THORAX-PELVIS SEPARATION ANGLE AND SPEED DEVELOPMENT IN THE HAMMER THROW

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INTRODUCTION

In the hammer throw, a thrower accelerates the hammer by performing turns across the throwing circle. The speed development during the turns is of high importance as the hammer speed at release has the greatest influence on distance thrown.

In each turn, hammer speed fluctuates with losses occuring during the single support phase and increases during double support [1]. Previous studies have suggested that throwers should minimise the magnitude of speed losses in single support [1,2] as once they return to double support they must first account for these losses before they can increase hammer speed once more.

In this study the relationship between losses in hammer speed and the thrower's thorax-pelvis separation angle was investigated. It was hoped the results of this study would give athletes and coaches an indication as to how they could reduce the size of speed losses through manipulation of the thorax-pelvis separation angle.

METHODS

Five male and five female throwers participated and each was required to perform 10 throws. Retro-reflective markers were positioned on anatomical landmarks of the throwers and on the hammer wire. All three dimensional marker coordinate data were recorded with an infra-red camera system (Oxford Metrics, Oxford, UK).

The hammer marker data were used to determine hammer speed [1]. The body marker data were used to create rigid segment models of the thorax and pelvis. The angle between the sagittal axes of these segments was then determined (thorax-pelvis separation angle).

For each turn of each participant, the speed loss and thorax-pelvis separation angle magnitude at its smallest were determined. These values were averaged over the participant's ten throws so that each participant had a mean speed loss and minimum angle value for each turn.

The relationship between above mentioned variables was examined for the entire group. Pearson's correlation and the associated p-values (p) measured the strength of the relationship. Hierarchical cluster analyses based on a squared Euclidean distance measure were performed to confirm the existence of any outliers [3].

RESULTS AND DISCUSSION

Cluster analyses showed that three female participants formed a cluster of their own. Therefore, the correlation measures were computed with these points removed. An additional female participant was grouped in this cluster for turn one and this point was also removed for this turn.

Thorax-pelvis separation angle was at its smallest at the end of double support while the speed losses occurred in the subsequent single support phase. The computed correlations (Table 1) indicate that in the second and second last turns, the speed losses during single support were smaller when the thorax-pelvis separation angle was reduced by a greater amount during the preceding double support phase. This is in agreement with coaching literature that suggests thorax-pelvis separation should be approximately zero in the latter stages of double support [2]. The correlations for the first and last turns were not statistically significant.

These findings suggest that this cohort of throwers, and those of a similar ability, may be able to reduce speed losses by reducing thorax-pelvis separation angle in double support by a greater amount. It is currently unknown if it is possible for throwers to actively manipulate thorax-pelvis separation. However, the period of double support is when the athlete is at their most stable so it is likely to be when it is easiest for a thrower to manipulate the separation angle

CONCLUSIONS

Hammer throwers should aim reduce the thorax-pelvis separation angle by as much as possible during the double support as this may lead to a reduction in hammer speed losses during the subsequent single support phase.

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Table 1: Relationship between thorax-pelvis separation angle at its smallest and speed losses within each turn.

Turn 1		Turn 2		2nd last turn		Last turn	
R	p	R	p	R	p	R	p
0.22	0.67	–0.97	0.00	–0.81	0.03	–0.51	0.20