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Preparing movement exercises using a proposed laser device on the heel of the foot to learn and develop the speed of rotation and accomplish to the discus throw for youth U 20

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Abstract

Appropriate technical performance is directly linked to the goal of this motor performance, and achieving the goal depends on a number of requirements, including the application of the laws and conditions that are subject to the possibility of achieving performance for precise parts of the movement. The researchers wanted to study one of the most important stages of the effectiveness of discus throwing, as the rotation stage is considered the key to performance. The correct way to reach the throwing position in the best way, hence the importance of research into manufacturing a laser device that is attached to the foot of the discus thrower from below, where a sound appears when the man's heel touches the ground during the rotation phase, which in turn increases the speed of rotation within the throwing circle, which is reflected to effectively increase discus throwing performance. Therefore, the research problem was set to solve one of the issues that learners and instructors suffer from in discus throwing, which is the slow speed of rotation within the throwing circle. This small device works to teach the player the motor performance of raising the foot of the spinning leg and relying on the rotation on the comb. In this research, the researchers seek to answer the questions: Does the manufactured laser device help greatly in reducing the friction between the ground and the rotating foot in the discus throwing circle? The research aimed to prepare motor exercises using a proposed laser device attached to the heel of the foot that would help in learning motor performance and increasing rotation speed within the discus throwing circle. The researchers used the experimental approach with a one-group design with a pre- and post-test, and (5) students were selected from the trainees and practitioners of throwing events from among the students of the College of Physical Education and Sports Sciences in Al-Jadriya to represent the research sample in an intentional manner, and through the application of 8 educational units based on the use of the device manufactured in the department. The main part of the educational unit, and the results showed the effectiveness of the work of the laser device in developing the speed of rotation and in improving the motor performance of the rotation stage and the completion of the discus throw for young people, and this achieves one of the sustainable development goals of the United Nations in Iraq which is (Good Health). The researchers recommend using the laser device (L.F) attached to the bottom of the heel of the foot in learning and developing the motor performance of the rotation stage of the discus throw before teachers and trainers for this event.

Keywords

motor exercises, speed of rotation in discus throwing, laser device for discus throwing

Introduction:

Appropriate technical performance is directly linked to the goal of this motor performance, and achieving the goal depends on a number of

requirements, including the application of the laws and conditions that are subject to the possibility of achieving performance for precise parts of the movement. The researchers wanted to

study one of the most important stages of the effectiveness of discus throwing, as the rotation stage is considered the key to performance. The correct way is to reach the throwing position in the best way. Therefore, learning optimal motor performance while relying on the physical abilities of the rotation stage of discus throwing helps a lot in developing the motor performance of this stage, which is the basis and most important in this event. Among these variables are rotation speed and rotation time. They greatly affect achieving the best rotation phase in the discus throw, and the greater this speed is, the higher the throwing phase will be with high speed and great force, because it depends on the speed gained from the rotation phase. Hence, the researchers headed to prepare educational motor exercises with the use of a proposed device that contains laser sensors placed inside a special shoe manufactured for this purpose (which can be enlarged or downsizing) and is worn over the athlete's shoe on the rotation leg, so that the laser device is below the heel of the rotation foot, as it determines the student at a specific height level and forces the learner to rotate on the insteps, and in the event of a drop in the heel, it gives an audio signal of the errors that occur. In the rotation foot, this height makes it easier for the learner to rotate by increasing the pressure applied to a small area of the foot, which is the beginning of the metatarsals, while reducing the force of friction and increasing the speed of rotation. Bilal Ali's study indicated, "Because the purpose of rotation in discus throwing is to generate speed." It helps in throwing, as well as putting the shooter in the appropriate position that enables him to throw." (2). We note that current exercises rely on free weights, which often represent the main aspect of strength training to develop the rotation phase, so the researchers adopted the study of the rotation phase of discus throwing as variables to observe the effect of exercises on this phase and the effect of the speed and time of rotation on the throwing phase. Harad's study indicated that rotation is accomplished by transferring the weight of the

body over the instep of the left foot, with the knees bent at the same time, and the left foot rotates and the left arm extends to the left (13). Rotation of the hip and torso also occurs as a unit. As for the left arm, its extension must be maintained without stiffness, and at this stage the right leg begins to swing at a wide range of motion in the circle. Kamal Al-Rabadi mentions: "The rotation phase ends after the front right leg reaches the center of the circle, so the right foot becomes the center of rotation of the body until the left foot is placed in its place next to the stop plate" (8). Faiq states: "In order for the learning and training processes to go on their proper paths, the importance of the relationship between learning and training and the associated cognitive-spatial abilities of the learner must be demonstrated" (12).

