ECRONICON OPEN ACCESS

EC ORTHOPAEDICS
Review Article

The Aberration of the Muscular-Contractile Gestalt Paradigm of the High Jump with a Run is the Reason for Limiting the Physical Capabilities of a Person Sin Jumping Locomotions

Alexander Egorov*

Federal State Budgetary Educational Institution of Higher Education, "Volga Region State University of Physical Culture, Sport and Tourism", Russia

***Corresponding Author:** Alexander Egorov, Federal State Budgetary Educational Institution of Higher Education, "Volga Region State University of Physical Culture, Sport and Tourism", Russia.

Received: September 13, 2021; **Published:** November 26, 2021S

Abstract

The modern understanding of jumping locomotion is based on the explosive contractile work of muscles. However, our studies show that muscles are not capable of manifesting dynamic characteristics recorded by equipment and determined analytically. At the same time, there are many indications that when performing jumps, a person does not use the muscular-contractile principle of locomotion. There is an assumption that both practitioners and researchers are mistaken in the perception of the gestalt image and, therefore, in the development of the jumping paradigm. Our research shows that jumping is carried out by using the energy of the deformation of the tendons. This aberration hinders the progression of records in jumping and does not allow demonstrating the true capabilities of a person.

Keywords: *High Jump; Muscular-Contractile Paradigm; Cytoplasmic Support; Tendons; Centrifugal Forces; Deformation*

Introduction

According to the statement of one of the most eminent philosophers of the 20th century, Thomas Kuhn, outlined in the work «The Structure of Scientific Revolutions», it follows that in any model there are initially flaws that are neglected, trying not to notice. But at a certain stage, these flaws begin to contradict the provisions of the fundamental sciences. This is the reason for the emergence of a new paradigm, with a different theory and with a different interpretation of the phenomenon. This determines the emergence of a process called the scientific revolution. Speaking about the mechanics of the athletics high jump, by the Fosbury flop method, we note that by now we have accumulated a lot of facts that contradict the provisions of the fundamental sciences. These paradoxical facts determine the detronization of the existing paradigm, based on the understanding of the contractile work of muscles, as the dominant factor in the acquisition of lift, during the implementation of jumping locomotions. The existing paradigm implies the use of creatine phosphate, but from the position interpreted by it of the rapid contractile work of muscles, it is not possible to explain many paradoxes «tied» to creatine phosphate energy supply. At the same time, one should take into account that a mistaken understanding is not just a harmless delusion. The aberration of knowledge about the mechanics of the high jump with a running start leads to an erroneous training system for athletes and, due to its low efficiency, does not withstand competition with doping. Scientists and practitioners talk about the limit of a person's physical capabilities. At the same time, human records are several times inferior to representatives of the animal world (Table 1).

No. Np/p	Representative of the fauna	Body length (cm.)	The absolute height of the jump (cm.)	The height of the jump relative to the body length
1.	Hare	50	250	5
2.	Stocky antelopes	50	500	10
3.	Red-eyed tree frog	7	100	150
4.	Flea Up to	0,5	40-70	220
5.	Cheetah	120-130	400	3,3
6.	Human (H. Sotomayor - world record holder)	195	245	1,25

Table 1: *Height of jumps of representatives of the animal world in absolute and relative values [5].*

But why are identical amino acids, in the "animal" structure, able to exhibit significantly higher rates than humans? Let us transform this question and rephrase it as an abstraction: why is the same set of amino acids materialized in the substance «fauna» three times (!) Superior in efficiency to the amino acid substance «man»? Maybe the athletes are not training properly? Or maybe they are not training what is required? Is it also possible that sports science is heading in the wrong direction? If you ask this question to a great sports scientist, or a practicing coach, then, as they say, you can get ... Therefore, we recommend using the recommendation of American entrepreneurs: "If you want to organize mass production of good shells, do it without artillerymen, that is, without specialists" dressed in uniforms "of established traditions and canons" [26, p.64]. Let's try to understand why the identical, with the human, "set of amino acids, materialized into the substance" fauna ", is three times (!) Superior in efficiency to the amino acid substance" man "?". Is it possible in this case to talk about the limit of human capabilities. And for this, let us throw off the «uniform» of established traditions and canons, abstract and analyze the following aspects:

1. As you know, the formation of the organism of both animals and humans is influenced by the environment. Of course, evolution is the great trainer in nature, and the most ingenious technique is the struggle for existence. But homo-erectus (erectus man) appeared 1.5 - 2 million years ago, the muscles of which consisted of an identical set of amino acids with the representatives of the fauna. He also survived in a single environment with predators, and also had to train authentic physical abilities. Moreover, at that time, physical abilities could not be replaced by the emerging mental inclinations. They only made life easier, but, in that period of the historical evolution of man, they could not be decisive in the struggle for survival. And this means that the ancient man, as well as the predators, should have had comparable physical abilities.

2. Theological saying reads: "And so take his talent and give to him who has ten talents. For to everyone who has it, it will be given and will be multiplied" [24, p. 95]. This quote about talent, known in the scientific world as the «Matthew Effect», is expressed in the law of exponential development [12], the essence of which is that an individual with an initial advantage will increase these advantages exponentially.

   And this means that a person who stood out from the environment of animals should have received great physical abilities, different from the rest of the animal world, or at least equal to it.

