Effects of ice hockey facial protectors on response time

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Introduction

While the added protection given to ice hockey players through the use of visors and cages has been well documented (Benson et al., 2002; Stevens et al., 2006; Lemair & Pearsall, 2007), a perception in the hockey community remains that cages and visors impair the field of vision, and in turn delay response time and subsequent movements. In ice hockey, a fast paced sport that heavily relies on vision and reaction time, any impairment in the field of vision has the potential to lower one's level of play. Furthermore, a slight latency in one's response time could have effects on both performance and safety on the ice. Some prior studies examining the effects of visors and sports goggles on visual function do report a reduction in peripheral vision (Ing et al., 2002). However, no studies have addressed the subsequent effects on movement response time. This forms the basis for the current study.

Methods and Procedures

Healthy subjects from the McGill University male and female varsity ice hockey teams (n=28) were recruited to participate in this study. Each subject stood in front of 13 light targets, arranged at equal intervals along a 180° horizontal arc array positioned at shoulder height and a distance of 1.3 arm lengths away. Three test conditions were examined wearing a helmet and: (1) no facial guard (control), (2) a cage, and (3) a visor. During each trial, upon random illumination of lights in the array, the subject was instructed to respond as quickly a possible to reach out and touch the activated light with their index finger. With button switches in the lights, as well as on the subject's chest (i.e. start hand position on mid-sternum), reaction time (RT), movement time (MT) and response time (RsT= RT + MT) were measured for each light target. Several trials per target were collected in random sequence among the 13 lights, controlled by an I/O DAQ board and software (National Instruments™, Labview™ 8). In addition, six Vicon® infrared cameras captured subject kinematics through each trial (figure 1). Passive reflective markers were placed at body landmarks on the subject in accordance with Vicon's® full body model. Records of body movement for each trial were synchronized with the above response time data.

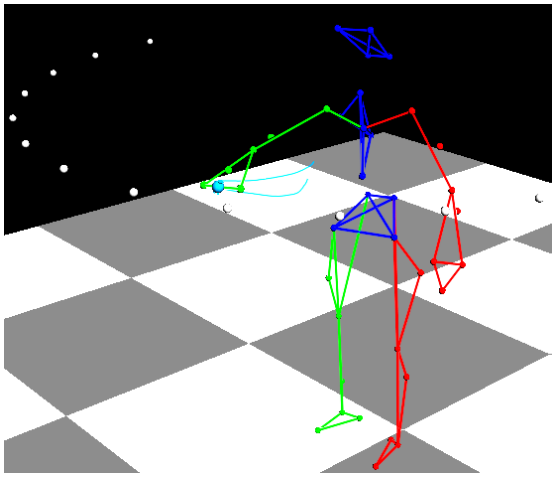

Figure 1: Example trial of the reach and point task.

For the purposes of this abstract, only the former variables will be discussed. Following subject testing, RT, MT and RsT data were statistically evaluated in Matlab® and SPSS®, incorporating a two-way repeated measures ANOVA.

Results

Significant differences were present between subjects' RsT. Pairwise comparisons indicated that these differences existed between the cage and control conditions ($p=0.039$). A rank order was observed between these cage, visor, and helmet conditions, with RsT means of 866, 855, and 843 ms, respectively, with an upper bound of 47 ms existing between the cage and helmet conditions (table 1).

Condition	Mean (ms)	Std. Error
Control	843	18.2
Cage	866	18.1
Visor	855	19.4

Table 1: Mean RsT times (ms) and standard error values.

Though similar ranking was observed for RT and MT measures, repeated measures analysis showed no significant differences.

Discussion

Though RT and MT values were not affected significantly by the test conditions, the cumulative RsT scores were delayed, in particular with the cages (~23 ms). This was a consistent observation for most of the light targets. In addition, the largest differences were detected within 45° of subjects' central focal point. This was unexpected, given the results of the aforementioned study by Ing et al (2002), in large part due to the unique qualities of cages versus goggles/visors.

Summary

The effect of three ice hockey facial protection conditions on reaction, movement and cumulative response times in a goal directed task was investigated. Results indicated that RsT is significantly different when comparing a subject wearing a helmet with no facial protection versus wearing a cage. Given the above results, further study is warranted to validate these findings during on-ice conditions and with respect to game specific skills. As well, re-evaluation of cage design and construction to optimize safety and functionality should be pursued.

References

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