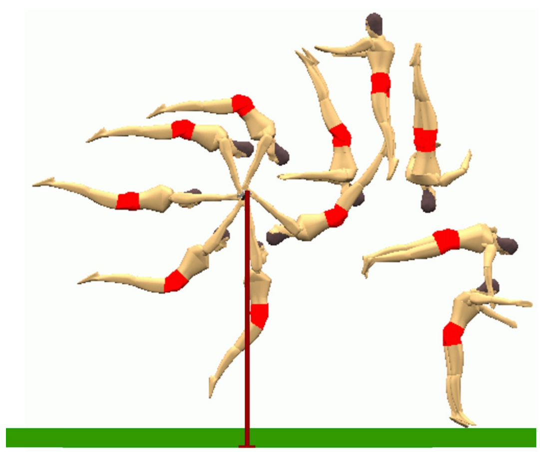
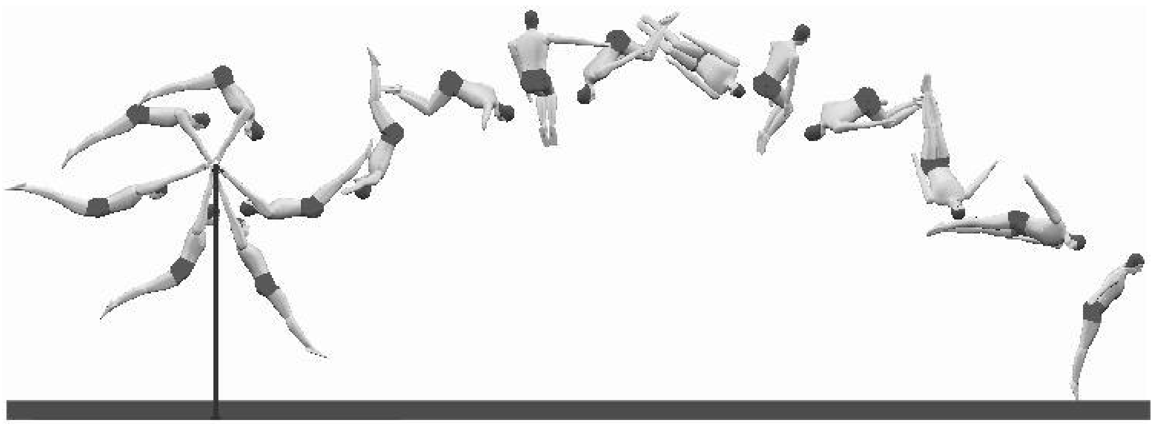
Hiley, M.J. and Yeadon, M.R. 2005. Maximal dismounts from high bar. Journal of Biomechanics 38, 2221-2227.

The majority of dismounts performed in elite competition comprise a double somersault with a straight (layout) body configuration with one or more twists or a triple somersault with a tucked body configuration. Although gymnasts have performed a triple piked somersault dismount, the triple straight somersault dismount from the high bar has yet to be performed in competition. All of these dismounts are performed from accelerated backward giant circles. The purpose of the accelerated backward giant circle is to generate sufficient linear and angular momentum by the time the gymnast releases the bar. In addition to producing angular momentum and flight, the backward giant circle can also have an effect on the sensitivity of the timing release from the bar. (Hiley and Yeadon 2003) defined the "release window" as the period of time during which the gymnast has sufficient linear and angular momentum to successfully complete the desired dismount. It may be argued that prior to the release for a triple layout the gymnast will be rotating faster than for a double layout and this will reduce the size of the gymnast's release window. If the release window becomes too small the timing of the release becomes critical.



The present study used a simulation model of a gymnast and the high bar apparatus (Hiley and Yeadon, 2003) to determine whether a gymnast could produce the required angular momentum and flight to complete a triple straight somersault dismount. Optimisations were carried out to maximise the margin for error in timing the bar release for a given number of straight somersaults in flight. During an optimisation the joint angle time histories at the shoulder and hip joints were manipulated to maximise the margin for error in timing the bar release. Joint torque limits were imposed to prevent joint angle time histories that exceeded the strength of the gymnast (King and Yeadon, 2002). The initial joint angle time histories were obtained from the double layout dismount of the 2000 Olympic high bar champion, and the release window was maximised. The required amount of rotation potential (number of straight somersaults) was then increased and the release window was again maximised. This process was repeated to determine the amount of rotation potential (number of straight somersaults) the model could produce whilst maintaining a realistic margin for error. A simulation model of aerial movement (Yeadon, Atha and Hales, 1990) was used to find dismounts that would be possible with this amount of rotation potential.

The model was able to produce sufficient angular momentum and time in the air to complete a triple straight somersault dismount. The margin for error when releasing the bar using the optimum technique was 28 ms, which is small when compared with the mean margin for error of 55 ms determined for high bar finalists at the 2000 Sydney Olympic Games (Hiley and Yeadon, 2003). Although the triple straight somersault dismount is theoretically possible, it would require close to maximum effort and precise timing of the release from the bar. However, when the model was required to have a realistic margin for error (55 ms), it was able to produce sufficient angular momentum for a triple piked somersault dismount. Using the simulation model of aerial movement a new dismount, which has previously not been performed in major competition, was also found to be possible, a double twisting triple somersault dismount.



Related Papers

Hiley, M.J. and Yeadon, M.R. 2003. Optimum technique for generating angular momentum in accelerated backward giant circles prior to a dismount. Journal of Applied Biomechanics 19, 119-130.

Hiley, M.J. and Yeadon, M.R. 2003. The margin for error when releasing the high bar for dismounts. Journal of Biomechanics 36, 313-319.

King, M.A. and Yeadon, M.R. 2002. Determining subject specific torque parameters for use in a torque driven simulation model of dynamic jumping. Journal of Applied Biomechanics 18, 207-217.

Yeadon, M.R., Atha, J. and Hales, F.D. 1990. The simulation of aerial movement - IV: A computer simulation model. Journal of Biomechanics 23, 85-89.