3. Dear scientists, such as, for example, Doctor of Medical Sciences, N.A. Agadzhanyan, head of the department of human reserve capabilities of the Central Research Institute of Sports, Professor V.V. Kandyba, have collected numerous evidences of supermanifestations of people who find themselves in an extreme situation [1,14,15]. Here, for example, is the testimony retold by V.V.Kuznetsov, the head of the department of human reserve capabilities of the research institute: "During a forced landing in the North, he (the pilot) got out of the cockpit to look at the damage to the landing gear. He squatted down and suddenly felt the heavy paw of a polar bear on his shoulder! He came to his senses only on the wing of the plane, where he found himself, not knowing how, jumped in cotton trousers, a jacket and fur boots to a height of 2 meters" [15].

Based on these arguments, let us carefully assume that perhaps a person possessed and has latent physical superpowers? In this case, a different locomotor mechanism is possibly used. However, apart from the musculoskeletal system, we do not know any other mechanism for locomotion. There is no other mechanism in the rudimentary tracks. But, as you know, vision is selective. A person sees only what he wants to see. And based on this, it can be assumed that the gestalt image of the high jump, based on the contractile work of muscles, is erroneous. Maybe there was a "dislocation" of the understanding of this locomotion? Therefore, in accordance with the word "orthopedia" (from the Greek. Let the great representatives of the scientific world and practicing trainers not take offense at us, but for this challenge statement we have our own facts that refute the existing paradigm of jumping locomotions based on the explosive work of muscles. By virtue of the available information, testifying to the exorbitant (400 kg) power interactions of the jumper with the supporting surface, it is quite logical to conclude that the high jump is closely related to the overcoming strength work of the muscles based on their explosive contraction. And in accordance with this Gestalt perception of strength as a dominant quality, the entire training of modern high jumpers is built, the main attention of which is aimed at fostering maximum strength and speed-power (explosive) abilities. But we declare that this direction of improving the jumping ability of a person is a delusion. As a result, the catastrophic lag of man from the animal world in the manifestation of the quality of jumping ability. However, let's look at the paradoxes that cannot be explained from the point of view of the muscle-contractile paradigm.

Paradox 1: We conducted numerous (1987 - 1991) tests of strength and explosive ability of muscles among highly qualified high jumpers, among whom were the Olympic champion of Seoul (1988) G. Avdeenko, bronze medalist of the Seoul Olympics (1988), world leader R. Povarnitsyn, bronze medalist of Seoul, world champion T. Bykova, showed no correlation with the result in the competitive jump (Table 2).

№ p / p	urname and./personal achievement	The result of the jump up from the place (time spent in flight-ms)	Best competitive result of the season (sm)
1.	Avdeenko, the Olympic gold medal in 1988.	703	237
2.	Povarnitsyn R./bronze Olympics 1988.	715	234
3.	Emelin/.	728	232
4.	Dymchenko S./	716	228
5.	Fedorkow G/	756	225
6.	Malchenko S./	773	236
7.	Puumalainen L./	753	216
8.	Dovzhenko M./	696	215

Table 2: *Correlation between the results in jumping up from the spot and the best competitive results of the leading high jumpers in the 1987-1988 season.*

To determine the explosive ability of muscles, we used a test - a high jump from a place. The jump height was determined by the time the athlete was in flight. This test meets the necessary metrological requirements for reproducibility in various conditions, resistance to external factors, indifference to the technique of its implementation. The high jump from the spot has been used in a number of studies [2,8,19,22,37-42], as a test that has the greatest information content about the state of the neuromuscular system and a high correlation between the creatine phosphokinase mechanism power supply and the height of jumping up from the spot [8,23].

But what did we get? Note that the champion of the Olympic Games in Seoul G. Avdeenko has almost the lowest muscle explosive ability (703ms).

Seoul bronze medalist R. Povarnitsyn (715ms) is doing a little better, but he also loses to everyone. The lack of correlation was also revealed when analyzing the correlation indicators of the country's leading jumpers in the training season of 1986-1987. - r = 0.3938, as well as when comparing the individual dynamics of the explosive ability of the muscles of athletes, changing during the annual training cycles, with the dynamics of their training results in the high jump from the run (correlation is negative).

Here is exactly where we need a recommendation to throw off the "uniform" of established traditions and canons, since any dedicated specialist will call our analyst heresy and anathematize! The explosive power of muscles for practicing trainers is a sacred cow. To defend our positions, we propose to delve into the consideration of the molecular structure of muscles and try to understand why explosive qualities do not correlate with a high jump from a run. In the modern understanding, all human locomotions are interpreted from the standpoint of the work of the musculoskeletal system (ODA), which has in its content the bones of the skeleton, designated as the "passive part" and muscles, which are the "active part". Books on biomechanics induces in us the understanding that a feature of human movements is that the links move under the action of muscles, the activity of which is caused by biochemical reactions taking place inside them. Physiology textbooks reveal more deeply the internal structure of muscles and the mechanics of movement. In particular, it can be generalized that muscles are composed of many bundles of myofibrils, which, in turn, are composed of actin and myosin filaments. And the movement occurs when these filaments are drawn into each other, as a result of which the total length of the myofilament is shortened (Figure 1), the articular angle changes, and movement is given to the body or part of the body [27].

