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Designing an innovative method to determine the degree and level of sprained wrist ligament injury in athletes with wrist injuries

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ABSTRACT

This study aimed to develop a specialized method for quantifying the severity and extent of sprained ligaments in the wrist joint of injured athletes, while also assessing the level of pain experienced by athletes with such injuries. The researchers used the experimental method to suit the nature of the problem in a one-group approach. The study targeted athletes with wrist sprain ligament injuries in Dhi Qar Governorate, which included handball, gymnastics, track and field, and basketball. The research community comprised athletes with wrist ligament sprains in Dhi Qar Governorate, totalling six athletes, representing 100% of the sample. The researchers used the following means and tools: the personal interview, tests and measurements, a device manufactured to measure the level of the wrist joint ligament injury (measured in degrees). The values of the arithmetic mean and standard deviation of the measurement of flexion down and flexion up showed that there is a great potential for this manufactured device to measure the degree of injury of the joint ligaments among athletes. This device effectively distinguishes between injuries resulting from flexion downward and upward movements. Moreover, the method devised by the researchers can be relied upon to predict future occurrences of sports injuries within the joint's range of motion.

KEYWORDS

Sprained Wrist; Ligament Injury; Athletes; Wrist Injuries

1. INTRODUCTION

Sports injuries are a phenomenon that calls for the attention of all workers in the sports field, as it is one of the important factors that force the player to stay away from competition temporarily or permanently. Sports injuries require to use the latest devices and tools, taking into account the provision of security and safety factors and the provision of specialists like doctors and rehabilitation

specialists in the field of injuries. In sports, the occurrence of sports injuries is still continuing in a way that threatens the health and safety of the player (Rashid & Haydan, 2018). Therefore, the researchers adopted the design of a special device to measure the degree and level of the wrist joint sprain injury by using a manufactured device to put the appropriate exercises according to the degree and severity of the injury (Muhammad, 2017; Al-Assaf, 2016).

Diagnosing sports injuries and knowing their percentage and locations using modern medical devices (such as a measuring device for the wrist joint injury level) is very important as we can reach the direct ability to develop appropriate solutions to rehabilitate those injuries. Researchers interested in the field of sports injuries have observed a large number of ligament injuries in the wrist joint, especially among athletes participating in various games, particularly at a young age. These injuries can occur suddenly during or after playing. Additionally, such injuries often lead to more severe complications, necessitating further treatment at a higher level of care.

This early detection may help coaches and players in studying one of the important pillars that help specialists to prevent these injuries, and the researchers hope, through this study, to identify deficiencies and motor weakness in the joint among young players, and to find ways to prevent and avoid sports injuries before they occur. For example, through the preparation of preventive exercises that contribute to the development of neuromuscular work and also contribute to reducing the incidence of injuries for athletes, as well as identifying the degree and incidence of injuries suffered by athletes.

Therefore, this study aims to develop a specialized method for quantifying the severity and extent of sprained ligaments in the wrist joint of injured athletes, while also assessing the level of pain experienced by athletes with such injuries. The research hypotheses are: 1) The proposed method measures the degree and level of wrist ligament sprain injury in injured athletes. 2) The proposed method determines the level of motor range of athletes with sprained wrist ligaments. 3) The proposed method determines the degree of pain for athletes with sprained wrist ligaments.

2. METHODS

2.1. Design and participants

The researchers used the experimental method to suit the nature of the problem in a one-group approach. The study targeted athletes with wrist sprain ligament injuries in Dhi Qar Governorate, which included handball, gymnastics, track and field, and basketball. The research community comprised athletes with wrist ligament sprains in Dhi Qar Governorate, totalling six athletes,

representing 100% of the sample. The study was conducted at the Physiology Laboratory, College of Physical Education and Sports Sciences, University of Thi-Qar. The study spanned from February 1, 2021, to August 1, 2022. Homogeneity was achieved in the variables of weight, height, and training age, as demonstrated in Table 1.

