

BIOMECHANICAL SIMILARITIES OF LONGSWINGS AT VARYING SPEEDS AND THE KOVACS ACTION

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INTRODUCTION: Low movement variability in the backward longswing has been partly attributed to external competitive constraints (Irwin & Kerwin, 2005). However, a number of high level skills (e.g. Gienger, Deff, Kovacs) derive from variations in the longswing action. If movement variability is viewed as having a functional role (Bartlett et al., 2007) then variability in the longswing might be beneficial to subsequent skill acquisition. This study aims to determine whether variations in the speed of longswing can induce movements that are more similar to movements associated with a high level skill, in this case the Kovacs.

METHOD: A former member of the men's national gymnastics squad performed one trial of 12 continuous backward longswings on the Men's Horizontal Bar at self-selected speeds in the following order: 3 normal, 3 fast, 3 slow, 3 fast; and a second trial performing a Kovacs. All trials were performed on a standard competition high bar. A Qualisys ProReflex system (100Hz) was used to obtain body marker coordinates of each trial. A digital filter with a cut-off frequency of 5Hz was applied for noise removal. Mean, time normalised sagittal plane hip and shoulder angular displacements (θ_S , θ_H) and velocities (ω_S , ω_H) were calculated for each speed of longswing. Time normalised sagittal plane hip and shoulder angular displacements and velocities were determined for the initial longswing action ('Prep') and the longswing prior to release ('Action') in the Kovacs trial. Analysis of similarities between the different longswing actions and the constituent parts of the Kovacs were performed through calculation of root mean square differences (RMSD).

RESULTS/DISCUSSION: The RMSD values are presented in Table 1. The lower RMSD values for the fast longswings indicate that varying the speed of the longswing can lead to greater similarities between the longswing action and the Kovacs skill. Interestingly, greater similarities in the hip joint motion were observed in the fast longswings performed after a series of slower longswings, suggesting that sequence of speed variation may be important. In conclusion, variations in speed of longswing can produce movements that have greater similarity to a high level skill. Variability in longswing actions may therefore be beneficial to gymnasts in terms of acquisition of high level skills, such as the Kovacs.

Table 1 The RMSD values

		Normal	Fast 1	Slow	Fast 2
θ_S (°)	Kovacs Prep	5	5	5	6
	Kovacs Action	6	6	7	5
ω_S (°s ⁻¹)	Kovacs Prep	46	47	56	47
	Kovacs Action	61	56	62	51
θ_H (°)	Kovacs Prep	7	7	7	5
	Kovacs Action	22	19	23	18
ω_H (°s ⁻¹)	Kovacs Prep	70	54	73	41
	Kovacs Action	183	156	183	151

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