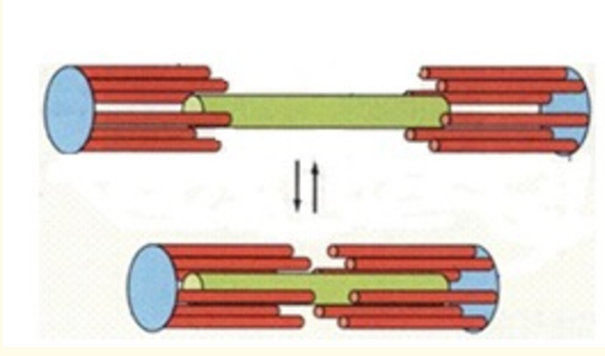

Figure 1: *Scheme of overcoming work when shortening actomyosin.*

Thanks to such a deep knowledge of physiology, we are completely brainwashed by the muscular-contractile paradigm of locomotion implementation. And if for most locomotions this mechanism is correct, then for jumping, it cannot be applied. And in order to get out of this state, we will take into account the following circumstances:

A) Actomyosin works in a colloidal solution of the cytoplasm, the viscosity of which is 18 - 25 times higher than the viscosity of water [36]. Of course, we must understand that the high density (viscosity) of the cytoplasm already initially burdens the work of actin and myosin when trying to produce their rapid contraction.

B) In hydrodynamics, the concepts of laminar and turbulent fluid flow are used. At the same time, the greatest resistance when a body moves in liquids is experienced by spherical bodies, which, due to the formation of vortex flows, are significantly slowed down by the low-pressure area that arises following the movement of a spherical object [16] (Figure 2).

   But pay attention to the fact that actin, "like a string with beads", consists of 14 globular molecules, which just have a spherical shape. Myosin, on the other hand, is composed of parallel laid protein filaments, which also end in rounded thickenings-heads [32] (Figure 3).

   This means that during their rapid movement in the cytoplasm, they experience the strongest resistance to movement caused by vortex flows and the area of low pressure exerting reverse thrust (Figure 2).

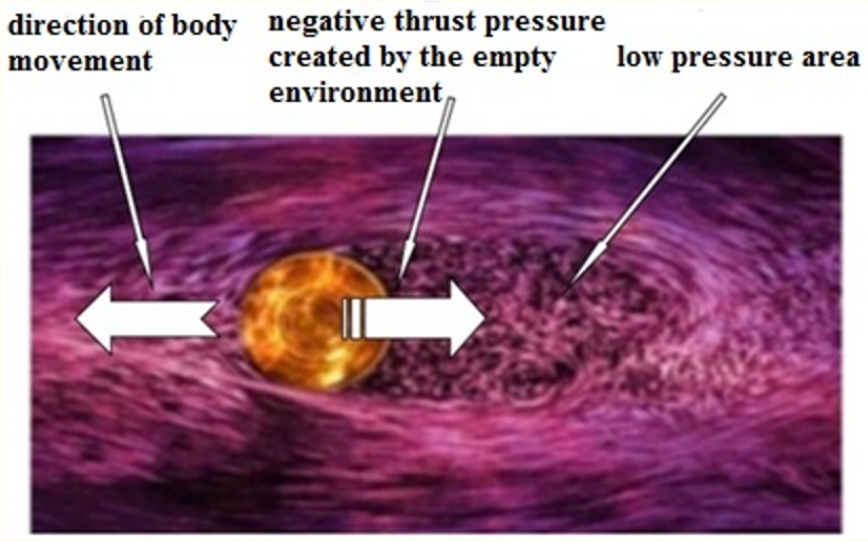

Figure 2: *Resistance of vortex turbulent flows when a spherical body moves in a liquid.*

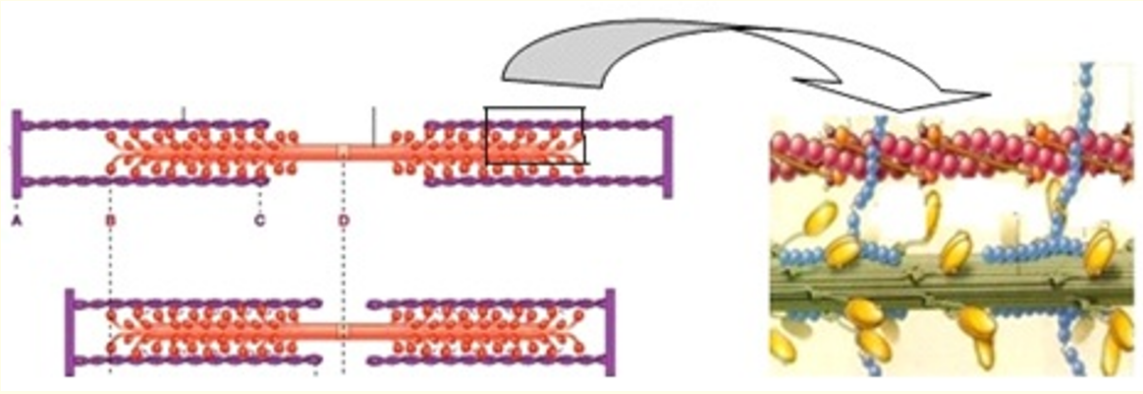

Figure 3: *Molecular structure of actin and myosin filaments.*

C) Moreover, the movement of a body in liquids and gases obeys the formula: (where p is the density of the medium; v is the speed of the body; S is the cross section), which states that an increase in the speed of the body causes the quadratic drag of fluid friction. That is, if we want to perform a strong and the fastest possible contraction of myofibrils, we run into the resistance of the cytoplasm. Moreover, the faster we try to reduce actomyosin, the stronger the resistance of the cytoplasm. Here we should mention the basic equation of muscle dynamics by A. Hill, according to which an increase in the rate of muscle contraction is accompanied by a decrease in the use of force (Figure 4, Hill graph). That is, strength and speed do not manifest themselves simultaneously and do not work in synergy in one motor act [35], and with their joint interaction, they show less than 10% of the power that is inherent in them [13].

