THOMAS FLAIRE WITH 1/1 SPINDLE VERSUS DOUBLE LEG CIRCLE WITH 1/1 SPINDLE

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The pommel horse exercises and elements on the pommel horse are not very often the subject of researchers in biomechanics. It is true, the elements on pommels are not so breath taking as flight elements on the high bar, but they are also very difficult as the gymnast has to maintain support. In the middle of the seventies two extraordinary gymnasts invented two new movements on the pommel horse. Zoltan Magyar (Hungary) performed in 1975 a double leg circle with 1/1 turn and Kurt Thomas (USA) performed in 1976 a circle with split legs. Both elements are better known in the gymnastic world as Magyar spindle and Thomas flaire. As the Thomas flaire became a basic movement on the pommels, like the double leg circles, the normal development was to perform the Magyar spindle in Thomas flaires. For our purpose, the Magyar spindle was performed by Zoltan Suppola (171cm/59kg), member of the Hungarian national team, and the Magyar spindle in Thomas flaires was performed by Ivan Ivankov Belorus (159cm/58kg) (present world and European all-around champion). Both elements were analysed by the Consport Motion Analysis System. For the definition of the 3D coordinates we used one two-meter cube. We recorded the motion with two SVHS cameras at a frequency of 25 frames per second. The digitisation of the chosen points, from the video recorder to the computer was done with genlock supported with the Consport Motion Analysis Software. For analysis the following points of the body were chosen: face top and bottom, left and right wrist, elbow, shoulder, ankle and hip, body centre of gravity (BCG), all together 13 points which formed the following 11 body segments: face, left and right forearm, upperarm, leg, hip, tranversal segments of hips and shoulders. We used the Susanka body model, which is implemented into the CMAS software. In both cases we started with the analysis in the front support and up to the end of the spindle plus 3 frames.

Graphs 1 and 2 illustrate graphs of the most important kinematic parameters; the flaire spindle (full line) and the dotted line the Magyar spindle data):

The Magyar spindle has to be performed faster, the duration of the Magyar spindle is 1.28 (from the frame 0.36 seconds to the frame 1.64 seconds) seconds and the duration of the flaire spindle is 1.52 (from the frame 0.52 seconds to the frame 2.04 seconds) seconds.

The pattern of the BCG velocity in space is quite similar, but the Magyar spindle has one extreme peak velocity prior to the last release with the right hand.

The flaire spindle has a higher absolute position of the BCG in the y axis, however the trajectory of the BCG in the y axis is similar for both elements; the flaire spindle has also a greater range from minimum to maximum height of the BCG.

In both cases there is a moment of two-arms support, one arm support and a short flight phase.

The flight phase is more visible during the flaire spindle,

The flaire spindle has higher displacement of the left and right wrist in the y axis; the gymnast has to lift arms up to 70 centimeters below the plane of the pommel horse,

The flaire spindle has a higher velocity of the left and the right wrist in the y axis,

Both elements show a similar pattern of the shoulders angle curve, the flaire spindle has slightly higher values,

The Magyar spindle has less changes of the hip angle then the flaire spindle; the flaire spindle shows sinusoid curve of the left and the right hip angle.