The importance of research lies in:

- Manufacture of a proposed laser device that is attached to the heel of the foot. Which in turn increases the speed of rotation within the throwing circle, which is reflected in increased performance in discus throwing.
- Preparing movement exercises that help learn the best movement performance for discus throwers.
- Working to direct coaches and workers in the field of learning and training to manufacture such a proposed and very cheap device. The researchers believe that it will be very useful for everyone who trains to develop motor performance for the discus throwing event. The research problem lies in the work of researchers in the field of learning and training in athletics and their studies continuing to search for everything new in terms of educational methods, devices and auxiliary tools, they noticed a weakness in learning the effectiveness of discus throwing, so the move was to conduct a study that would help solve one of the most common issues that trainees and learners of discus throwing effectively suffer from, which is slow speed. Rotating inside the throwing circle by preparing

exercises that suit the development of motor performance in this event while linking its implementation to the manufactured device. In this research, the researchers seek to answer the following questions:

- Does the manufactured laser device greatly help in reducing the friction between the ground and the turning foot in the discus throwing circle?
- The manufactured laser device helps in learning the correct performance of the cycle phase of discus throwing, which is the key to the throwing process.

The research aims to manufacture a laser device that is worn over the athlete's shoe on the spinning leg that helps in reducing the friction between the ground and the spinning foot in the discus throwing circle. Preparing movement exercises using a proposed laser device that is attached to the heel of the foot that helps in learning motor performance and increasing the speed of rotation within the discus throwing circle. The research hypotheses were that there are statistically significant differences between the average results of the pre- and post-tests in learning motor performance and achievement in discus throwing for youth in favor of the post-test, and there are statistically significant differences

between the average results of the pre- and post-tests in rotation speed and rotation time of discus throwing for youth in favor of the post-test. The areas of research were the human domain, a sample of students practicing throwing events at the College of Physical Education and Sports Sciences / University of Baghdad, Al-Jadriya, the temporal domain for the period from 3/6/2022 until 4/14/, and the spatial domain - the throwing field in the College of Physical Education and Sports Sciences / University of Baghdad. Al-Jadriya.

Method and procedures:

The researchers used the experimental approach with a one-group design with a pre- and post-test, while the research community consisted of trainees and practitioners of throwing events among the students of the College of Physical Education and Sports Sciences in Al-Jadriya. (5) students were chosen to represent the research sample in an intentional manner due to the possibility of controlling them in carrying out the exercises and using the device. The research sample is largely equivalent, as the ages are similar, as well as the physical specifications are similar, as they are all students and practitioners of throwing activities.

Table .1 Explains the details of the research sample

Name	Length	Wight	Chronological age for throwing practice
Waleed	179 cm	71kg.	years4
Mohammed	180cm	75kg.	years3
Ibrahim	178cm	107kg.	years4
Hussein	179cm	73kg.	years3
Ahmed	184cm	80kg.	years3

Devices, tools and means of collecting information:

The International Information Network, the Internet, a team of assistants to carry out the research, a discus throwing circle, (6) discs weighing 1,750 kg, a tape measure (50) meters long, (2) video cameras (Sony) type, camera

speed (1000 rpm/Second), a stand with a height of (3) meters with an arm length of (1.5) meters, a camera stand. Student records.