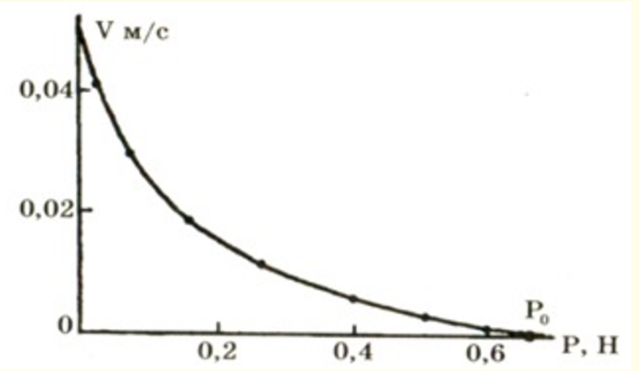

Figure 4: *Graph of the basic equation of human muscle dynamics (according to A. Hill).*

This is what the solution to the inconsistency of the basic equation of muscle dynamics of A. Hill consists in - when trying to quickly contract a muscle, the cytoplasm puts a rigid barrier to this action. But if we assume that evolution deliberately gave our muscles a slow speed of contraction and, therefore, not a high speed of movement, then it follows that the original purpose of a person is only to be a link in someone's food chain? But this is not the case. And this means that a person, from the creator and evolution, in addition to the muscular-contractile motive force, should have received some other, even more effective mechanism. This means that the Gestalt paradigm, about the dominant role of muscle-contractile mechanics, which we are trying to apply in the training of jumping locomotions, is an aberration (lat. Aberratio - "from" + "wandering is a delusion). We must have a different mechanics of locomotion and train it differently!

Paradox 2: When studying the action of centrifugal forces carried out using scaling, taring of time intervals, curvimetry, segmentation of body parts [9,10] using the formula F = mv2/r, we obtained the following values of the action of centrifugal forces when performing swinging movements in a high jump take off table 3.

Part of a body	Mass of a part of a body (kg)	Speed of movement of a part of a body (m/s)	Length of a radius of angular rotation of a part of a body (m)	Magnitude of action of centrifugal force (kg)
Fly leg	10,8	9,26	0,5	186,55
Left hand	3,4	5,69	0,2	56,16
Right hand	3.4	4,87	0,2	41,14
Total: 283.85 kg				

Table 3: *Summary table of the magnitudes of the action of centrifugal forces when swinging the leg and left and right hands.*

Adding here the value of the resultant (74.8 kg), from the action of the centrifugal force (48.5 kg) arising during the takeoff run of the athlete along the arc (running speed - V- 8.12 m/s, the jumper's mass - m - 57 kg, radius of the turning arc - r - 8 m.) And the athlete's own weight (57 kg), we found that in the high jump, the total value of the burden of centrifugal forces, for example, the Olympic champion A. Chicherova reaches 358 kg. And the world champion E.M. Barshim - 319 kg.

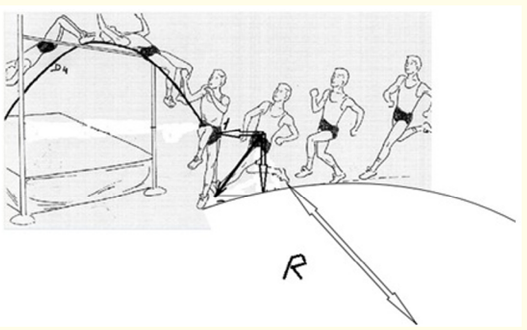

Figure 5: *The action of the centrifugal force during the take-off along the arc and the decomposition of the resulting force of the vectors of the action of the centrifugal force and the athlete's own weight.*

How can you explain that in conditions of burdening with centrifugal forces, amounting to 358 kg, an athlete will be able to push himself vertically upward at a speed of more than 4 and even more than 5 m/s? He (the athlete) not only will not push off, but is unlikely to be able to straighten the jogging leg.

Paradox 3: Even more paradoxical turned out to be the results of our analysts, obtained in the study of the dissertation work of A.P. Strizhak [28]. In particular, it turned out that it shows the incredible speed of achieving supramaximal muscle tension. In the so-called repulsion phase in highly qualified high jumpers, the value of force pressure on the tensoplatform of the universal dynamographic stand (UDS - 5), just 0.02 s after placing the foot on the support, reached 372 kg (Figure 6, Graph A).

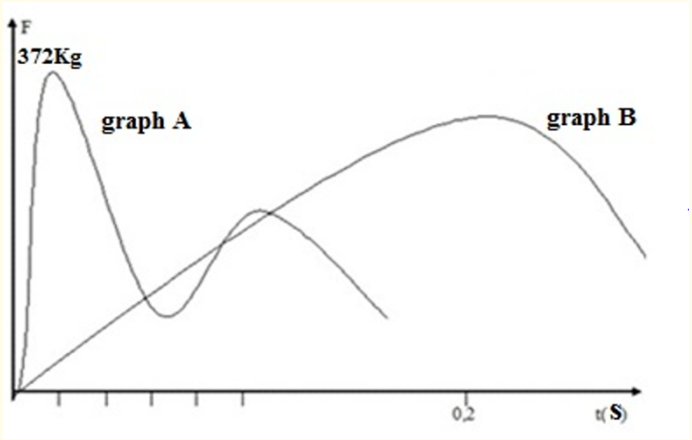

Figure 6: *Indicators of push-off dynamometry in female high jumpers (according to Strizhak AP, [28]) - graph A, and the limiting physiological capabilities of a person in the manifestation of a force gradient (according to Mitreikin V.G., Andris V.D. [18]) - graph by B.*

