BIOMECHANICAL ASPECTS IN FORWARD FLICK-FLAC LEARNING

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Abstract

Background

Under current conditions, sports and athletic performance potential suffers a deep mutation, reaching implications, not only in sports training and selection strategies, but also in terms of training methods based on multiple information technology in movement execution. Video analysis and description of the technique through its kinematic model and dynamic composition enables technical implementation rules and detection and correction of mistakes of execution.

Material and Methods

To achieve the proposed elements biomechanical analysis, we used a Nikon camera and a camera brand Samsung, and were processed with Kinovea program. The place where the technical elements were recorded was the gym of the University of Oradea. The athlete who is taken as a model in our study was a gymnast at high performants actualy one of the author of the work.

Results

It is important to note that thigh trunk bends at an angle of 53^0, with an opening of 27^0 in the shoulder joint which gives an optimal alignment of the palms on the ground. The timing pulses in wrist and scapular-humeral, together with muscle chains involved, causes the flight phase of the element and the following sequence: landing.

Conclusions

By applying video analysis in the gymnasts' technical training, especially at junior level, premises can be accomplished so as the technical training should be made based on biomechanical recommandations, the instruction becoming thus objective, scientifically reasoned with immediate implementation in the practical activity.

Key words: artistic gymnastics, overthrow forward, biomechanics.

Rezumat

Introducere

În condiţiile actuale sportul şi potenţialul pentru performanţa sportivă suferă mutaţii profunde, cu implicaţii majore, nu numai în strategiile de selecţie şi pregătire sportivă, dar şi în ceea ce priveşte metodele de instruire bazate pe informaţii multiple în tehnica executării mişcărilor. Analiza video şi descrierea tehnicii model prin caracteristicile sale cinematice şi dinamice oferă posibilitatea alcătuirii unor reguli de execuţie tehnică şi depistarea şi corectarea unor greşeli de execuţie.

Material şi metodă

Răsturnarea înainte a fost efectuată de către o gimnastă de mare performanţă, studentă a Universităţii din Oradea, executie ce poate fi considerată model deoarece respectă cerinţele tehnicii corecte. Pentru realizarea analizei biomecanice elementelor propuse, am folosit un aparat foto marca Nikon şi o cameră de filmat marca Samsung. Fotografiile şi înregistrările video obţinute au fost prelucrate în programul Paint din meniul calculatorului şi programul Kinovea. Unghiurile şi momentele de desprindere şi de zbor au fost calculate în programul Kinovea.

Rezultate

Analiza biomecanică se realizează în funcţie de părţile elementului ce-l compun, pornind de la unghiul de înclinaţie pe elan, dezechilibrare continuând cu flexia braţelor pe trunchi, importanţă majoră avand unghiurile dintre coapsa piciorului de impulsie şi trunchi de 53 grade şi cel dintre trunchi si braţe de 152 grade, care se modifică la aşezarea palmelor pe sol, ajungând la 170 grade.

Concluzii

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- Prin analiza biomecanică video se poate îmbunătăți tehnica elementelor, realizându-se programe individualizate în funcție de necesitățile anumitor faze sau momente ale mișcărilor, acestea constituind soluția cea mai eficientă în pregătirea tehnică modernă.
- Prin aplicarea analizei video în pregătirea tehnică în gimnastică şi mai ales la nivelul juniorilor, se pot realiza premise astfel încât pregătirea tehnică să se facă pe baza recomandărilor biomecanice, instruirea devenind astfel obiectivă, argumentată ştiinţific cu implementare imediată în activitatea practică.

Cuvinte cheie: gimnastică artistică, răsturnare înainte, biomecanică

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BACKGROUND

In the current sports and the potential for athletic performance suffers deep mutations, reaching implications, not only in sports training and selection strategies, but also in terms of training methods based on multiple information technology execution of movements. These issues are observed and expressed by more and more researchers, making use of a rich factual material of the sport (Verhoshanski, 1986; Bibire, 2001; Grigore, 2001; Bompa, 2002; Gaverdovski, 1986, Dragnea, 1990). The issue of fairness in the technical execution gym is now necessary support in achieving the maximum energy saving efforts. Human movements are governed by mechanical laws can not be violated, but the gym can be used to achieve the improvement of technical skill. Knowledge of the biomechanical aspects is a very discussed topic today as progress is made on the basis of actual gymnastics increasing difficulty, originality in the combination and the emergence of new items (Manno, 1992).

Modern trends in the field of biomechanics come as dedicated research arm, just discovering these mechanisms. Looking for new ways to optimize sports training, our interdisciplinary approach addressing improvement in women's artistic gymnastics technical training, using video and biomechanical analysis.

Video analysis and description of the technique through its kinematic model and dynamic composition enables technical implementation rules and the detection and correction of errors in execution (Hanțiu, 2012).

