

SCORE PREDICTION ON KIPS PERFORMED ON THE PARALLEL BARS

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KEY WORDS: Kip, gymnastics, parallel bars, score prediction

INTRODUCTION: Kips are performed by both male and female gymnasts in a variety of apparatus including the parallel bars. Although kips are considered to be one of the fundamental skills in gymnastics, research is scarce (Prassas, 1993). The purpose of this study was to investigate the factors that influence the score awarded to kips performed on the parallel bars by qualified judges.

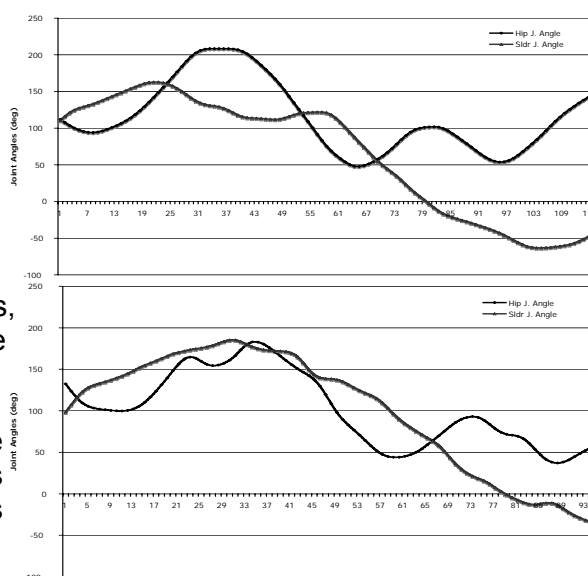
METHODS: Eighteen kips performed by elite gymnasts were recorded utilizing a NAC 400 high-speed video camera operating at 100 Hz. The analysis was performed using the Ariel Performance Analysis System (APAS). Two-dimensional position data of four (kips performed without knee and/or elbow joint flexion) to six (kips exhibiting knee and/or elbow joint flexion) body points were digitally smoothed with a cut off frequency of 6 Hz before submitted to further analysis. The analyzed kips were rated by two internationally qualified judges on a scale ranging from 1 (worst) to 10 (best). SigmaStat 3.5 (SYSTAT, Inc.) software was used for statistical analysis.

RESULTS AND DISCUSSION: Preliminary regression analysis results suggest that the judges' score variation can be predicted ($R^2=0.720$) by the following equation:

$$\text{SCORE} = -5.232 - (0.0444 * \text{SJAROMB}) - (0.00276 * \text{SJAHPREXA}) + (0.0366 * \text{HJROMB}) + (0.00958 * \text{MINHJAA}) + (14.845 * \text{CGMHA})$$

where SJAROMB/HJROMB is the shoulder/hip joint range of motion below the bars, SJAHPREXA is the shoulder joint (hyperextension) angle above the bars, MINHJAA is the minimum hip joint angle above the bars, and CGMHA is the maximum height of the center of gravity above the bars. The best predictor of the judges' score (explaining 59% of the scores' variation) was the CGMHA ($p=0.004$). The MINHJAA was also a significant contributor ($p=0.05$). SJAHPREXA had the least influence on the judges' scores. Hip/shoulder joint angle data for the highest scored kip revealed smoother hip joint angle and greater shoulder joint SJAHPREXA as compared to the lowest scored one (Figure 1).

Figure 1. Hip and shoulder joint angles for the highest (top) and lowest (bottom) scored kips.



REFERENCES:

Prassas, S. (1993). Technique analysis of the kip on the parallel bars performed by elite gymnasts. *International Society of Biomechanics in Sports*, XI Annual Meeting, Amherst, Massachusetts.