ISOKINETIC EQUIPMENT IN THE STRENGTH TRAINING OF ARMWRESTLERS

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ABSTRACT

The author introduces the main reasons for aiming his research at the development of isokinetic, diagnostic and training equipment which should have its basic exploitation in armwrestling. In the results he discusses what parts the equipment is composed of. He brings the information about what data from the IsoForce system can be obtained and what can be set up on the Tend Force Gauge microcomputer. Later he describes three modes of exercise in detail, their foundation in training process or in diagnosics. The author explains inevitable portable adjustable construction which allows the implementation of all needed movements for armwrestling and that it has to meet other different requirements. In the results he describes all the advantages that TENDO IsoForce brings. He also informs about the tests that can be done within the diagnostics of strength abilities in armwrestling with the help of this equipment. In the end the author states that he sees the big potential in TENDO IsoForce for armwrestling purposes and informs about his plans for future as to the improvement of the equipment.

Keywords: IsoForce; isokinetic dynamometers; testing; strength abilities; armwrestling

Introduction

Since ancient times a man armwrestling match (in various modifications) has been very attractive for viewers. The best test of strength of armwrestling is match itself, but it only chooses a winner. The muscle strength is considered to be one of the determinants of sports performance in armwrestling.To be more specific it is rather a speed strength sport. Based on the result we don´t know the strength parameters that the winner generated against his rival. We are able to measure the time of the match and say whether the rival was beaten by explosive force after the start, or the match was balanced, long and the winner is a sportsman with better strength endurance. We still don´t know what force was developed within the ceratin technique. To do so we would need to find (create) suitable diagnostic equipment and tests. Harcarik (2008) states that until now oldfashioned terrain tests for strenght measurment has been used in armwrestling (pull ups, bench press, biceps stroke with EZ dumbell against wall, rolling thunder® grip, ...). These tests do not correspond to the biomechanics of motion in armwrestling. Cvecka and Schickhofer (2011) say that modern approach in assessment of strength abilities reperesents the equipment exploitation that enable ongoing recording of the forces apllied in dynamical conditions within constant speed in so-called isokinetic mode. The advantage of these equipments is the ability of measuring of acting force and associated parameters in full movement range during concentric, with some equipments also excentric, phase of movement. In the certain test, there is no trace of increased efforts in acceleration of movement like in standard dynamic tests. Increased effort results in increased strength. With constants speed it results into increased performance (Hamar, 2007).

Based on the desribed problems we started searching for the equipment which would be suitable for our needs. During the market research we were analyzing many isokinetic equipments such as Keiser, Excentrix, 1080 Quantum. They would be suitable for our diagnostics, but they are expensive and not portable. We also come acros to TENDO AbEx for torso strenghtening and abdominal muscle measuring. It uses isokinetic equipments with hydraulic resistance system. Its 6 speed system is different from previous equipments and it measures only concentric movement phase, which is sufficient for armwrestling purposes.

Methods

We underwent TENDO AbEx testing to find out whether measured data were correct and whether they have informative value. Different treatments followed the testing and we also atest its potential in testing of armwrestlers. The result is creating of brand new universal isokinetic equipment TENDO IsoForce (Figure 1) created by Mgr. Gabriel Harcarik, PhD. In cooperation with TENDO which started to be used in armwrestling. TENDO IsoForce je high quality isokinetic hydraulic resistance system with six different levels of speed. This equipment is equipped with strength measurement TENDO Force Gauge (Figure 2) with LCD display which gives immediate feedback about the developed force. We can see the use of this equipment in training process but in present we attest its potential in diagnostics of strength abilities of armwrestlers. For testing we need three implements.

1. Measurment system TENDO IsoFORCE (sensor unit)+Force Gauge (mikropočítač)
2. Portable adjustable construction
3. Armwrestling competition table (ten je standardized by rules)

Figure 1 *Tendo IsoForce*

Figure 2 *Tendo Force Gauge*

What data do we obtain with the help of TENDO IsoForce + ForceGauge?

- The system measures an average force and peak force in the point of pulling the arm;
- By entering body weight, it is possible to calculate relative force for 1 kg of body weight (Relative Average Force to BW);
- The system measures time of force;
- The system counts the number of repetitions;
- The system counts percentage of the strength compared to the best repetition (percent value of the bestrepetition);
- Possibilty of setting the time interval of force measurement;
- Possibility of setting a unit of measurement (kg, lb, N);
- Possibility of setting the amount of force for the beginning and end of force measurement.