Laser device manufacturing:

The researchers manufactured a laser educational device (L.F.) in which (2) sensors were placed on

both sides of the shoe from the inside, so that a sound for each sensor appeared when the player's foot touched the ground from the right or left side. Its aim was to accustom the player to rotating on the instep and working to raise the heel of the foot. A high distance from the ground, and when the foot lands, the laser shows an interaction and an audio signal for the player to raise the heel again. The device weighs (400) grams, (25) cm long, and (10) cm wide. A metal lever (2) cm is attached to it, which causes the sound to appear if it is touched. It is associated with a sound resembling a continuous whistle with a weight of (10) grams. The sound appears after the foot touches the ground. Appendix (1) shows pictures of the device and pictures of the stages of its manufacture.

Videography:

The researchers photographed each of the throws of the research sample, which numbered (30) throws, using (2) Sony video cameras. The camera speed was (1000 p/s), and (120 p/s) was used. The two cameras have a stand (3) meters high, with an arm (1.50) meters long to hold the two cameras.

One of the two cameras was placed above the middle of the circle at a height of (3) m and perpendicular to the player's movement from above, so that the player's movement and rotation are fully visible, through which the rotation speed and rotation time are extracted. As for the second camera, it was filmed from the side using a stand at a height of (1.20) meters to film the complete motor performance, from which videos are extracted for each thrower and then presented to the arbitrators (Appendix 2) who are specialists and those with experience in learning the motor performance of discus throwing to evaluate the motor performance by giving a score from (10) to the best throw among the six throws that every player performs.

Research tests:

The achievement test was conducted in accordance with international law (4) to measure the distance achieved (achievement). The researchers used a legal discus throwing circle, a throwing field, discs, and a measuring tape. According to the provisions of the law, each player is given (6) attempts, and each attempt is measured with a measuring tape. legal discs weighing (1,750) and (6) tapes measure (50) meters long were used.

Pre-measurement - The pre-test was carried out on (3/6/2022) by conducting the completion test and videotaping with two cameras. Each player was given (6) attempts, the distance was recorded and all throws were photographed.

Then the best in achievement, the best in rotational speed, and the lowest in rotational time were selected, in addition to the best in motor performance evaluation score.

The basic experiment - a laser device was manufactured and movement exercises were developed to be carried out with this device.

The Post-test - As for the post test, it was conducted on April 14, 2022, under the same conditions and place in which the pretest was conducted.

Research exercises:

The implementation of the research exercises began on (3/13/2022), by applying (2) educational units per week for a period of (4) weeks, with (8) educational units, in which the main section of the educational unit was intervened, where the students applied the exercises prepared for this research by adding the laser device which attached to the heel of the left leg (rotation leg), in order to help the learner raise the heel of the left leg during rotation in order to increase the speed of rotation and by relying on the instep of the foot and reducing friction to reduce the area that is pressed by the foot. Various exercises were used. During the rotation phase, the discus throw is effective, which is not a strange or unused exercise, but what is completely

new about it is that the laser device is connected to every exercise during rotation. Appendix (3) shows us a set of exercises used with the educational units that were used in this research. The holistic learning method was used to implement the full motor performance of the turning and throwing phase. The degree of difficulty ranged between (85%-95%) and the number of repetitions ranged between (8-12) repetitions, carried out during (3-4) sets - while the rest periods were between 1-2 minutes during the repetitions, and remember (Nahid) “Codifying the exercises and performing the correct and

integrated sequence of the units by giving sufficient rest between them (between the units and between the repetitions)” (14). The implementation of the exercises was completed on (10/4/2022). Statistical treatments. The researchers used the ready-made statistical bag (SPSS) to process the data and the results obtained.

Results:

The researchers tried to collect the results of the data obtained into tables and are presented below.