The pressure of the pushing leg with a force of 372 kg is prohibitive for a person. But this is not yet the most surprising thing. In the above diagram of A.P. Strizhak, the achievement of this prohibitive force occurred in 0.02s. But according to physiology, the maximum muscle tension can be achieved only after 0.3 s, after the start of the effort [28] (Figure 6, graph B), and according to some data, it can be achieved only after 2-4s [3,4,7]... That is, judging by the dynamogram of muscle efforts presented in this work [28], the physiological capabilities of the muscles are exceeded by more than 15 times! This contradiction brings us back to the "basic equation of muscle dynamics" (A. Hill, Figure 6), which is simply "ignored": the muscles were able to show an outrageous super-effort (372 kg) in an ultra-short time of 0.02s (Figure 6, graph A), and even in synergy and confluence with each other! But if the "prescriptions" for the muscles are violated, is it possible that not muscles are used for the jump, but a different propeller?

Paradox 4: The graphics, presented in another work by A. P. Strizhak [29], show the exorbitant value of the repulsive power (more than 7000W) in the high jump in women (Figure 7, graph "Mechanical power of repulsion").

Result in high jump (sm)		170	180	190	200	202	204	206	208
Mechanical power repulsion (W.)	7700 6900 6100 5300 4500								

Figure 7: *Biokinematic and biodynamic indicators of repulsion in the high jump among jumpers of various qualifications (according to A.P. Strizhak).*

This is nonsense, since the total power of all energy sources available to a person to ensure muscle work is only 6000 W [21]. But if the displayed energy exceeds the energy intensity of creatine phosphate and ATP, then the muscular-contractile paradigm of repulsion is even more deadlocked.

Paradox 5: In the work of the creative group - A. Strizhak, V. Bobrovnik, V. Nosov, it is concluded that in the high jump with a running start, the main driving link in repulsion is the foot [29]. It is known that the leg muscles are set in motion. But, according to A.A. Filippov, the lower leg muscles are the slowest link in the high jumper's musculoskeletal system. He points out that fast powerful movements are not characteristic of the lower leg muscles; they successfully perform holding or slow work [33], since they are not adapted to an explosive overcoming contraction. This is confirmed by the conclusions of V. Dmitriev [6], which are based on the study of the phase structure of repulsion, where it is noted that in a high jump from a run, the nature of the work of the muscles of the jogging leg can be considered as parastatic, close to isometric. That is, there is no repulsive movement! But speaking of the high jump, according to the currently used paradigm, it is the explosive, overcoming work of the muscles of the jogging leg that is meant. Why, then, did A. Strizhak., *et al*. Assign the foot, working in an isometric mode, set in motion by the slow muscles of the lower leg, not adapted to explosive, overcoming work, the role of the main driving link? After all, the muscles of the lower leg simply cannot cope with the task of explosive manifestation of efforts assigned to them. Perhaps Hamlet's words should be used here to avoid answering an awkward question: There are more things in heaven and earth, Horatio, Than are dreamt of in your philosophy, that when paraphrased it sounds like this: Horatio, not everything that is in nature can be explained by Science. However, we have found an explanation for the phenomena presented by A. P. Strizhak. Their solution lies in the conclusion made by C. Koni and C. Bosco, which states: "the higher the percentage of slow fibers, the better the elastic energy is used" [17]. That is, a large percentage of slow fibers participating in locomotion indicates that elastic deformation energy is used in this locomotion. This means that the repulsion is not due to the contraction of the lower leg muscles, but due to a different mechanism based on the mechanism of elastic deformation. But what kind of mechanics can be used? V. Tyupa [30] rejected the muscle paradigm and accepted for consideration a sequential elastic component, that is, a tendon.

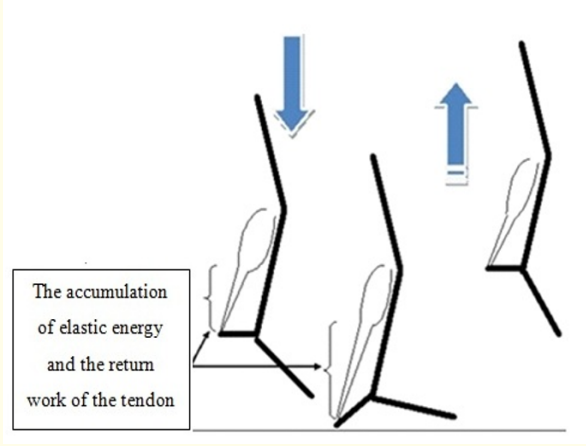

Figure 8: *Presents a conceptual model for obtaining useful work due to the recurrent action of the achilles tendon.*

A feature of this mechanics is that the abdomen of the muscle in this case works in an isometric mode, holding the free ends without changing its length. But questions arise:

1. Can the tendons stretch? Scientists answer this question positively Collagen fibers of tendons are not absolutely rigid core. The ability to reversibly deform, at 13 - 15% of the original length, is a fundamental property of this tissue [25,30,31,34].

2. Will the muscles be able to resist stretching and transfer this tension to the tendon. Otherwise, the myosin bridges will not cope with the stress and myosin will simply "drag out" the hexagonally structured actin like a badger from a burrow. At the same time, the force gradient must also be high, otherwise a muscle with a low force gradient simply will not have time to "grab" this tension?

We are ready to offer a version of the transit of tension to the tendon, allowing for the conduction of force up to 1 ton. The solution to this problem came to us with the analysis of a curious case that occurred in 1985 with a negligent student of the Volgograd Institute of Physical Culture (VGIFK) - Russia. During the lesson in the classroom, the student-gymnast, pushing the teacher, opened the window and ... «left» the classroom through the window of the 4th floor (Figure 9).