This kind of feedback enables not only to find out the force of skeletal muscles and follow the progress for set training program, but it also is an important motivational factor in training itself which leads to effectiveness. Effective strength training means the rise of sports performance with faster recovery. But in majority of sports it is only a part of the sport preparation.

The advantage fo hydraulic isokinetic piston is possibilty od setting speed for concentric phase of movement and the possibility to test right and left limb separately and together, which enables implementation of various exercises and tests. In diagnostics and training it is possible to choose from three modes of exercises.

1. *Isokinetic exercise without excentric muscle contraction.* It means that exercise resistance is concluded only in concentric muscle contraction. The advantage of this type of exercise is that after exercise there is no muscle pain which is caused by excentric muscle contraction. Excentric training is very difficult, but it is an integral part of every training on the table with stronger sparring partner. It prolongs the time of regeneration, worsens the arm pain and increases the risk of injury. Excentric method for strength ability development is therefor not

used in armwrestling training for it is an offensive sport. To win we armwrestle the rival. This demands mainly isometric-isotonic muscle mode or the alternation during the match.

2. *Isokinetic exercise joined to additional excentric muscle contraction.* We achieve this by additional burden od rubber expander at the end of the IsoForce arm. The measured results, mainly with rubber expander, are not usable for repeated testing and comparing the results because they are distorted by expander features. These are changed by abrasion and it is difficult to measre these changes. It doesn´t matter in training but it hasten the implementation of individual repetitions. The main reason for adding the rubber expander is that the hydraulic piston is very strong and the arm too light to get it back to its starting position. To solve this, it is possible to add some weight at the end of the arm. The 5-kilogram weight proved itself in practice and we count with it in diagnostics. This weight distorts the measurment, but it is a constant weight which is not changed during the whole motion path in comparison to expander features. The expander increases the resistance with longer path.

3. *Isometric exercise:* we achieve this by simple disabled arm. In isokinetic exercise it is suitable to choose measuring of average strength (even though force value is measured in armwrestling). For isometric exercise it is reccomended to measure the maximal force. Ideally, the meter displays the actual data about the developed isometric force. Mazurenko (2016) made isometric measurements of peak force with the help of other equipment and then he determined preservance in force in a way that a sportsman had to maintain 70–80% of this rate for as long as possible. We can set the time of measuring static force on TENDO Force Gauge. After the set time of measuring (e. g. 20 seconds), the equipment ends the measuring and displays the measured value (for armwrestling it is a very important entry as to the tactics). In isometric dynamometers we are able to create different positions and tests which comes from individual particularities of the individual and are crucial for a sportsman in match. In the case of weak endurance strength he can add an isometric time training. The problem is that this kind of training is refused to be done regularly by armwrestlers. According to Harcarik (2016), but also to Mazurenko (2016) static dynamometer was not proved itself because the sportsmen were locatin the pain in elbow, wrist during and after testing and the did not want to undergo the diagnostics again.

Portable adjustable construction (Figure 3) had to be designed as a between part that allows force transfer from TENDO IsoForce with the help of a cable on the hand of an armwrestler. The construction meets the following criteria:

- It has to be light, solid, portable, demountable in a way that the fit into the boot of the car together with TENDO IsoForce (for diagnostic purposes),
- It has to be able to be fixed to armwrestling table easily and firmly to front and from the side,
- Calibration pulley has to be of a standardized height 110 cm and has to move to sides,
- It also has another pulley and this one has to be height adjustable and able to move to sides,
- It can be used as a loading roller for discs which enables to connect speed sensor and a movement path as for example fitrodyne, tendo, myotest, ...