Table .2 Shows the arithmetic means and standard deviations for the variables of angular velocity and rotation time

Variables	D	MD	Calculated T	Sig	Significance
Angular velocity m/s	43,157	8,896	4,851	0,008	Sign
Rotation time m/s	0,019	0,0067	2,858	0,046	Sign

Table.3 Shows the calculated and significant T value and the significance level for the variables of angular velocity and rotation angle

Variables	D	M D	Calculated T	Sig	Significance
achievement	3.45	1.21	9.113	0.0213	Sign

Table .4 Shows the arithmetic means and standard deviations for the degree of learning to throw the discus

Variables	Pre		Post	
	A	+STD	A	STD+
Achievement	5.27	0.479	8.72	0.657

Table .5 shows the calculated and significant T value and the level of significance for the degree of learning to throw the discus

Variables	D	M D	Calculated T	Sig	Significance
	3.45	1.21	9.113	0.0213	Sign

Table .6 Shows the arithmetic means and standard deviations for the discus throwing achievement variable

Variables	Pre		Post	
	A	+STD	A	+STD
Achievement	26,80	2,32	29,12	2,98

Table .7 It shows the time of the means, the calculated and significant T value, and the significance level of the achievement variable

	D	MD	Calculated T	Sig	Significance
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Variables					
Achievement	2,32	0,91	45,15	0,022	Sign

Discussion:

Muhammad Othman mentions that discus throwers often need training with auxiliary means to develop their own speed and its contribution to strength, and that the relationship with this speed or what speed strength relates to (9). The use of modern devices, such as the device prepared by the researchers, helped greatly, as shown in Table (2), in increasing the angular velocity of the research sample by increasing the rotational speed of the thrower as a result of reducing friction with the ground. We also notice a decrease in the rotation time of the research sample, which is the same reason mentioned above. These two indicators are considered one of the main factors for increasing the throwing distance. And achieving very good motor performance learning. Bomba states, "The development of the disc launch speed is an indication of the achievement of a high angular velocity in the throwing arm and the correct rotation of the torso through the correct stabilization of the foot and supporting leg during the initiation phase of the push during the individual support phase.(3)

This is inevitably related to the degree of shoulder flexibility of the throwing arm and the use of (pulling) the free arm. At the same time, this leads to the development of high effort and angular velocity, as the centrifugal force keeps the disc on the wide acceleration path. It was shown in Tables (4) and (5) that the degree of learning motor performance for the discus throwing event achieved significance and to a fairly good degree between the pre- and post-tests, and this is undoubtedly due to the exercises used with the proposed device (L.F) prepared by the researchers. It had a major role in achieving better achievement as a result of what we previously concluded regarding the development of rotational speed and its reflection on learning correct motor performance. Ahmed Wardah Al-Khatib states, "This type of learning is a way to

manage the educational/learning process, so that students are occupied with educational tasks that suit their educational needs, developmental levels, and cognitive styles.(1)

This is inevitably linked to the athlete's ability to learn using the comprehensive method of learning, which is one of the most important main learning methods and which teaches the motor parts in a coherent manner to the learner without dividing the movement into details in which the learner may lose part of the learning. (AlJaf & Al-Shamaa) indicate (that development in motor performance depends on the continuous change in the pattern of training and learning during one educational unit itself. The laser device used is considered one of the basic methods for learning in the overall manner, as it issues an alert beep with any stop or descent. foot). (10)

Faten Ismail mentions that exercises are an important basic component of the educational unit, as this unit is made up of a group of exercises, and these exercises must be effective, and subject to basic conditions and considerations, through which the goals of the educational unit can be achieved (6).

It is clear to us in Tables (6) and (7) that the achievement variable achieved significance and to a fairly good degree between the pre- and post-tests, and this is undoubtedly due to the exercises used with the proposed device (L.F.) prepared by the researchers, which played a major role in achieving the best result of what we previously concluded regarding the development of rotational speed and its reflection in learning correct motor performance. (Faaq, Haider) assert, "The most clear and most indicative studies on experimental research variables that give us undoubted evidence are when appropriate statistical methods are used for the results of post-tests between the groups used in the research.(11) This device is considered one of the most important achievements that can be relied upon in

learning the rotation phase effectively in the discus throw, developing rotation speed and improving motor performance as a primary result, and then this is reflected in developing or increasing the completion distance for discus throw players.

