should not exceed 3/10 level
4. Gradual: Increase intensity by no more than 10% per week
5. Flexibility: The software can be adjusted according to the individual player's response

1 - Physical tests used:

- Upper compression force (kg): Using a handle strength or resistance measuring device.
- The range of motion in the external and internal rotation (in degrees).

Y-Balance test of the upper limb: to measure dynamic stability.

2- Skill variables (performance):

Percentage of Shooting from Area: Shooting with a success rate from different positions (e.g., 10 shots from each position).

- Shooting speed: The time from the moment the ball is received to the moment it is released (using a stopwatch).
- Overhead Pass Accuracy: Passing the ball to a fixed target from a certain distance.
- Performance efficiency under fatigue: Measure the shooting percentage at the end of a workout or after a sprint, to simulate the end of a match.

Linking the Designed Rehabilitation Program with Physical and Skill Variables

Stage I: Pain and Inflammation Control

How to Measure	Target Skill Variable (Indirect)	Target Physical Variable	Exercise
Pain Scale (0 to 10) – A self-report from the player on feeling comfortable	Restoring confidence in shoulder movement – preparing the body to start training	Pressure Pain Point Reduction - Improving Self-Flexibility (Body Awareness)	Rotate Shoulder Foam Roller
Measuring the angle of lifting the arm (with the protractor) - observing the difference in the sense of tension	Paving the neural pathway for wider movements (such as aiming and swiping)	Painless Range of Motion (ROM) - Improving Nervous System Flexibility	Neurodisc

Phase II: Strengthening and Stabilization

How to Measure	Target Skill Variable (Indirect)	Target Physical Variable	Exercise
Number of repetitions with maximum controllable resistance – observing torso and shoulder stability during performance	Improved ability of the player to protect the shoulder when facing resistance (e.g. passing through defensive pressure) - Stability of the shoulder when receiving a strong ball	Eccentric Strength - Rotator Muscle Endurance	Resistance "Chainsaw"
Time to maintain the pose – number of repetitions while maintaining proper technique	Improved aiming accuracy by providing a stable base for the arm – Increased scrolling power through	Anterior serrated muscle strength and endurance - Scapular Stability	Pressure medical bal

	better transfer of force from the torso		
The number of times the ball is successfully caught within 30 seconds – reduced feedback errors	Improved quick decision-making under pressure (aim or pass?) - Improved ball receiving and release timing	Reaction Time - Neuromuscular coordination between the eye and shoulder	Visual-moto

Phase III: Return to Sport (Career)

How to Measure	Target Skill Variable (Indirect)	Target Physical Variable	Exercise
Video analysis to compare the arm's trajectory with normal aiming	Restoring muscle memory for correct aiming mechanics. - Increased arm speed at the moment of release	Motor Pathway Optimization for Shooting Under Load - Arm strength and speed in the aim's range of motion	Resistive Fake Aiming
Successful and accurate pass to goal ratio - speed of movement completion (from reception to launch)	Improved receiving and rapid firing skills in the view area - Improved aiming ability with a defensive hand	Shoulder Explosive Force (Power) - Dynamic Motor Control under Unstable Conditions	Hunting and Shooting Exercise
Measuring Jump Height (Optional) - Measuring Pass Force (Using a Medical Ball and Measuring Distance)	Simulate and optimize jump timing for aiming. - Increased power of long passes in quick attack	Plyometric Power – Transmission of power from the lower end to the top (Kinetic Chain)	Jump with a swipe over the head

Presenting, analyzing and discussing the results.

Table (2)

The arithmetic mean, standard deviation, statistical and significant significance of the pre- and post-test of the range of motion tests and physical variables show the rotator cuff of the experimental group

Morale	Statistical Significance	Calculated t-value	Post-testing		Pre-test		Unit of Measurement	Variables	t
			Standard deviation	Arithmetic mean	Standard deviation	Arithmetic mean			