Table 1. Homogeneity

Variables	Unit	Arithmetic mean	Standard deviation	Skew modulus
Weight	kg	69.90	7.014	0.096
Height	centimeter	176	5.193	0.085
Training age	month	36	1.23	0.021

To start from a single starting point, the researchers relied on the foundations of sports injury, which are as follows: 1) Homogeneity in the degree of injury: All members of the sample were suffering from ligament sprains and according to the magnetic resonance imaging. 2) Homogeneity was observed in the site of injury, as all members of the sample sustained ligament injuries within the interior of the wrist joint, as confirmed by MRI. 3) Homogeneity in the duration of the injury: All the participants had an injury that did not exceed 14 days.

Table 2 shows the homogeneity of magnetic resonance waves. Since the value of the skew coefficient is less than 1, the sample is normally distributed.

Table 2. The homogeneity of magnetic resonance waves

	Unit	Arithmetic mean	Standard deviation	Skew coefficient
Resonance waves	Percentage	42.50	5.40	0.00

2.2. Instruments and procedures

After the personal interview, the device was used to measure the level of the wrist joint ligament injury, measured in degrees. This device consists of a base that is firmly fixed on a flat wall with a length of 2 m and a width of 5 cm, so that we can control it according to the length. It has a watch on which degrees are installed to measure the two sides, in prominent colors, measuring 8 cm in diameter. The lever is between the clock and the base installed on the wall, and its length is 25 cm. It consists of a grip attached to the watch, which is moved and measures the movement range of the wrist joint from the top and bottom. An indicator is installed on the watch to move in both directions according to the extent to which the injured person reaches (Figure 1).

Figure 1. The shape of the device

The device operates as follows. The tester stands in front of it with the arm fully extended, gripping the handle. They then move the wrist vertically downward to the point of pain or discomfort for the injured athlete and record the score. Subsequently, the wrist of the hand is moved upward in the same manner until reaching the same level of pain or discomfort, and the researchers record the score accordingly (Figure 2).

Figure 2. Measurement

The researchers evaluated the validity of the device by presenting it to a group of experts in the fields of sports training, tests and measurement, and sports injuries, and to some doctors specialized in joints. The percentage of agreement was 100% after the amendment. Furthermore, the researchers calculated the reliability coefficient (test and retest method). Moreover, for the purpose of identifying the objectivity of the test, the researchers used the Spearman correlation coefficient between the first judgment and the second judgment (Table 3).

Table 3. Reliability and objectivity coefficients

	Reliability	**Objectivity**
Bend down	0.90	0.93
Flex up	0.89	0.91

An exploratory experiment was carried out to identify the positive and negative aspects that may appear in the future, and to ensure appropriateness and safety. The researchers conducted the exploratory experiment on 3/6/2021, testing the degree and level of wrist ligament injury. It was

conducted at ten o'clock in the morning on a sample of 6 athletes, in the physiology laboratory of the College of Education and Sports Sciences of the University of Thi-Qar. The main experiment was conducted on 10/3/2021 under the same conditions.

2.3. Data analysis

The statistical package SPSS, version 23.0, was utilized for processing the statistical data. This research employed the following statistical methods: arithmetic mean, standard deviation, t test, and homogeneity, reliability, and objectivity tests. For the present study, statistical significance was set at $p < 0.05$.

3. RESULTS

Table 4 shows the arithmetic means and standard deviations of the wrist joint downward flexion of the injured athletes. By observing Table 4, we find that the arithmetic mean value for the "wrist bend down" variable is 2.50, with a standard deviation of 0.707.

Table 4. Descriptive statistic results of the wrist joint downward flexion among the injured athletes.

Variable	Unit	Arithmetic mean	Standard deviation
Bend the wrist down	Degree	2.50	0.707

Table 5 shows the arithmetic means and standard deviations of the wrist flexion of the hand upwards among the injured athletes. By observing Table 5, we find that the arithmetic mean value for the "wrist flexion upward" was 2.25, with a standard deviation of 0.366.

Table 5. Descriptive statistic results of the wrist flexion of the hand upwards among the injured athletes.

Variable	Unit	Arithmetic mean	Standard deviation
Bend the wrist upward	Degree	2.25	0.366

Table 6 shows the average value of the downward flexion and the upward extension of the wrist joint, the level of significance, and the T value. When comparing the means through t test, a significant difference was observed ($p<0.001$). This indicates the device's capability to differentiate between wrist injuries caused by bending down and flexing upward. This information assists experts and researchers in rehabilitation, by guiding the development of tailored exercises based on injury severity and emphasizing the most affected areas during measurements.