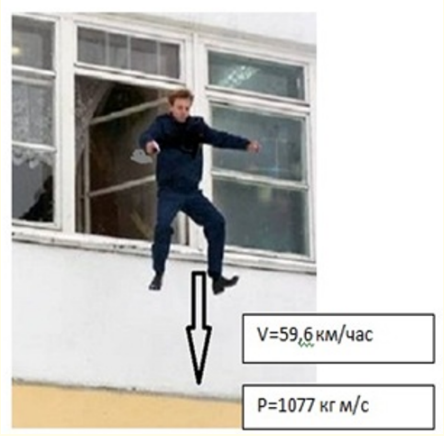

Figure 9: *Presents a conceptual model for obtaining useful work due to the recurrent action of the achilles tendon.*

The climatic conditions of winter in Volgograd, as a rule, are snowless and therefore we note that the landing of this gymnast student had not in a snowdrift, but directly on the ground. The landing was successful, but the student was expelled for impudence. According to the information of the vice-rector of the institute, Sergey Alekseevich Bakulin, at the request of a gymnast student to reinstate in the university, he was told: «If you can jump back to the fourth floor, then we will restore you». This can be mistaken for a bitter irony, but there is a logical rationale in the words spoken. Indeed, according to Newton's second law, «the force of action is equal to the force of reaction» [38]. And if he was able to land successfully, then he showed the appropriate force when braking! In this case, what prevents him from showing the same strength when performing overcoming (repulsive) work, flying back to the fourth floor and demanding restoration at the educational institution? Our life experience immediately tells us - it's impossible! But what prevents you from doing this? After all, the musculoskeletal system actually showed this magnitude of force resistance upon landing! According to the formula: V2 = 2gh, where V is the speed of approaching the ground, g is the acceleration of gravity, h is the height of the jump, with a jump height of 14 meters (4 floor), the speed of approach to the ground will be 16.57 m/s, or 59.6 km/h. And the impulse of the body, in a collision with the ground, with a gymnast's own weight of 65 kg, according to the formula: P = mV2/2, where m is its own mass, V is the speed of a gymnast student, at the moment of interaction with the earth's surface, will be 1077 kg m/s. But 59.6 km/h and 1077 kg m/s are prohibitive values for humans. And the consequences can be so global that the help of an orthopedist, after getting into a similar situation, is just luck. However, as follows from the chronology of events, the gymnastic preparation of the negligent student turned out to be on top and the "exit" to the window ended successfully. So it wasn't a hard fall. That is, this overload was taken over by the gymnast's musculoskeletal system, which safely absorbed this blow. However, we repeat, "the force of action is equal to the force of reaction" and it means that the gymnast did not fall and

did not break his locomotor system, but was able to somehow mirror the force that braked these 1077 kg m/s. But human muscles are not capable of manifesting such values of kinetic energy when performing overcoming work. For example, the world leader Zhu Jianhua, taking off to an altitude of 239 cm, reached a vertical take-off speed of 5.21 m/s [11]. With its own weight of 70 kg, the kinetic energy of body movement was only 364.7 kg m/s, that is, almost three times less. But for what reason, when braking, a person is able to show such a power of force resistance - 1077 kg m/s, but when performing a repulsive action, no (the power of overcoming work is only 364.7 kg m/s)?

We have already mentioned that the movements of actin and myosin filaments occur in the cytoplasm. As we indicated earlier, these threads are based on a spherical or spherical structure (Figure 4). And therefore, they are subject to great resistance during rapid movement in the liquid medium of the cytoplasm in any direction, be it contraction or elongation. Thus, the muscles of a person will not be able to show such a force of resistance, but the cytoplasm can. It is she who limits the rapid elongation of actomyosin and performs the transit of tension on the tendon without affecting the muscles. We have identified a number of paradoxes that cannot be explained in terms of muscular (actomyosin) overcoming work:

- Why does the explosive ability of athletes' muscles not correlate with the result in the high jump from the run?;
- How, contrary to the basic equation of muscle dynamics (according to A. Hill), an athlete manages to achieve a force pressure of 372 kg, moreover, manifested in 0.02s, which is 15 times higher than the human physiological capabilities declared?;
- Where does a person get so much energy that exceeds the capacity of all metabolic sources of human energy?;
- How do the slow muscles of the lower leg, adapted to static work, perform explosive overcoming work?
- How, having an encumbrance from the action of centrifugal forces, amounting to more than 350 kg, an athlete manages to give the body a vertical takeoff speed of 4-5 m/s?
- How is it possible, under conditions of the inhibitory action of the cytoplasm, to achieve such a speed of vertical departure (4-5 m/s)? These paradoxes cannot be explained in terms of muscle contraction. At the same time, our analyst indicates that a person should have some other, more effective motor mechanism for the implementation of jumping locomotions. And a person has such a mechanism, it works in conditions of rapid interaction with the supporting surface and is based on the deformation of the tendons and their subsequent return work. Moreover, for example, 358 kg is not an encumbrance. This is the force that deforms the tendon. And the more it (deformation) is, the higher the rebound we have the right to count on. An example would be the bounce of a basketball (Figure 10).