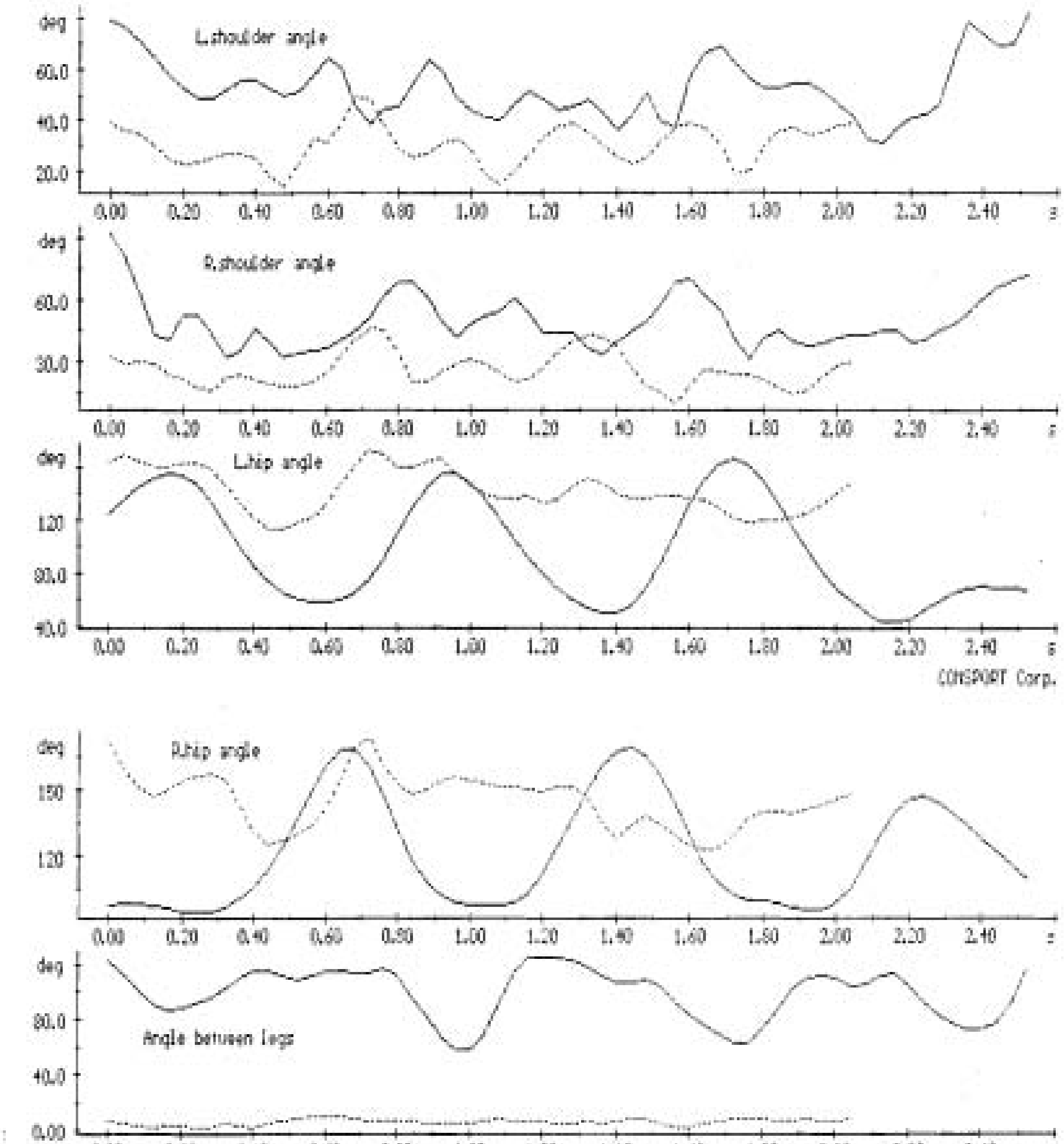
From these results we can conclude, that the flaire circle is more difficult than the Magyar spindle because the gymnast has to have higher values of the kinematic data. But if this would be the true the gymnasts should perform the Magyar spindle more often then the flaire spindle. By our experience every gymnast will say the flaire spindle is easier. Why?

In both cases the gymnast has to perform during the double leg circle or the Thomas flaire a turn around the longitudinal axis. All the turns are related to the angular momentum and moment of inertia. During the rotation in the flight phase we can easily change the moment of inertia while the angular momentum is constant. The Magyar spindle changes the moment of inertia from the slightly piked body position to the stretched position. The flaire spindle changes the moment of inertia with the angle between split legs, during the rotation the angle between legs is half of that during the normal flaire. If we presume, that both elements have the same angular momentum it is easier to change the moment of inertia in the flaire spindle and perform the turn in the short time of the flight phase while the remaining time the gymnast is concerned with obtaining equilibrium.