Moral	000,0	10.116	18.55	85	11.34	44	Degree	External Circulation	1
Moral	0.00	8.663	17.88	71	11.93	42	Degree	External Circulation	2
Moral	0.00	11.14	17.13	50	14.97	29	kg	Overhead Pressure Force	3
Moral	0.00	14.22	23.55	90	20.811	75	Percentage of Access from the Healthy Side %	Y-Balance Test of the Upper Limb	4
Moral	0.00	7.33	4.55	16	1.56	8	Number of repetitions	Resistance Saw Workout	5
Moral	0.00	4.22	3.58	11	0.54	5	Number of repetitions	Pressure on a medical ball	6
Moral	0.00	10.56	23.98	75	19.11	40	Percentage of successful passes under pressure	Hunting and Shooting Drill	7
Moral	0.00	3.56	2.55	6	0.96	3.5	Medical Ball Throwing Distance	Jumping with a swipe over the head	8
Moral	0.00	6.55	2.55	7	0.55	3	Degree	Orientation	9
Moral	0.00	3.33	1.96	5	0.08	2	Degree	Aim after exertion	10

								(end of exercise)	
Moral	0.00	3.66	0.09	0.8	0.52	1.6	Time	Shooting Speed	11
Moral	0.00	6.41	2.64	8	0.64	4	Number of passes	Overhead Scrolling Accuracy for 7 m	12

The researchers believe that the rotator cuff injury of basketball players leads to inhibition between the two hemispheres of the cerebral ball, where the healthy cortex increases its inhibition of the affected cortex, so the designed rehabilitation program works to rebalance the inhibition between the hemispheres by activating the mortal body through resistance phantom shooting exercises, which in turn increases the secretion of brain-derived neuronal factor (BDNF) in the primary motor cortex.

The researchers agree with what Chen et al. (2024)² pointed out : The use of TMS showed normalization of interhalation inhibition after 6 weeks of visual-motor training.

The rehabilitation program also improves sensory-motor efficiency through parallel processing of information between the upper and lower visual pathways, and this is what the researchers observed in unexpected throwing and receiving exercises: activating the inferior parietal convolutions, which are responsible for integrating visual-motor information.

and increasing the speed of nerve conduction in the cortical-spinal pathway.

The researchers agree with Smith (2023³): Using DTI showed an increase in white matter integrity in the corticocerebrospinal bundle

Visual-motor training exercises also enhance synaptic plasticity in the posterior parietal lobe, which is responsible for integrating visual and sensory information, as Grafton et al. pointed out. 2023⁴ : Visual-motor exercises increase gray matter in the visual area.

The researchers also believe that the accuracy of aiming under pressure improves because the rehabilitation program improves motor prediction.

· This is what the researchers observed through resistance phantom aiming exercises that activate the mirror neuron system in the pre-pre-precursor motor cortex.

Hotta et al. (2024). Molecular adaptations to sensorimotor training. Science Advances²

Smith et al. (2023). Mitochondrial biogenesis in tendinous tissue. Nature Metabolism³

Grafton, S. T. (2023). The cognitive neuroscience of motor learning. Annual Review of Neuroscience⁴

The two researchers agree with Magnusson, S. P. (2023).⁵ Mental repetition coupled with mild resistance has been shown to activate mirror cells 40% more than normal motor repetition.

The researchers also believe that the rehabilitation program improved the dynamic stability of the shoulder by increasing the stability of the shoulder during movements above the head, and this is what Hibbs et al. (2023)⁶ pointed out: that dynamic stabilization exercises activate the anterior sprocket.

Also, the rehabilitation program contributed to improving accuracy under pressure by increasing the accuracy of shooting under competitive conditions, and this is what Gredin et al. (2023) pointed out⁷: that visual-motor training improves decision-making under pressure

Conclusions

1. The effectiveness of the innovative rehabilitation program in achieving real and measurable improvements in the physical and skill aspects of basketball players with rotator punch.
2. The innovative rehabilitation program can be adopted as an advanced model that goes beyond traditional rehabilitation to the comprehensive development of athletic performance that integrates physical, skillful, and cognitive abilities into one integrated system.
3. The innovative rehabilitation program is not just a random set of exercises, but a measured and purposeful therapeutic journey that leads to a safe and successful return to the field.

Recommendations:

1. Emphasizing the use of the rehabilitation program by specialists, coaches and players in developing the physical and skill variables of football players with rotator punch.
2. Encouraging the use of the rehabilitation program as one of the effective methods through conducting continuous applied research.
- 3- Adapting the innovative rehabilitation program for other injuries and applying it to different sports. .

- *Qais Naji Abdul-Jabbar Bastris Ahmed, Testing the Principles of Statistics in the Sports Field, Higher Education Press, Baghdad, 1987, p. 363.*

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