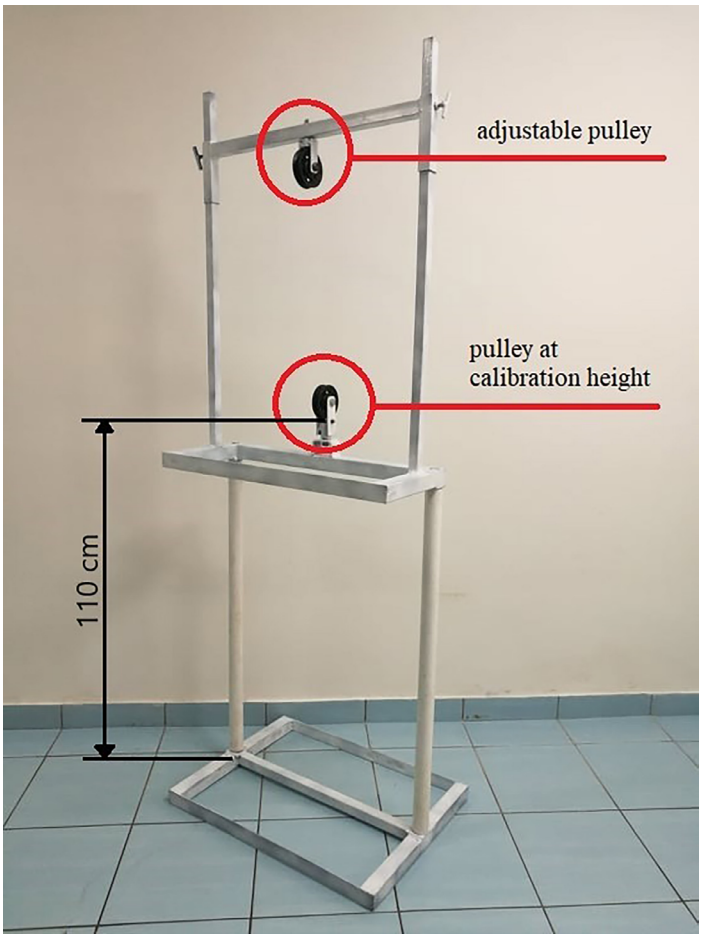

Figure 3 *Freestanding construction*

Construction ofthis type together with TENDO IsoForce enables to appy various working positions and modes in training or in diagnostics. One equipment supplies functions of more equipments. Based on our several months lasting testing, attesting and training on this isokinetic equipment we are able to see its big potential in the use either in training, but mostly in diagnostics of armwrestlers. The advantage of the whole diagnostic/training aquipment is that sportsmen are enabled to perform the same biomechanics of movement as it is used in an actual armwrestling match. It is a complex technology and not only an isolated movement in one joint. On the other hand, it is possible to use this equipment for either testing or training.

Results

Advantages of isokinetic hydraulic equipment in practis

1. *Possibility of diagnostics of strength abilities in isometric and isotonic muscle mode.* The equipment is suitable for standardized testing of armwrestling techniques, that means complex movements which are performed naturally, without restrictions. This is a big asset in comparison to old fashioned „terrain“ tests that measured strength abilities isolated and not directly. Our isokinetic equipment together with the adjustable pulley and competition table allow us testing directly the strength which is developed by amwrestler in certain technique. Thanks to that we are able to compare the results among sportsmen in specific techniques or exercises and quantify the difference in strength among rivals. Based on the discussions with coaches we agreed that for armwrestling more appropriate would be the measurement of peak force. Also with the help of this equipment we are able to perform also isolated tests or exercises as needed. In the future it will be inevitable to exactly describe them and standardize them.

2. *Control of the process of convalescence after an injury.* In case that a sportsman comes back after his injury, it enables to uncover efectively possible muscle disbalances. If he was already tested on this equipment or he trained on it we are able to say exactly what performance decline an injury caused, what the difference is in certain exercises/tests, how fast the return to previous form is and how to be at the same or higher level as his rival (if we know his parametres).

3. *Training availability.* The equipment is available also for club training. His price is a little bit higher than the price of common roller trainer, but significantly lower than the price of other isokinetic equipments.

4. *Motivation and competitiveness.* Thanks to immediate feedback a sportsmand and a coach are informed about achieved results. Overcoming own results can be motivating, but also those that training partner achieved in the same exercise. This was confirmed also on the national meetings or during the trainings in the club where the sportsmen naturally long for overcoming their rivals not only in matches, but also in measured values in certain exercises or tests. We can see the big difference in comparison to common training where dumbells, pulleys or special trainers.

5. *Multifunctionality.* It is possible to use this equipment for wide range of exercises from isolated ones (e. g. flexion in the lactate) to more articulated (whole technique, e. g. „top“). It enables performance of pull exercises and after the modification also pressure exercises.

6. *Variety in the training process.* In training the exercises on this equipment can be a part of traditional exercises within general and specialized preparation. Sportsmen like the training on the isokinetic equipment because it allows them to train the same exercises as are the exercises on pulley. At the same time it gives them feedback about achieved force at different speed levels. Also if needed we can use isokinetic or isometric mode.