Diaa and Nofal confirm, "The basic and important principles during the educational process are the availability of assistive devices that work to speed up learning by feeling the ability to develop performance in terms of skills and movement. (5) It can also be said that the proposed exercises helped significantly and clearly in learning how to raise the heel of the research sample's foot off the ground during the rotation process as a result of an attempt to prevent the sound of the laser device attached to the heel of their feet from emitting, which led to rotation on the instep of the foot and thus reducing the distance of rotation on the ground, which leads to reduce friction with the ground and thus reduce the obstacle that the player may face during the speed of rotation inside the circle. Therefore, the researchers relied on these exercises, which perform exactly similar to the main part of the discus throwing skill, with the use of the laser device (L.F.) attached to the bottom of the heel of the foot to achieve good learning, which is reflected in the best achievement in this event. (Qasim Hassan Hussein) pointed out that (delaying the muscular action of the muscles affects the speed of performance, which greatly affects achievement) (7) and this was one of the foundations upon which the researchers relied in preparing and building the proposed device, which has a major role in speed. The muscular work of the muscles is a result of the lack of disability resulting from the increase in the area of contact with the ground, and thus reflects its results in increasing the speed of rotation, which has a significant impact in increasing the achievement of the discus throwing event. The above results in our research indicate that the hypotheses imposed by the researchers were fulfilled by the superiority of the average results of the post-tests in learning motor

performance and the development of rotation speed and rotation time for discus throwing, which led to the development of discus throwing achievement for the research sample. What the researchers reached from what was mentioned above indicates that the research objectives that were expected for the results of this research were achieved, which was in the first objective the effectiveness of learning and training with the laser device (L.F.) attached to the bottom of the heel of the foot manufactured by the researchers in achieving clear development in motor performance and achievement of discus throwing. The second goal indicated an increase in the speed of rotation within the discus throwing circle.

Conclusions:

The effectiveness of learning and training with the laser device (L.F.) attached to the bottom of the heel of the foot manufactured by researchers.

Learning the motor performance of the rotation phase of discus throwing was very effective and useful to a high degree with the use of the proposed laser (L.F.) device designed by the researchers.

The laser device (L.F.) attached to the bottom of the heel of the foot had an effective role in developing the speed of rotation inside the discus throwing circle, in addition to reducing the time taken by the thrower as a result of this performance inside the discus throwing circle.

It was also concluded that the exercises prepared with the proposed laser device were effective in developing performance in discus throwing for young people.

Recommendation:

Using the laser device (L.F.) attached to the bottom of the heel of the foot to learn and develop the motor performance of the rotation phase of the discus throw by teachers and coaches for this event.

Work on manufacturing the proposed laser device in a better and more practical way by manufacturers of sports equipment.

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 (February /2024)

Author's contributions:

All contributions of this study were done by the researchers (N.H., H.F. and F.H.) who get the main idea and work on writing and concluding also with number of experts, Haider Faiq (Physical Education and Sport Sciences College/ University of Baghdad) in Statistics, Oliver Stoll in revision, Nour Riadh in translating, Maurizio Bertollo in proofreading

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Appendix(1)
Shows pictures of the device and pictures of its manufacturing stages



Appendix (2)
Educational units

Educational Unit / First Objective / Adapting to wearing the laser device on the right leg
Main section time: 45-50 minutes. Sample number: 5 students

Seq .	Exercises name	Repetiti on	Rest	Performance speed
1	Wear the laser device on the left leg, then on the right leg, and walk 5-6 steps with both	4	-	-
2	From the initial standing position, perform three-quarters of a cycle on the left leg	6	sec.30	Average
3	From a standing position in the middle of the circle, perform three-quarters of a turn on the right leg	6	sec.45	Average

Educational Unit / Third Objective / Adapting to wearing the laser device and rotating with the left leg
Main section time: 45-50 minutes. Sample number: 5 students

Seq .	Exercises name	Repetiti on	Rest	Performance speed
1	Wear the device on the left leg and from a standing position perform a half turn	6	sec.45	Average
2	From the initial standing position, perform a three-quarter turn on the left leg with the device	8	sec.45	Average
3	Perform the same exercise as before	4	min.1	Fast

Educational Unit / Fifth Objective / Learn three-quarter rotation with the laser device
Main section time: 45-50 minutes. Sample number: 5 students