To choose the most suitable options to be applied to the proposed motion learning, must first establish execution features and different modes of action, and then specify the external picture of the movement (form and character), motion mechanism, and and modification of human movements.

Rotating body in gymnastics are represented by complete or incomplete rotational elements of the body, performed hung freely in support or develop a certain angular velocity. Any rotation about an axis of rotation which involves usually corresponds to the axis of the body(Gaverdovski, 1986).

In all the movements that occur changes in angular velocity that tend to develop centrifugal force to remove the body from the axis of rotation and centrifugal forces which tend to approach the axis of rotation. The vertical timing is also interesting because the rocking motion in this place has the largest accumulation of forces which are in danger of accidental detachment of the device.

Most biomechanical studies were performed on soil related to mechanical detachment and landing jumps back (Hwong, G.Seo and Z.Liu, 1990, research at J.O. Seul, 1988); Kerwin, Yeadon, 1998; Geiblinger, Morrison, McLaughlin, 1995; studied mechanical detachment to jump and the angular momentum contribution of different segments of arm action and ground reaction forces was concerned by Knight, Wilson, Hay, 1978(op. Crețu, 2006).

We can say that this device research interest is directed towards the study of biomechanics rotation breakaways during acrobatic elements of difficulty. Technology provides many video recordings to study the movement of practicing specific individuals. It can make performance analysis technique movements can be observed evolution videos on aceelasi person or different people can highlight aspects that differentiate executions or make them more effective.

Video recordings enable images frame by frame analysis, slowing or accelerating scroll speed imaging but also making conturograme, calculations of trajectories and angles(Hantiu, 2012).

SCOPE

This paper aims to highlight the most favorable angles present in different joints and muscle groups involved in forward turn, to achieve a proper technically execution.

MATERIALS AND METHODS

To achieve the proposed elements biomechanical analysis, we used a Nikon camera and a camera brand Samsung. Photos and videos were processed in the computer program Paint menu and Kinovea program. Angles and moments of detachment and flight were calculated in Kinovea program. The place where the technical elements were recorded was the gym of the University of Oradea. The element was performed by a high performance gymnast so allow us to say that the technically execution is correct she is the third author of the paper.

Biomechanical analysis of forward turn over – ground (photo 1)

Photo 1. Forward turn over on two legs (source: personal archive, of the third author).

Actual analysis

The element is part of the turn over category, being preceded by a leap in order to acquire optimum velocity. During the take-off, the gymnast is unbalanced forward with 28° from the vertical line which falls perpendicularly on the ground when the gymnast's body is in standing position. The leaning angle between the gymnast's body and the ground at this unbalance is of 58°, simultaneously with the unbalance, the arms are flexed on the trunk in a 142° angle. (Photo 2)

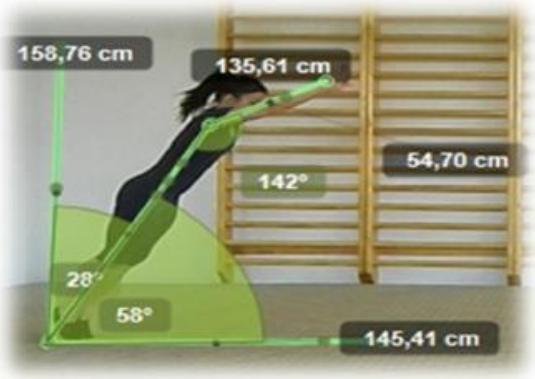

Photo 2 (source: personal archive, of the third author)

After the unbalance moment, detachment follows for the leap, with which the gymnast prepares the beginning of the turn over movement with a feint step in which the trunk makes a 27° flexion on the impulsion leg's thigh, the trunk and arms being approximately parallel with the ground. The leg spread in sagital plan presents a 96° angle and the angle between trunk and thigh is of 53°. The arms continue the flexion on the trunk and reach an angle of 152°.

Photo 3 (source: personal archive, of the third author)

Photo 4 (source: personal archive, of the third author)

The actual turn over movement follows, in which the hands are placed on the ground in an angle of 50°. The impulsion lasts 0.08 seconds and the impulsion leg is detached from the ground in an angle of 70, the body, continuing the turn over movement, reaches the support moment.

Photo 5 (source: personal archive, of the third author)

Photo 6 (source: personal archive, of the third author)

The support moment is the hand stand one and it lasts 0.16 seconds. In this position, the arms support the entire body weight. The legs are spread in antero-posterior plan, the swing leg accomplishing a slight extension of 32° on the trunk, while the impulsion leg maintains a 47° flexion position on the trunk (photo 5). After passing the vertical moment in the support phase, the feint leg quickly gets close to the swing leg with an extension on the body of 37° from 0 position and of 84° from anterior flexion position, simultaneously with energetic push from the shoulder joint (photo 6).

