APPLICATION OF COMPARATIVE METHOD FOR KINEMATICS ANALYSIS OF MOVING ACTIVITIES

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INTRODUCTION

The movement of the body is possible to describe with the basic physical issue; for example time, trajectory and velocity. One of the possibilities how to characterize this issue is application of kinematics analysis. The analysis is obtained from video record with adding plane coordinates of important points or segments. Kinematics analysis based on the computer processed videorecords offers big amount of useful information like is trajectory in individual axes or planes, velocity of the points, or angles of the whole segments. All this information is useful only after a proper selection and after processing into the interpretation form. There is necessary to look for the mutual relations between the stimulation (for example training) and the moving structure influenced with this stimulation. These relations can influence the movement by itself, training of the movement and also it's cultivation. Therefore we must use this method, which can create a model allowing comparison of chosen variables (real movement - ideal model situation). The principle of this method is an integration of the time axis towards the important point of the movement activity. It can be for example the moment when the legs are leaving the floor, or when the hands are leaving the equipment. With the backward comparison we can see the same and the different trajectories or velocities of individual segments.

METHODS

Used equipment for analysis is Consport Motion Analyzer developed in Czech Republic and based on the similar principle as motion analyzer APAS. Our analyzer used two cameras S-VHS and video system PAL (25 frames.s^{-1}). The object has been recorded with both cameras which are standing at the angle 70° - 120°. The recorded material is processed on the computer system PC.

RESULTS

Method of comparative kinematics analysis is based on comparison of measurable results of moving activity. We can compare good or wrong attempt visually during the exercising or later from video record, but there is not already necessary to make complicated kinematics analysis. If we value the attempts which are qualitatively comparable, an expert can already see the basic differences; but still without mutual relations. Visual comparison is immediate but kinematics analysis allows saving all obtained information and later using them for comparison. To look for the wider connections of causes of movement exercise is sensible only in the area of moving exercises which are possible to qualify as better or worst attempts. Therefore the principle problem for application of this method is the choice of suitable dates. We have to record at least two concrete movement activity for every subject and then we can use it as

„individual model". Only then it is possible to compare these „models" between each other and to reveal differences. Also it is necessary to unite all these activities at the same moment which is for many reasons decisive for this movement. This method is used mainly at the branch of sports gymnastics especially for processing of results from the European championship held in Prague 1994.

Double sommer solt backward from the rings.
On the double sommer solt backward from the rings we can demonstrate an equifinal process which means that we can achieve the same result with the different technique. At the Fig.1 there is an a unconnected kinogram of one type of this exercise. Releasing from the rings and starting of the fly happens still before the body gets to the vertical position. During the flight you may change the moment of the body inertia and the velocity of the rotate movement with two different mechanism. Which is the change of the angle between arms and the body and the measure of the chest backward bend.

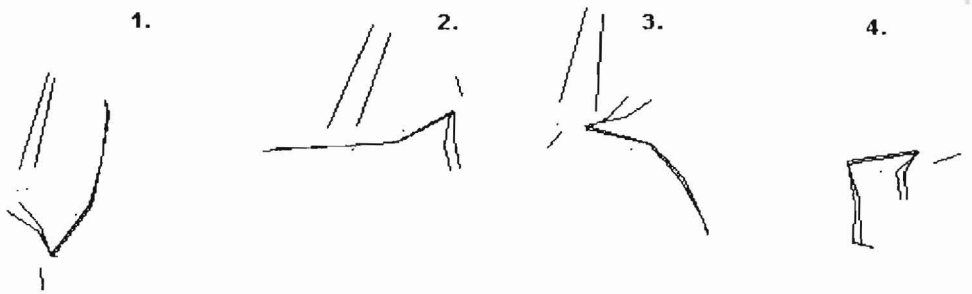

Fig.1 Unconnected kinogram of the double sommer solt straight backward from the rings

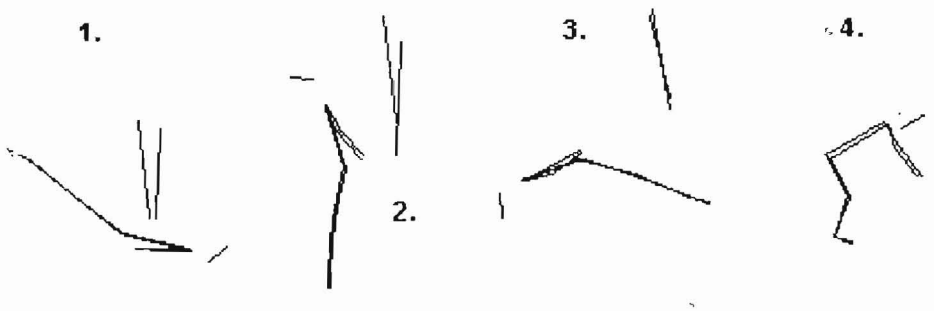

Fig.2 Unconnected kinogram of the double sommer solt straight backward from the rings

At the Fig.2 there is a kinogram of the other possible way for this exercise. Releasing from the rings and starting of the fly happens after the body has left the vertical position. In this part of the movement the angle between the arms and the body decreases. To compare it with the first technique in this one the

body is turned approximately for 90° from the floor in the direction of the rotation backward and the vertical position is higher above the floor.

