PERCEIVED DIFFERENCES IN SKATING CHARACTERISTICS RESULTING FROM THREE CROSS SECTIONAL SKATE BLADE PROFILES

Marshall Kendall, Scott Foreman, Philippe Rousseau and Blaine Hoshizaki

International Ice Hockey Research Academy, University of Ottawa, Ottawa, Canada

The purpose of this study was to document differences in perceived skating characteristics resulting from three unique cross sectional skate blade profiles. Sixteen (n=16) University level hockey players were used in this double blind study looking at the perceived performance differences of four different skate blade profiles. No significant differences were found between skate blade profiles, preferred skate blade profile and time to complete given drills. Future research should look at different blade profiles and their interaction at ice level.

KEY WORDS: skate, blade, hockey

INTRODUCTION: The ability to skate faster, start and stop more proficiently, and be more agile than your opponent is a big advantage in ice hockey (Hoshizaki et al., 1989). The skate blade's ability to bite or hold on the ice during high intensity skills is crucial to allow the skater to perform required agility skills during a hockey game (Federolf et al., 2008). Very little research looking at cross sectional profiles has been done with the goal of optimizing the performance of skate blade/ice interface. Blackstone Sports has developed a new and innovative method for resurfacing skate blade profiles using a flat-bottom V shape rather than the more popular circular-shaped cut. The objective of this study was to document differences in perceived skating characteristics resulting from three different unique cross sectional skate blade profiles.

METHODS: Data Collection: Eighteen university level male hockey players (87.32 $\pm$ 6.04 kg) were recruited for this study. Four profiles were investigated: the subject's original profile, *105 x .05*, *90 x .75* and *80 x 2 (where the first number represents the width of the blade(in 100th of an inch) and the second number representing the depth of the cut (in 1000th of an inch))* .

Skating drills were also developed to isolate the important skating performance characteristic involved in ice hockey (Appendix B). These drills included starting, stopping, agility, short radius and long radius cornering both forward and backwards as well as acceleration and high velocity. These drills were also timed to identify performance differences between specific skills.

Drill description

#1 – Agility: Used Progressive high speed cornering, starts and stops with changes in direction around obstacles.
#2 – Power: Involved players taking tight corners. Quick acceleration-deceleration profiles which forced players to push skate blade cornering capabilities.
#3 – Start/Stop: Demanded the player accelerate and decelerate with Blade edge manipulation to help evaluate blade "bite."
#4 – Control: evaluated agility in backwards, lateral and forward skating following an arc in both directions.

Each participant repeated the drill three times under each of the different blade profiles including their own pattern. It should be noted that the players profiles were determined by asking each subject what profile they were using. Eight of the skaters identified a radius of ½

inch as their preferred sharpening profile. The others ranged from *3/8* inch radius to *1 ½* inch radius.

A five point Likert scale (performance perception) questionnaire consisting of eleven questions was developed to measure the athletes perceived performance differences during the various drills using the four different blade profiles. Upon completion of each drill, participants were asked to fill out the performance questionaire. Players were also encouraged to add their own comments regarding the skate blade performance during the skating drills.

Timing data was also collected for each participant during each drill for all four cross-sectional blade profiles.

A completely crossed repeated measures design with randomly assigned conditions was used. This study used a double blind protocol, meaning that neither the subjects nor the testers knew which profile was being used at any time in the study. This protocol was chosen to ensure that no artificial bias by either the subjects or the experimenters would influence the results.

Questionnaire Analysis:

The answers from the questionnaire were broken down in to 3 categories; negative, neutral and positive answers. Negative answers were defined by an answer to a question being either ‘strongly disagree’ or ‘disagree’, neutral answers were defined by ‘neither agree nor disagree’ and positive answers defined by answering either ‘agree’ or ‘strongly agree’. These categories were then summed together for each of the four blade profiles. A Performance Index with this data was determined by dividing the number of positive responses by the number of negative responses.

Statistical Analysis:

A spearman correlation was performed in order to see if there was any correlation between, the blade profiles, the preferred blade profile as chosen by the skater and the combined timing data.

RESULTS:

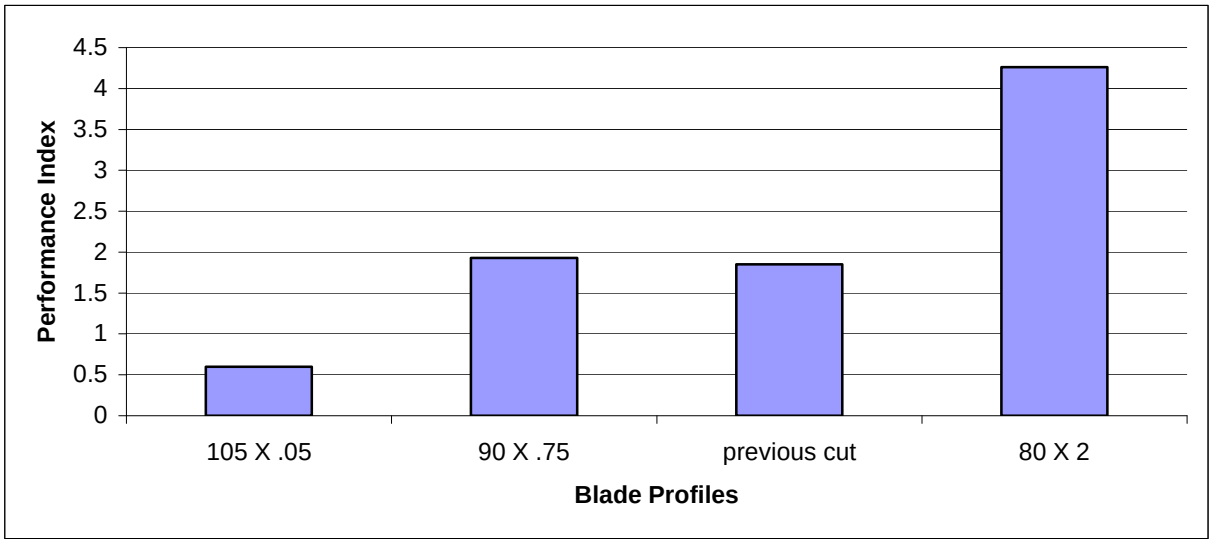

Figure 1: Shows the performance index scores for each blade profile.