Photo 7 (source: personal archive, of the third author)

Photo 8 (source: personal archive, of the third author)

The flight has amplitude of 107.54 cm in height and 130.89 in length. During the flight, the body is extended from the coxo-femoral, shoulder and spine joints. The arm extension on the trunk is of 47° from up arm position and 230° from 0 position, maximum anatomic flexion plus the 47° of extension, and the legs achieve a 48° extension from the trunk (photo 7). Contact with the ground is achieved with the tip toes at an angle of 61° from the horizontal with the ground (photo 8).

For a better understanding of the biomechanical analysis with the involvement of muscle groups in action, we have devised the technical element in times (table n^{o} 1).

Table 1. Movement description in forward turns over

Movement times	Movement	Muscle groups involved in movement and their action
Time 1	Arm extension on trunk	Concentric contraction of deltoid (posterior fascicle) and of brachial triceps (long head)
	Trunk flexion on pelvis	Concentric contraction of back extensors and lumbar extensors
	Thigh flexion on calves	Concentric contraction of hip extensors: large gluteal muscle, semi-tendinous, semi-membranous, femoral biceps.
Time 2	Arm flexion on trunk	Concentric contraction of deltoid (anterior fascicle) and thoracic-brachial muscle
	Trunk extension on pelvis	Eccentric contraction of back extensors and lumbar extensors
	Thigh extension on calves	Concentric contraction of right femoral muscles, vast intermediary, lateral and medial
	Plantar legs flexion	Concentric contraction of gastrocnemian muscles (medial and lateral head), solear, own flexor of big toe and common flexor of toes
Time 3	Trunk flexion on pelvis	Eccentric contraction of right abdominal
	Thigh flexion on calf (right leg)	Eccentric contraction of femoral biceps (long and short head), semi-membranous and semi-tendinous

	Calf extension on foot (right leg)	Eccentric contraction of anterior tibial muscle
Time 4	Trunk flexion on pelvis	Eccentric contraction of right abdominal
	Thigh extension on calf (right leg)	Concentric contraction of hip flexors: large psoas and iliac
	Calf extension on foot (right leg)	Concentric contraction of anterior tibial muscle
	Plantar flexion (right leg)	Concentric contraction of gastrocnemian muscles (medial and lateral head), solear, own flexor of big toe and common flexor of toes
	Lower limb extension on pelvis (left leg)	Concentric contraction of large gluteal muscle, semi-tendinous, semi-membranous and femoral biceps
Time 5	Lower limb extension on pelvis	Eccentric contraction of large gluteal muscles, semi-tendinous, semi-membranous and femoral biceps
	Trunk extension on arms	Eccentric contraction of lumbar and thoracic extensors
	Head extension	Eccentric contraction of large posterior right muscle, small posterior right, oblique superior and oblique inferior
Time 6	Calf extension on feet	Eccentric contraction of anterior tibial
	Thigh flexion on calves	Eccentric contraction of femoral biceps (long and short head), semi-membranous and semi-tendinous
	Trunk flexion on pelvis	Eccentric contraction of right abdominal muscle
	Arm extension on trunk	Eccentric contraction of deltoid muscle (posterior fascicle)
	Head flexion	Eccentric contraction of right anterior and lateral muscles
Time 7	Arm flexion on trunk	Concentric contraction of deltoid muscle (anterior fascicle) and thoracic-brachial muscle
	Trunk extension on thighs	Eccentric contraction of large gluteal muscle
	Thigh extension on calves	Eccentric contraction of right femoral and vast intermediary, lateral and medial muscles

DISCUSSIONS

- It appears that placing hands on the ground is made at an angle of 50^0, which as we show chinograma is an optimal angle for making blocking and other phases of the flick-flac.

- Another point to highlight is closing of legs simultaneously with the implementation phase of flight due to reaction of support, duration of 0.16 seconds. The angle between the swing and the impulsion leg must not exceed 40^0.
- Trunk extended position in flight, making an extension of 48^0 feet on the trunk, preparing landing at an angle of 61^0.
- Muscle involvement is crucial and complex in element achieving at the same time providing important information on muscle engagement.

CONCLUSIONS AND PROPOSALS

- On the video biomechanical analysis, technical improvement of elements can be done by making individualized programmes according to the requirements of certain movement phases or moments, constituting the most efficient solution in modern technical training.
- By applying video analysis in the gymnasts' technical training, especially at junior level, premises can be accomplished so as the technical training should be made based on biomechanical recommendations, the instruction becoming thus objective, scientifically reasoned with immediate implementation in the practical activity.
- The construction of technical pattern is of high importance, requiring the use of modern video technology, computer assisted, as it increases measurement possibilities.

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