Table 6. Comparison between bend down and flex up the wrist

Bend down		Flex up		T value	Significance level
Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation		
2.50	0.707	2.25	0.366	3.59	0.001

4. DISCUSSION

The values of the arithmetic mean and standard deviation of the measurement of flexion down and flexion up show that there is a great potential for the manufactured device in measuring the degree of injury of the joint ligaments among athletes, and this in turn has achieved the desired benefit from the manufacturing of the device (Hadek, 2018; El-Din, 2016).

The aim of manufacturing this method is to detect the degree of injury or even before its occurrence, and this helps researchers, and those interested in developing preventive exercises, to prevent sports injuries before they occur, by determining the range of motion of the injured joint. The scores for this method are recorded from two directions, up and down, starting from zero to three degrees. The athlete gets a score of zero if he suffers from severe pain during the application of the test in any part of the body; a score of one is given if the subject is relatively unable to complete the movement; two degrees are assigned if the athlete completes the movement despite experiencing pain; three degrees are given if the movement is executed correctly. The best degree awarded to the tested subject is three, indicating correct execution without pain.

The most important thing is that the points of movement must be recorded, whether they are up or down. The researcher worked in this method to target the range of motion of the joint, and this helps to determine the degree of injury accurately, especially if it was used in training places where modern detection devices are not available, as injuries are common phenomena in activities.

This early detection may help coaches and players in studying one of the important pillars that help specialists to prevent these injuries, and the researchers hope, through this study, to identify deficiencies and motor weakness in the joint among athletes, and to find ways to prevent and avoid sports injuries before they occur. For example, through the preparation of preventive exercises that contribute to the development of neuromuscular work and also contribute to reducing the incidence of injuries for athletes, as well as identifying the degree and incidence of injuries suffered by athletes (Al-Zaid et al., 2012; Baseer, 2018; Salem, 2017).

The design of devices to measure sports injuries is a very hard and very accurate work because it requires effort and time, as well as experts in manufacturing, but the researchers have provided and relied on specialists to achieve the possible benefit, as indicated by Mahjoub (2014).

From the principle of making sure that the device lives accurately, we made a measurement after a certain period of time, and we noticed an improvement in the degree of injury, and this indicates that a recovery from the injury occurred through physical therapy and exercises performed by the injured subjects (Salman & Al-Saffar, 2015).

5. CONCLUSIONS

The device developed by the researchers assesses the degree and severity of wrist joint injuries during downward flexion movements for injured players, as well as ligament injuries during upward flexion movements for athletes. This device effectively distinguishes between injuries resulting from flexion downward and upward movements. Moreover, the method devised by the researchers can be relied upon to predict future occurrences of sports injuries within the joint's range of motion. Based on the results of our study, we recommend to employ this manufactured device to assess wrist injury through downward bending and upward flexion.

6. REFERENCES

Al-Assaf, S. B. H. (2016). *Introduction to Research in Behavioral Sciences.* Al-Riya, Al-Aibkan Library, 2016.

Al-Zaid, N. F., & Alyan, H. A. (2012). *Principles of Measurement and Hypnosis in Throwing.* Dar Al-Fikr for Publishing and Distribution.

Baseer, A. A. (2018). *Mathematical Training and Integration between Theory and Application.* Al-Kitab Center for Publishing.

El-Din, T. H. (2016). *Scientific Encyclopedia of Training.* Al-Kitab Center for Publishing.

Hadek, M. T. (2018). *The scientific foundations of exercise and sports performances.* Dar Al-Wafaa for Printing and Publishing.

Mahjoub, W. (2014). Methods of Scientific Research. *Dar Al-Hikma for Printing.*

Muhammad, S. K. (2017). *Sports Injuries.* Ministry of Higher Education, University of Baghdad.

Rashid, A. H., & Haydan, H. M. (2018). *Future trends in sports training.* Diyala University, Central Publishing Press.

Salem, M. (2017). *Stadium Injuries*. Riyadh, Dar Al-Ribah Publishing.

Salman, W., & Al-Saffar, N. (2015). Sports injuries of students of the College of Physical Education. *Al-Rafidain Journal of Sports Sciences, 4*(10), 55-69.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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