FORCE COMPARISON OF BACKWARD LONGSWINGS ON HIGH BAR AND UNEVEN PARALLEL BAR

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INTRODUCTION: This study constitutes the initial phase of ongoing research into the biomechanics of men's and women's artistic gymnastics. The backward longswing is a crucial element of all high bar (HB) and uneven parallel bar (UB) routines and is exploited as a means of developing the angular momentum and release parameters required for the successful completion of complex release and re-grasp skills (Witten *et al*., 1996). Kerwin and Hiley (2003) found that the forces applied at the bar can be estimated to within 7% by analysing the bar displacement.

METHOD: A standard competition HB and a UB (Continental Sports Ltd, UK,) were fitted with active markers (CODA, Charnwood Dynamics Ltd, Leics UK). The bar was calibrated using Kerwin and Hiley's (2003) field based calibration technique; incrementally loading the bar and recording the displacement of its centre. These data were used to perform a regression analysis, linking the bar displacement with the force being applied. A single female gymnast performed repeated backward longswings around the HB and UB during which, the locations of all the markers were recorded using the CODA CX1 system.

RESULTS: Figure 1 presents the results of the regression analysis and predicted force profiles of repeated longswings on both bars. It is clear that a similar force applied to both bars causes more displacement of the UB than the HB.

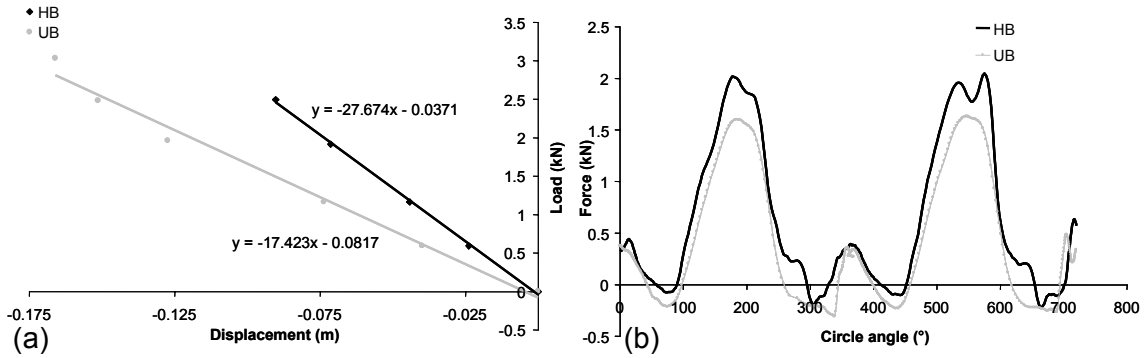

Figure 1 - Regression analysis (a) and force profile (b) of longswings performed on high bar (HB) and uneven parallel bar (UB).

DISCUSSION: The regression analysis unsurprisingly showed that the HB displays higher stiffness characteristics than the UB, this allows the gymnast to generate more force on the HB (Fig 1). The force profile is smoother on the UB and the peak forces generated are lower.

CONCLUSION: Initial findings suggest the stiffer HB may allow gymnasts to transfer more energy to the bar providing them with the opportunity to develop a greater release velocity and therefore alter the flight profile. Further application of the above methodology will facilitate comparisons of the bar-gymnast interaction and in particular the interaction of the biomechanical energetic processes occurring between the gymnast and the apparatus.

REFERENCES:

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