7. *The ability to set the speed of movement.* It is an advantage and a disadvantage at the same time. Neither a coach nor a sportsman can quantify speed/resistance that is recalled on the equipment. In practice, they are used to kilograms and therefore they ask how much one kilogram is per one speed level on the equipment. They need to understand that it is not about weight but defined movement speed they work at. We can set the speed from 1 to 6. The 1 is the highest speed and the 6 is the lowest! The 6 is sufficient even for the strongest sportsmen, but weaker sportsman can use it too. This speed is used also in the diagnostics of force abilities in armwrestling. In practice training on lower speeds (4–6) prove itself in strength development if a sportsmen does his best. The next advantage of this isokinetic equipment is the training of the starts. In present, these are performed only with rubber expanders or by sparing partners. In both cases we miss the feedback about the developed strength. In speed training we used the speeds 1–3, where the 3 was better option for sportsmen than the 1, which was described as too „easy/light“. If we can observe that the performance of a sportsman does not increase but it even decreases, we can search for the mistake in training or in diet or tiredness. It is necessary to make a change to achieve the required result. We can also compere the level of force in at different speed levels before various competitions or within individual mesocycle.

8. *Safety.* So far, no injuries or negative response were recorded during the screening, testings or trainings. It is a very important factor for a sportsman and his performance growth. Armwrestling is a very difficult sport and there are many minor injuries mainly in the area of elbow or wrist.

Diagnosis of strength abilities in armwrestling with the help of TENDO IsoForce

The first big testing in armwrestling with TENDO IsoForce took place on 16/03/2019 in Presov on the national meeting of wide cadre before the Europe Championship. We attest the usage of these tests.

Imitation of the technique „top“ (Figure 4).

It was the most responsible and the most exact out of all the tests. We attest it on the 3 other meetings. We caught flies and now we can start to standardize it.

Figure 4a *Testing of imitation of technique „top“ a) starting position*

Figure 4b *Testing of imitation of technique „top“ b) final position*

- *Wrist flexion with winding attachment* was not the right one because we did not know how to remove undesirable movements that affected the result. We replaced it by more suitable and more exact test where we use special excentric holder in different sizes according to the length of the middle finger of the dominant hand.
- *Test with eccentric handle for the finger and wrist force in the isometric mode* (Figure 5) passed the retest and attest on the training and meetings. We can start with standardization process.

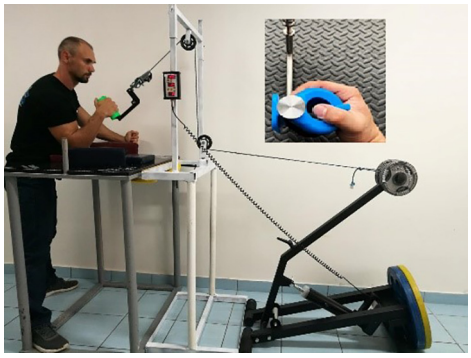

Figure 5 *Test with eccentric handle for the finger and wrist force in the isometric mode*

- *Test of imitation of technique bottom sideways (pulley from above)* did not prove itself in the form we designed and it has to be further modificated until it meets the requirements.

- *Test lateral pronation with belt (pulley in plane with hand)* did not prove itself in the form we designed and it has to be further modificated until it meets the requirements.

Conclusion

We can see a big potential in the use of IsoForce in sport practice and we dare to say that it can be a revolution in armwrestling in either diagnostics or training process. It is a high quality isokinetic hydraulic restistant, multifunctional and affordable equipment with 6 different speed levels. This equipment is equipped with force measurement (Tendo Force Gauge) with LCD display which gives the immediate feedback about developed strength. IsoForce is not capable of measuring excentric force, but this is not needed. For armwrestling performance isometric force and the size of concentric contraction are crucial.

In the next research we will focus on the attesting of other tests that are redeemable for armwrestling followed by their standardization. In the future we aim to design the equipment that will enable diagnostics and training of force abilities for as many sports as possible so it can be used in fitness and for commercial purposes. At the same time it should be universal, portable and affordable. The manufacturer works on computer software which should be able to make a graph we we can see increased strength in time and all the data should be saved in computer as it can be seen in other diagnostics equipment. The next task will be attesting the relationship between the achieved results in tests and in match.

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