KINEMATICS ANALYSIS OF STROKE CYCLE TO AN INTERNATIONAL ATHLETE ON CANOEING - K1

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INTRODUCTION

The purpose of this study was the kinematics analysis, in sagital plane, of the stroke cycle done on a simulator, by an athlete of canoeing-K1 with an international curriculum.

This analysis has allowed to describe in detail the technique of stroke and, especially, its expression through some kinematics parameters like:

1. displacement of the body centre of gravity according to a bidimensional axes system (x,y);
2. horizontal and vertical linear velocity of the left hand;
3. absolute angle of the trunk: defined by the left shoulder and the left hip;
4. articulate angle of the left knee: defined by the left thigh and left leg;
5. articulate angle of the left ankle: defined by the left leg and the left foot;

Bearing the lack of biomechanical studies on this area and the increase of the number of practitioners in Portugal, this knowledge could contribute to a better understanding of the training process.

METHODS

We have analysed one of the most representative athletes of the National Canoe Federation, a 32 year-old men, 90 Kg of weight and 187 cm of height.

We used the video camera to "catch" the stroke cycle during a training session. After this we have analysed the kinematics parameters, using a bidimensional computer programme "Peak Performance 5 - Motion measurement system" from Peak Performance Technologies, Inc..

RESULTS

It was observed several stroke cycles and was taken the medium values to the kinematics parameters studied.

1. In what concerns the displacement of the centre of gravity in the sagital plane, having in mind the system of bidimensional axes, we registered the following values:

1.1 horizontal axis: x = 4,075 cm (displacement of the centre of gravity in the horizontal axis, sagital plane)

We also observed on the horizontal axis that the longest position of the centre of gravity in relation to the body is related to the entrance of the paddle in the aquatic phase and the nearest position of the centre of gravity in relation to the body it's associated to the paddle position next to the vertical.

1.2 vertical axis: y = 3,525 cm (displacement of the centre of gravity in the vertical axis, sagital plane)

We also observed on the vertical axis that the highest position of the centre of gravity is related to the entry of the paddle in the aquatic phase and the lowest position of the centre of gravity it's associated to the paddle position next to the vertical.

2. Bearing in mind the horizontal and vertical linear velocity of the left hand we obtained the following results:

2.1 horizontal velocity (V_x) - it was registered two maximum peaks during the stroke cycle in which one corresponds to the aerial phase (V_x = 2,12 ms^{-1}) and the other to the aquatic phase (V_x = 1,74 ms^{-1}). These two maximum values coincide with the position of the paddle next to the vertical. The value V_x = 0 ms^{-1} was registered in the aerial phase also in two points during the stroke cycle which correspond to the position of the paddle next to the horizontal.

2.2 vertical velocity (V_y) - it was also registered two maximum peaks during the stroke cycle both in the aerial phase with the paddle next the horizontal, one with the left hand forward (V_y = 2,55 ms^{-1}) and the other with the left hand backward (V_y = 1,78 ms^{-1}). The value V_y = 0 ms^{-1} was registered for a position of the paddle next to the vertical, equally in two points, on superior and the other inferior.

3. Absolute angle of the trunk.

In the forward bending of the trunk, the registered value was of 14,77º and corresponds to the entry of the paddle in the aquatic phase. For the backward bending of the trunk, the registered value was 11,32º and is associated with the final of the aquatic phase. The range of motion was 26,09º.

4. Articulate angle of the left knee

The value registered for the angle of greater flexion of the left knee was of 129,7º and coincides with the final of the aquatic phase of the right side. The value registered for the angle of greater extension of the left knee was of 163,4º and coincides with the final of the aquatic phase of the left side. The range of motion of the left knee was 33,7º.

5. Articulate angle of the left ankle

The value registered for the greater dorsal flexion was of 89,7º and coincides with the final of the aquatic phase of the right side. The value registered for the greater plantar flexion was of 107,7º and coincides with the final of the aquatic phase of the left side. The range of motion of the left ankle was 18º.

From the discussion of the results we can state the following aspects:

. the displacements of the centre of gravity in the horizontal plane axis might arouse an anteroposterior oscillation of the kayak, and that's why those displacements should be minima. Equally the displacements of the centre of gravity in the vertical axis might cause an elevation/sinking of the kayak and that's why they also should be minima.

. The maximum value founded to the horizontal velocity in the aquatic phase (V_x = 1,74 ms^{-1}) justifies that the propulsion of the kayak should be maxim on that moment.

. The superior value of the horizontal velocity of the left hand in the aerial phase (V_x = 2,12 ms^{-1}) in relation to the one found in the aquatic phase (V_x = 1,74 ms^{-1}), as well. as the different values of the vertical velocity can be justified by the fact of having been applied a resistance to the paddle which in a situation of simulated training acts in the opposite direction to the movement of the paddle during the aquatic phase.

. We call your attention to the fact that the absolute angle of the trunk doesn't correspond to the true bending of the same. What we can observe in the sagital

plane is the advance of one of the shoulders meanwhile the opposite shoulder moves backward. This movement allows the trunk to maintain the same position in the sagital plane occurring a true rotational movement of the trunk in the horizontal plane.
The most relevant angular values are those of the knee and the ankle. There is a relation between the flexion/extension of the knee and the dorsal/plantar flexion of the foot. The flexion of the knee is related to the dorsal flexion of the foot and the extension of the knee is related to the plantar flexion. The extension movement of the knee it's important to the transmission of the propulsive force to the kayak. This movement is made by the foot leaned on the metatarsal area which allows the mobilisation of the heel and the fingers of the foot. The heel mobilisation is important in the variation of the articulate amplitude of the knee and the ankle.

CONCLUSION

Having in mind the results we found, we think that training sessions of this kind could be done in a simulator without affecting the performance objectives. When the weather is bad or for better correction and intensity of the training, the athlete could exercise in the gymnasium and in the simulator. The conditions will be similar to the ones demanded in the aquatic field.
From this study it could be improved the components of the simulator with the objective of improving the training methodology since the results founded in the simulator are very similar to the ones of the real conditions.

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