Seq .	Exercises name	Repetiti on	Rest	Performance speed
1	Wear the device with the left leg and perform three-quarters of a cycle inside the circle	8	sec.45	Average
2	Wear the device on the right leg and stand in the middle of the circle, performing a quarter turn on the right leg	6	sec.45	Fast
3	Repeat the same previous exercise	4	min.1	Very fast

Educational Unit / Seventh Objective / Learn three-quarter rotation with the laser device
Main section time: 45-50 minutes. Sample number: 5 students

.Seq	Exercises name	Repetitio n	Rest	Performance speed
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1	From the initial standing position, perform a three-quarter turn on the left leg with the device	6	.min 1	Fast
2	Wearing the device on the right leg and standing in the middle of the circle, perform three-quarters of a revolution on the right leg	6	.min 1	Fast

اعداد تمرينات حركية باستخدام جهاز ليزري مقترح على كعب القدم لتعلم وتطوير سرعة الدوران والانجاز بفعالية رمي

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2 جامعة بغداد / كلية التربية البدنية و علوم الرياضة

3 وزارة التربية

يرتبط الأداء الفني المناسب ارتباط مباشر بالهدف من هذا الأداء الحركي وان تحقيق الهدف يعتمد على جملة من المتطلبات ومنها تطبيق القوانين والشروط التي تخضع لإمكانية تحقيق الاداء لأجزاء دقيقة من الحركة، إراد الباحثون دراسة مرحلة من اهم مراحل فعالية رمي القرص اذ تعتبر مرحلة الدوران هي المفتاح للاداء الصحيح الذي منه يمكن الوصول الى وضع الرمي بأفضل صورة، من هنا جاءت أهمية البحث بتصنيع جهاز ليزري يربط في قدم لاعب رمي القرص من الأسفل حيث يظهر صوت عند ملامسة كعب الرجل من الأرض خلال مرحلة الدوران والذي بدوره يزيد من سرعة الدوران داخل دائرة الرمي والذي ينعكس على زيادة الإنجاز بفعالية رمي القرص. ولذلك وضعت مشكلة البحث في حل واحدة من الأمور التي يعاني منها المتعلمين والمدربين بفعالية رمي القرص وهي البطء في سرعة الدوران داخل دائرة الرمي، اذ يعمل هذا الجهاز الصغير على تعليم اللاعب للأداء الحركي لرفع قدم رجل الدوران والاعتماد بالدوران على المشط، ويسعى الباحثون في هذا البحث على الإجابة على الأسئلة: هل الجهاز الليزري المصنع يساعد كثيرا في التقليل من الاحتكاك بين الأرض وقدم الدوران في دائرة رمي القرص؟ وهدف البحث الى اعداد تمرينات حركية باستخدام جهاز ليزري مقترح يربط على كعب القدم تساعد في تعلم الأداء الحركي وزيادة سرعة الدوران داخل دائرة رمي القرص. واستخدم الباحثون المنهج التجريبي بتصميم المجموعة الواحدة ذي الاختبار القبلي والبعدي وتم اختيار (5) طلاب من المتدربين والممارسين لفعاليات الرمي ضمن طلاب كلية التربية البدنية وعلوم الرياضة في الجادرية ليمثلوا عينة البحث وبالطريقة العمدية، ومن خلال تطبيق 8 وحدات تعليمية تعتمد على استخدام الجهاز المصنع في القسم الرئيسي من الوحدة التعليمية، وظهرت النتائج بفاعلية عمل الجهاز الليزري في تطوير سرعة الدوران وفي تحسين الأداء الحركي لمرحلة الدوران والانجاز برمي القرص للشباب، وهذا ما يحقق احد اهداف التنمية المستدامة للامم المتحدة في العراق (الصحة الجيدة). ويوصي الباحثون الى استخدام الجهاز الليزري L.F المربوط في أسفل كعب القدم في تعلم وتطوير الأداء الحركي لمرحلة الدوران برمي القرص من قبل المدرسين والمدربين لهذه الفعالية.

تمرينات حركية، سرعة الدوران برمي القرص، جهاز ليزري لرمي القرص.

الكلمات المفتاحية