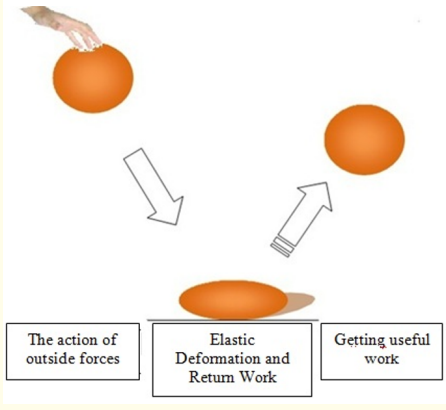

Figure 10: *The work of the energy of elastic deformation, as exemplified by the rebound of a basketball.*

Thus, we argue that in jumping locomotions, the work of the musculoskeletal system occurs not in the regime of muscular-contractile explosive work of muscles, but in the regime of the tendon-deformation mechanism of obtaining kinetic energy for vertical take-off. At the same time, we do not deny muscular contraction as a motor action when performing locomotions, but only add that in conditions of rapid interaction with the supporting surface, kinetic energy for performing hopping locomotions arises due to the work of deformation forces. We argue that the jumping ability displayed by humans is far from the potential inherent in evolution. The aberration of the muscular-contractile gestalt perception of the high jump led to an erroneous paradigm and was the reason for this limitation.

Conclusion

Nature has endowed the homo-erectus motor mechanism with cytoplasm, which limits the manifestation of explosive power. However, it (evolution) endowed a person with an even more effective motor mechanism - the cytoplasm-tendon mechanism. In fact, as it turned out, in the structure of the musculoskeletal system, there is an alternative motor system that performs locomotion on the basis of the «return work of tendons». Our research has shown that explosive muscle contraction is a dead-end way to train jumping ability. According to an alternative paradigm of locomotion, the training of fast interactions with the supporting surface should be based on the cytoplasmic support and the return work of the tendons, the summation of irritation, the lift reflex, and the loading load of centrifugal forces. Perhaps then, having adopted an alternative paradigm of rapid interactions with support, Homo Sapiens will naturally and without steroids be able to realize what is laid down by nature and significantly advance their positions in the dispute with fauna and with gravity. The tests carried out, mathematical processing of the results and analytical research showed the following:

1. The existing concept of explosive repulsion, based on the reduction of actomyosin (overcoming work of muscles), does not explain the facts revealed in the course of the study that contradict the data of physiology, namely:
    a. Fifteen-fold excess of human capabilities in the manifestation of the power gradient in highly qualified high jumpers;
    b. The manifestation of the power of repulsion in female high jumpers, which cannot be provided by all biochemical sources of energy inherent in a person;
    c. The competitive result of highly qualified high jumpers does not depend on the level of explosive qualities development;
    d. The implementation of the explosive work of the foot in a high jump from a run occurs due to the slow muscles of the lower leg.
2. Insurmountable obstacles for the implementation of explosive overcoming work in the high jump from a run are:
    a. High viscosity of the cytoplasm;
    b. The spherical structure of the chains and bridges of actin and myosin and the associated fluid (cytoplasm) turbulence, which causes an inhibitory effect;
    c. A quadratic increase in the resistance force of a liquid medium with an increase in the speed of movement of actin heads and myosin filaments.
3. Our research revealed an alternative paradigm of the high jump by the Fosbury flop method, based on the support of the cytoplasm, deforming loading of the tendons, the return work of the tendons and the accumulation of action potential as a result of the summation of stimuli according to the lift reflex type.
4. The research results obtained by us give grounds for the introduction of new (physiological and biomechanical) concepts: «cytoplasmic-tendon structure» and «return work of tendons».
5. Since the cytoplasm acts as a factor of force resistance, there is no need for muscle hypertrophy and anabolism, which makes the use of steroids beyond the interests of trainers, and this is very relevant today.

Bibliography

1. Aghajanyan NA and AYu Katkov. "The reserves of our body". 3rd edition., Rev. and additional -M.: Knowledge (1990): 240.
2. Bobrovnik VI. "The rational composition of the main means of training high jumpers (women) in the annual training cycle". Dis. Cand. ped. Sciences: 13.00.04 - The Theory and a technique of physical education, sports training and improving physical training / Bobrovnik Vladimir Ilyich. - M., VNIIFK, (1986): 146.
3. Verkhoshansky YuV. "Fundamentals of special strength training in sports". *Physical Culture and Sport* 290 (1977): 7-39.
4. Verkhoshansky YuV., *et al*. "Factors determining the working effect of explosive effort in speed-power sports". Problems of optimization of the training process: Sat. scientific works. M .: GTsOLIFK .- S (): 32-40.
5. The height of the jumps of representatives of the animal world in absolute and relative values [electronic resource] (2018).
6. Dmitriev V. "Fosbury flop. The phase structure of repulsion". *Athletics* 9 (1983): 13-14.
7. Donskoy DD and VM Zatsiorsky. "Biomechanics. Textbook for institutes of physical culture". *FiS* (1979): 264 p., Ill.
8. Dushenkov VD. "The ratio of special training means of physical and technical training among pole vaulters in the annual cycle". Dissertation ... candidate of pedagogical sciences: 13.00.04 - Theory and methodology of physical education, sports training and health-improving physical culture / Dushenkov Vladimir Dmitrievich 192 (1988).
9. Egorov AT and SN Pavlov. "The phase structure of the high jump by the fosbury flop method in the light of the new paradigm of locomotion". Actual problems and modern trends in the development of athletics in Russia and in the world: materials of the All-Russian scientific and practical conference with international participation, dedicated to the memory of Professor G.V. Tsyganova. (2019): 33-36.
10. Egorov AT. "The values of the burden in the high jump by the fosbury-flop method: materials of the All-Russian scientific and practical conference with international participation, dedicated to the memory of Professor" (2021).
11. Zhukov I and VYufrikov. "Fosbury-flop terms". *Athletics* 1.356 (1984): 28.
12. The law of exponential growth [electronic resource] dic.academic.ru ›dic.nsf / ruwiki / 923675).
13. Zatsiorsky VM., *et al*. "Biomechanics of the human motor apparatus". *Physical Culture and Sport* (1981): 143.
14. Kandyba VM. "Superpowers of a person". Physical reserves of a person [electronic resource] 2021).
15. Kuznetsov V. "Science about the man of the future century. What are our reserves". *Technology for the Youth* 09 (1982): 15.
16. Laminar and turbulent fluid flow [electronic resource] Pavel Lebedev (2017).
17. C Koni and C Bosco. "Guidelines for the assessment of mechanical and morphological features of skeletal muscles and tendons in stayers" (1978).
18. Mitreykin, VG. "On the topography of "explosive" power among athletes". Improvement and management of the training process: Sat. works. Tashkent (1981): 19-22.
19. Nemtsev OB. "About measuring results in a jump up from the spot Text of a scientific article in the specialty "Medical technologies" / Nemtsev Oleg Borisovich, Kodzheshau Madzhid Khalidovich, Grekalova Irina Nikolaevna (2021).
20. Popov GI. Biomechanics of motor activity: textbook. for stud. institutions of higher. prof. Education / G.I. Popov, A.V. Samsonov. 3rd edition, Erased. M: Publishing Center "Academy" (2014): 320.

