INTRODUCTION
The hockey stick is a tool used to extend one’s arms that, with respect to shooting skills, also affords greater distal end swing velocities to project the puck [1]. Shaft movement is mediated by the grip forces at the hands [2]. Despite this, little is understood of the grip mechanics. The goal of this study was to demonstrate the feasibility to 1) acquire grip force distribution during rapid tasks and 2) differentiate grip dynamics between wrist and slap shots.

METHODS
A carbon fibre stick (Bauer Hockey Corp. NH, USA) was instrumented with two arrays of 16 piezoresistive sensors (FSA-ISS-O, Vista Medical, Winnipeg, Manitoba) placed around the upper and lower hand grip locations on each of the 4 stick surfaces. Each sensor was connected to thin flexible wiring, allowing unencumbered movement of the stick by the subject. A 32-channel amplifier was connected to a data acquisition device (cDAQ-9174) and computer using LabVIEW™ v2010 (National Instruments®, Austin, Texas) software to record the voltage of each sensor at a sampling rate of 1000 Hz. Each sensor was calibrated using a quasi-static stepwise dynamic loading within a measurement error of ± 10 N.

Ice hockey players (n=5) performed 5 wrist shots and 5 slap shots. Grip force measures were recorded and grip force distribution and dynamics were determined for both shots for each of the 4 stick shaft surfaces: leading, lagging, toe-up and toe-down.

RESULTS
During both the slap and wrist shots, the sensing regions were able to acquire grip force measurements and distribution around the four stick surfaces (Figs 1 and 2). Each shot showed a distinct grip force pattern, with the wrist shot exhibiting distinctive loading, pushing, and follow through phases and the slap shot exhibiting distinctive loading and downswing, pushing, release and follow through phases. The results showed diverse grip force profiles between subjects, but very repeatable grip force profiles within subjects.

DISCUSSION & CONCLUSIONS
The system developed allowed for estimation of grip force responses during shooting tasks of short duration. This study demonstrates the feasibility of this quantitative approach for direct measurement of grip force at the hand-stick interface while executing tasks with the hockey stick.

REFERENCES

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