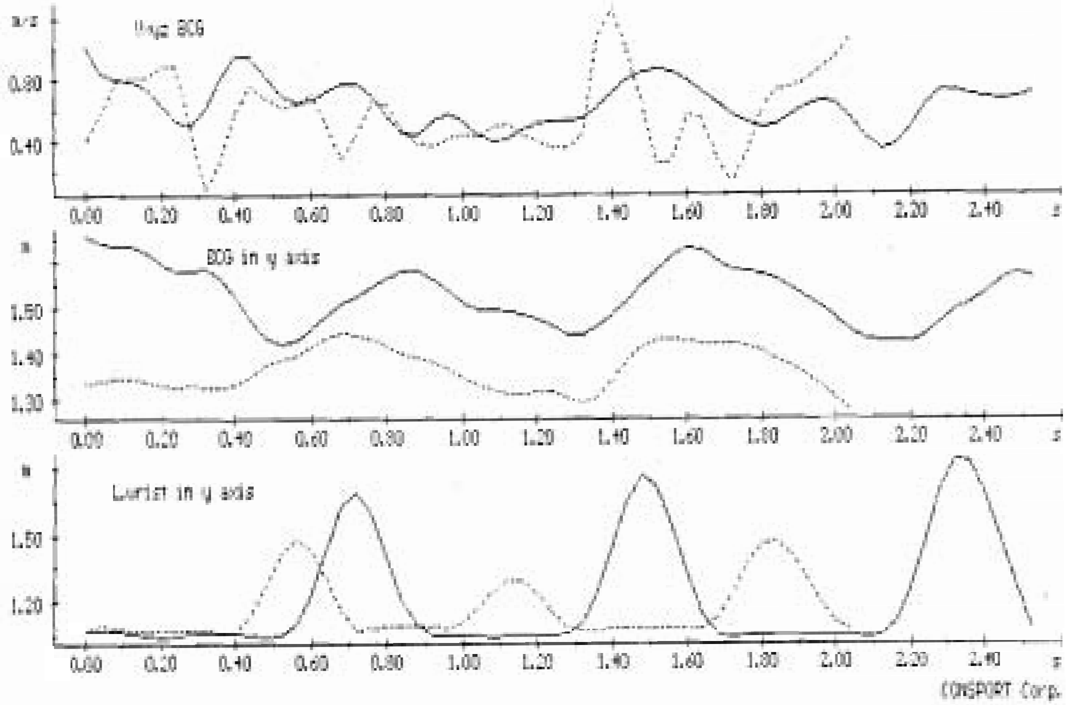
Specially the last is perhaps the reason, why more gymnasts perform the flaire spindle in their exercises and why the Magyar spindle is so rare.

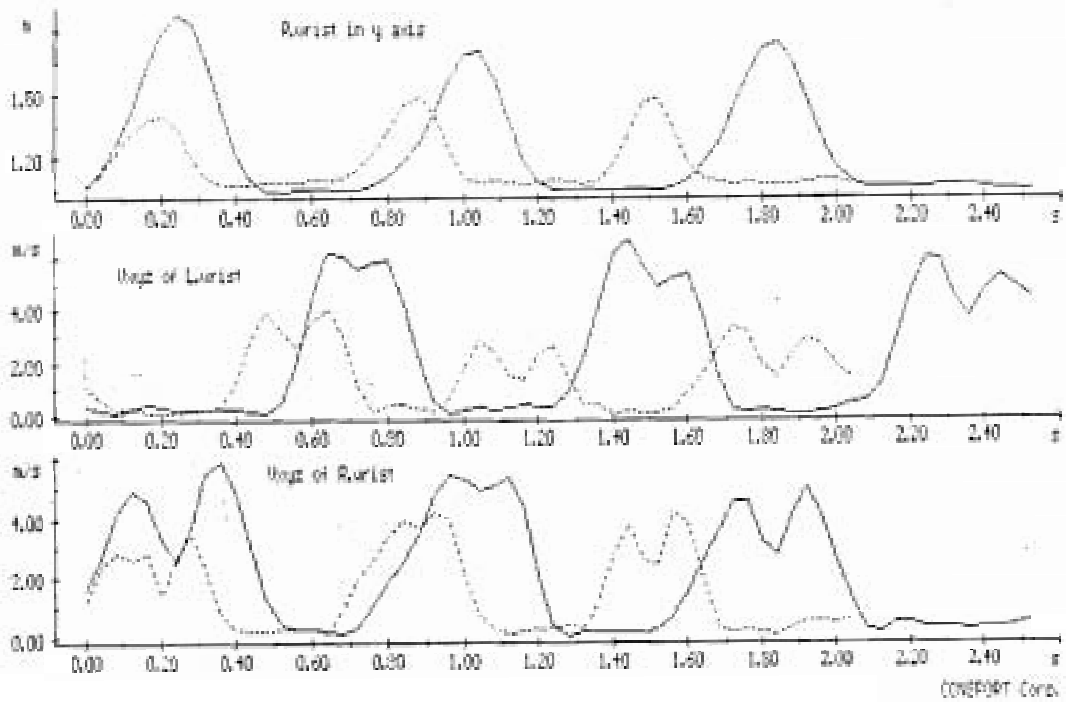
Conclusion

Results from kinematic analysis show some important differences between two types of spindle. However, from kinematic results we could conclude the flaire spindle is more difficult than the Magyar spindle. If this would be true gymnasts (they know best how difficult a particular element is) would perform the Magyar spindle more often, but they perform the flaire spindle more often. The possible reason why the Magyar spindle is less seen is in a more difficult generation and conservation of the angular momentum and more difficult change of the moment of inertia around the longitudinal axis during the turn in the Magyar spindle.



Graph I. Kinematic Parameters of Flair Spindle (-)
Magyar Spindle (---)





Graph 2. Kinematic Parameters of **Flair Spindle (-)**
Magyar Spindle (---)

Literature

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