21. Prilutsky BI. "Eccentric mode of muscle activity during sports locomotions". *Theory and Practice of Physical Culture* 1 (1991): 53-60.

22. Pyanzin AI. "Calculation of the result in the long jump based on the result in the upward jump from the spot". Bulletin of the Chuvash State Pedagogical University named after I. Ya. Yakovleva Bulletin of ChSU im. I.Ya. Yakovleva. - 2016, no. 10? ... - S. Text of a scientific article in the specialty "Earth Sciences and related environmental sciences" [Electronic resource] (2021).

23. Pyanzin AI. "The proportionality of the parameters of the interaction of the body with the support when running and jumping". *Science and Sport: Modern Trends* 3.12 (2016): 41-45.

24. Holy Gospel. With the blessing of His Holiness Patriarch of Moscow and All Russia KIRILL. M: Siberian bell tower (2017): 95.

25. Serov VV. "Connective tissue (functional morphology and general pathology". Medicine (1981): 312.

26. Smelyakov NN. "Business America (Notes of an Engineer), 2nd edition. (additional) M., Politizdat, (1970): 64.

27. Solodkov AS. "Human physiology. General. Sports. Age: textbook". Solodkov A.S., Sologub E.B. M: Sport (2016): 624.

28. Strizhak AP. "Kinematic and dynamic features of the high jump technique by the "Fosberiflop" method and the ways of mastering it: abstract of Ph.D. dis. for a job. scientific step. Cand. ped. Sciences: 13.00.04 - The Theory and a technique of physical education, sports training, improving and adaptive physical training / Strizhak Anatoly Petrovich. M: VNIIFK (1974): 25.

29. Strizhak AP., *et al.* "Special exercises for high jumpers". *Athletics* 8 (1986): 16-17.

30. Tyupa V., *et al.* "Biomechanics of repulsion". *Athletics* 9 (1981): 10-12.

31. Tyupa V. "Elastic properties of muscles and technique of movements of an athlete". *Athletics* 1-2 (2013): 12-14.

32. DL Teplyi., *et al*. "Physiology of man and animals: textbook". Under the general editorship of DL Teplyi/[and others]. - Astrakhan: Publishing house "Astrakhan University" (2017): 336.

33. Filippov AA. "The role and significance of the foot when performing repulsion in athletics exercises" (1977): 354.

34. Hein VE and AA Vine. "The role of biomechanical properties of muscles in the repulsion mechanism when performing somersaults". *Theory and Practice of Physical Culture* 4 (1983): 11-13.

35. Hill AV. "Mechanics of muscle contraction: Old and new experiences". Translated from English. Yu. A. Sharonov: edition. and with a foreword. acad. G.M. Frank. M: Mir (1972): 183.

36. Cytoplasm [electronic resource] (2016).

37. Athanasios Vanezis and Adrian Lees. "A biomechanical analysis of good and poor performers of the vertical jump". *Ergonomics* 48 (2005): 1594-1603.

38. Burnett A. "The Biomechanics of Jumping: the Relevance to Field Event Athletes". Coaches Information Service web site. Edinburgh: The University of Edinburgh (2001): 3-10.

39. Elisa Benito-Martinez., *et al.* "Effects of combined electrostimulation and plyometric training on vertical jump and speed tests". *Revistas - Journal of Human Sport and Exercise* (2011): 603-615.

40. Lees A., *et al*. "The maximal and submaximal vertical jump: implications for strength and conditioning Adrian Lees 1, Jos Vanrenterghem, Dirk De Clercq Affiliations expand" 18.4 (2004): 787-791.

41. Principal Component Analysis Reveals the Proximal to Distal Pattern in Vertical Jumping Is Governed by Two Functional Degrees of Freedom [electronic resource]". *Frontiers in Bioengineering and Biotechnology* 7 (2019): 193.

42. Stefanyshyn DJ and Nigg BM. "Contribution of the lower extremity joints to mechanical energy in running vertical jumps and running long jumps". *Journal of Sports Sciences* 16 (1998): 177-186.

Volume 12 Issue 12 December 2021