Kinematic Determinants of Success in the Fencing Flick: Logistic and Linear Multiple Regression Analysis

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Previous research on sport fencing has focused primarily on associated medical risk. The few papers addressing performance examined footwork and the lower body, but not the upper body. One difficult upper body action is the flick, which involves changing angular acceleration of the blade to produce a curve to reach the target, much like a whip. The specific aim of my research was to determine the characteristics of limb movements, which are under the fencer's direct control, that determine success. Current coaching suggests that a high hand height yields high success, which I put to the test as my hypothesis. Subjects performed the flick at a stationary horizontal target, which simulated the shoulder, while recording high speed video (650 fps). Markers along the blade and arm segments were later tracked in software. These features were then used to calculate kinematic variables (position, velocity & acceleration) of the tip, blade, and arm. I then created a multivariate logistic and linear regression model, working backwards from scoring success to the tip, along the blade, then to the arm variables. I found that of the variables of the fencer's upper arm, peak angular velocity produced by the fingers and the final hand distance from the target were the only two variables to significantly ($p<0.001$) impact final success. These results also falsified the hypothesis that hand height plays a valuable role in success. These results can be applied not only to myself and subjects of this study but to all fencers seeking to hone their skills and coaches striving to improve their teaching techniques. Further, my regression approach may be applicable on a broader scale to similar sporting scenarios with dichotomous outcomes and several tiers of input variables.

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