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ICE HOCKEY STICK RECOIL MECHANICS

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INTRODUCTION

Several studies have been conducted with respect to the performance of shooting (1,2). From these studies, the authors suggested that movement patterns of elite players were predominant factors in determining critical outcomes such as puck velocity despite the variation of stick stiffness. However, the effect of the different mechanical factors (e.g. stick bend, puck velocity, puck contact time) on shooting performance is not completely understood. For instance, how do these parameters affect the catapult or recoil effect of the stick during a shot? Hence, the purpose of this study was to identify the recoil effect of the ice hockey stick shaft during a stationary slap shot as observe for elite and recreational players.

METHODS

Nine male Hockey players were selected as subjects for this study (four 'elite', five 'recreational'). The subjects wore ice hockey gloves and stood on a 3 m square piece of 0.004 m thick polyethylene (artificial ice) and were asked to complete eight to ten stationary slap shots for one model stick. Performance measures included: puck acceleration, stick shaft bending and kinetic energy. Data collection consisted of the simultaneous use of a high speed video recording at 1000 Hz (HSC Motion Scope RedLake Imaging, Model PCI 1000), and a piezoelectric triaxial accelerometer (Kistler Inst. Co., model 8792A500) linked to a coupler (Charge Amplifier Type 513m4, Kistler Instrumentation Corp., Amherst, NY,USA) then to a data acquisition card (AT-MIO-16X PC DAQ board, National Instruments). Blade-puck contact time was recorded (LabView 4.1® software) using the same DAQ by means of wrapping the blade of the hockey stick and the puck with a metal foil, thereby creating a ±5v contact circuit which allowed the synchronization of both systems (Figure 1).The shaft kinematics was processed using APAS Software (Ariel Dynamics Inc.).

RESULTS AND DISCUSSION

As Figure 2 shows, differences in both the magnitude and sequence of the two main phases identified (i.e. stick shaft bend and recoil) were observed between groups. For instance, a consistent bend-recoil sequence of the three stick shaft segments examined for the 'elite' group was observed in contrast to the 'rec' group, where a 'recoil' phase was relatively non existent. For the 'elite' group, the bending occurred shortly before or at the instant of first contact (t1) until 28.8 % of blade-puck contact window, followed by the recoil-phase, which lasted until 59.8 % after bend phase or 88.6 % after first touch. Conversely, the "rec" group showed a different sequence, such that the bend phase began only after half way through the contact window (i.e. 44.4 %), and then lasting for only 18.2 % of 'T_A ' before initiating the stick recoil (up to 35.4 % of contact time remaining).

On average, the 'elite' group achieved higher puck velocities than the 'rec' group within a range of 120.8 ± 18 km/h and 80.3 ± 11.6 km/h, respectively. In addition, significant differences were observed in the stick elastic (bend) energy , whereby the 'elite' and 'rec' groups showed 16.49 ± 13.29 joules versus 2.10 ± 2.10 joules, respectively. Furthermore, strong relationships were found between puck velocity and stick bending energy and between puck velocity and blade-puck contact times.

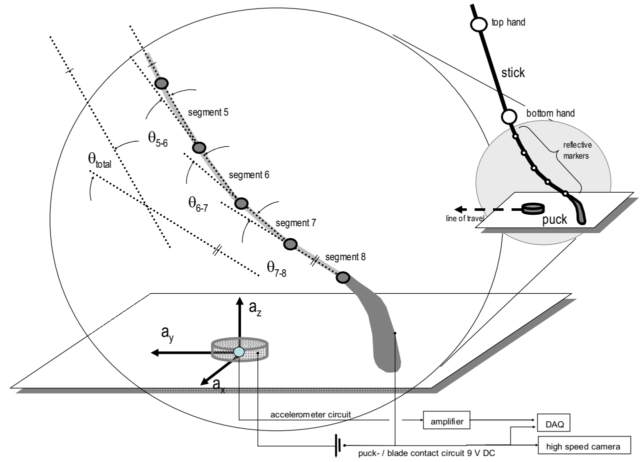

Figure 1 Set up of the experiment. Stick angle deflections (θ5-6, θ6-7, θ7-8, θtotal) and system synchronization .

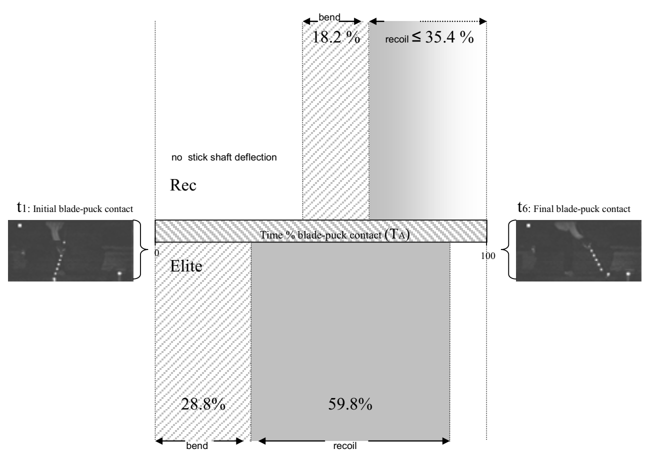

Figure 2 Percentage bend-recoil during puck-blade contact time in the slap shot.

CONCLUSIONS

Stick elastic bend energy (i.e. Ed) and blade puck contact times (i.e. $T_{A,}$ T_B) were identified as the two main factors highly related to final puck velocity. From these results, a better understanding of the impact blade-puck event during a stationary slap shot was obtained

REFERENCES

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