PREPARATORY LONGSWINGS PRECEDING TKACHEVS ON UNEVEN BARS

Michelle Manning, Gareth Irwin, David Kerwin and Marianne Gittoes

Cardiff School of Sport, University of Wales Institute, Cardiff, Wales, UK

KEY WORDS: gymnastics, functional phases, angular momentum.

INTRODUCTION: The preparatory longswing on uneven bars is fundamental to the development of more complex skills in women's gymnastics. The preceding longswing governs the release parameters that in turn determine the success of the straddle Tkachev (Arampatzis & Brüggemann, 2001). Of the many longswing variations currently in use in women's gymnastics, this study aims to investigate differences in the biomechanics of three distinctive preparatory longswings used in performing the straddle Tkachev. The long term purpose is to increase understanding of these skills and potentially improve the effectiveness of coaching.

METHODS: Twin video image data from the 2000 Olympic Games were reconstructed using 3D DLT techniques. Pike (n=3), straddle (n=3) and arch (n=2) preceding longswings (LS) were analysed. The start and end of the hip and shoulder functional phases (FP), defined according to Irwin and Kerwin (2005), and their respective joint angle changes were calculated. Release angle (Θcm) and vertical and horizontal centre of mass (CM) release velocities (Vv and Vh), together with normalised angular momentum in straight somersaults per second (SS/s) of CM about the bar (Ln_b) and about gymnast CM (Ln_c) were calculated.

RESULTS & DISCUSSION: In all preparatory LS techniques, the FP at the hips precedes the shoulders. Between the three techniques the start of the FP occurred earliest for the arch, then straddle and finally pike. Ln_b was lowest in the pike technique resulting in a reduction in Vh and Vv. Ln_c for the pike LS was smallest, with the corresponding values for the arch and straddle being approximately two and three times larger (Table 1).

Table 1 Mean [±SD] release parameters for the pike, straddle and arch longswing preceding the straddle Tkachev on uneven bars

	Θcm (°)	Vv (m/s)	Vh (m/s)	Ln_b (SS/s)	Ln_c (SS/s)
PIKE	54 [6]	1.39 [0.57]	-1.91 [0.30]	1.885 [0.079]	-0.098 [0.075]
STRADDLE	75 [10]	1.43 [0.35]	-2.00 [0.30]	2.162 [0.065]	-0.302 [0.147]
ARCH	74 [11]	1.62 [0.59]	-2.25 [0.49]	2.297 [0.122]	-0.213 [0.070]

The straddle and arch techniques each resulted in greater angular momentum about either the CM or the bar respectively. Each therefore appeared to benefit from the preceding longswing. Both angular momenta were lowest for the pike technique indicating that the reduced radius of rotation and delayed FP may limit the subsequent generation of angular momentum.

CONCLUSION: This study aimed to investigate how the biomechanics of the female longswing preceding the straddle Tkachev changes as a function of technique. From a coaching perspective, as the pike LS results in the lowest velocity and angular momentum at release it may be the least effective technique to adopt. Current work is focussed on examining a wider range of preceding longswing techniques across different competitions.

REFERENCES:

Arampatzis, A. and Brüggemann, G.P. (2001). Mechanical energetic processes during the giant swing before the Tkatchev exercise. *Journal of Biomechanics*, 34, 505-512.

Irwin, G. and Kerwin, D.G. (2005). Biomechanical similarities of progressions for the longswing on high bar. *Sports Biomechanics,* 4, 163 -178.