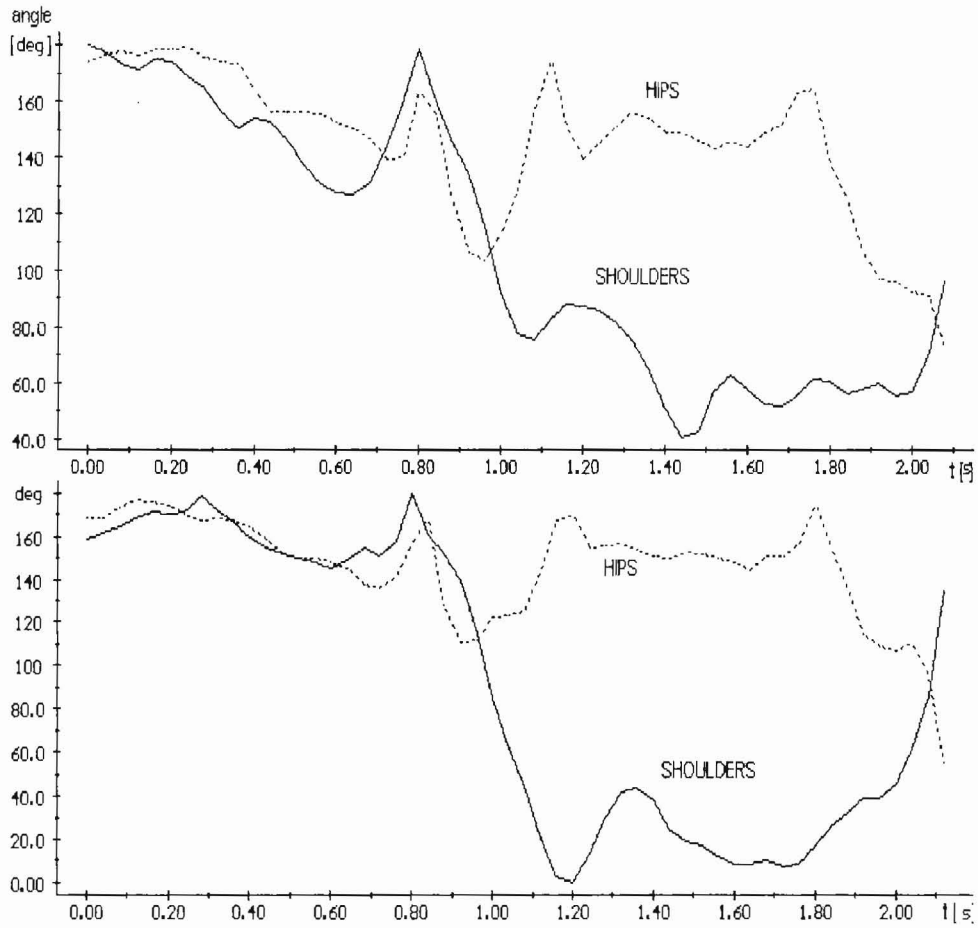

Fig.3 Angle of shoulder and hip joint in relation to the time

At the Fig.3 there is a graph which shows how the angle of shoulder and hip joint changes in relation to the time. You can see very similar values. Both described mechanisms of the changing of the moment of the body inertia have the same effect - the angle velocity of the body rotation increases. It proves the eqifinality, when the different start position of the body does not influent the final position which is equal in both cases.

CONCLUSION

We consider the activities of the sport gymnastics as the systems of gymnastic exercises, connected by single disciplines. The person performing this is a gymnast. Single exercises (gymnastics units) are separated into the

systems. From this point of view we can consider them as the stationary, dynamic system with the target behavior.

We are able to appoint a different style of a performance by the comparing or we can find mistakes during the moving exercise. For every exercise we can create an individual model and use this model for comparison the intra-individual characteristics of moving activity.

REFERENCES

Books-

Allard, P., Stokes, I., Blanchi, J-P. (1995). Three - Dimensional Analysis of Human Movements, Human Kinetics

Journal article-

Best, J., Bartlett, M., Morriss, J. (1993). A three-dimensional analysis of javelin throwing technique. Journal of Sports Sciences, 11, 315-328.

Kabada, P., Ramakrishnan, K., Wooten, E. (1992). Measurement of Lower Extremity Kinematics During Level Walking. Journal of Orthopaedic Research, 8, 383-392.

Wang, Y., Ford III, T., Ford jr., T, Dong Min Shin (1995). Three Dimensional Kinematic Analysis of Pitching in Acceleration Phase. Perceptual and Motor Skills, 80, 43-48.