The perception questionnaire identified the 80 x 2 profile as the one that player felt performed the best during the four drills (figure 1). It resulted in a performance index of 4.26. The next profile was the 90 x .75 at 1.93 followed by the prior profile at 1.85 and the 105 x .05 only scoring a score of .60. These results are telling in that the players prior cut was third

in perceived performance, which is unusual as players become very attached to their sharpening profile and often choose their existing profile over novel profiles.

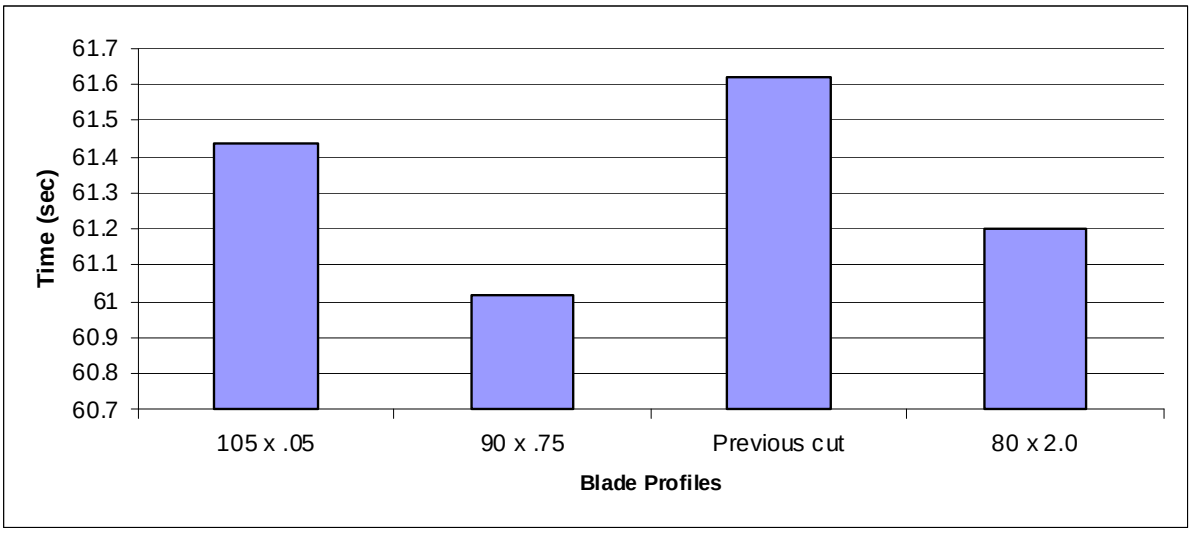

Figure 2: Shows the total average time to complete all four drills for each blade profile.

Timing data was collected on all subjects during all drills for each of the four blade profiles. It was thought that the players would perform faster on their previous profile due to the fact that they are familiar with this profile. The sum of the averaged times (figure 2) shows that all of the new blade profiles outperformed the previous blade profiles of the skaters. The 90 x .75 profile had the best combined total of 61.02 seconds followed by the 80 x 2 profile at 61.20 seconds, 105 x .05 at 61.44 and last was the subject's previous profile at 61.62.

At the end of the test session each player was asked to rate each profile in order of perceived performance and then to choose a profile as their final sharpening. The highest preference was their previous cut (38%) and this was expected as it is the profile they are most familiar. However the 90 x .75 rated second with 34% ahead of the 80 x 2 at 21%. When the subjects chose a profile to continue playing with after they left the study we found an interesting result. Tied for first choice was the 80 x 2 profile and their previous profile (29%). The third choice after their original profile was 90 x .75 (24%) as expected with the lowest choice being the 105 x .05 (18%).

After running spearman correlation, there were no significant differences found between the skate blade profile, the preference chosen by the skater and the timing data.

DISCUSSION: The results shown with the performance index demonstrated some very interesting findings. Surprisingly, the players previous cut was ranked third in perceived performance, which is unusual as players tend to become very attached to their sharpening profile and are often more resistant to equipment change. This being said, when given a choice of blade profiles that they could continue playing with, the player's previous cut ranked tied for first, proving that there may be a comfort zone among hockey players when it comes to the skate blade profile that they are used to playing with.

Though there were no significant differences in the timing data between the four blade profiles, it was quite surprising to see that the players' previous cut actually performed the worst. It was believed prior to the study that the 105 X .05 profile might perform the best in terms of time (speed) since this cut offered the least amount of resistance (according the Blackstone Inc.), however this was not the case. A cause for the higher than expected timing data could be related to the drills used in the study. The drills did not really include pure gliding, which would likely be this profile's forte. It is believed that this profile did not give the

players the balance they required to complete the drills efficiently, as it was described by many of the skaters as “too slippery“.

The players expressed that there was an easily perceived difference in performance in the profiles tested. When we look at the timing data however, it would seem that the preferred profile chosen by the players didn’t necessarily match their fastest time for a given drill. This is probably because in ice hockey overall skating speed is not necessarily the highest predictor of skating performance. Speed is important,however, it is unlikely the deciding factor if it meets a certain performance threshold. In this case, all profiles may have met the speed performance threshold. Once the speed threshold was met, other performance characteristics like purchase and control became more important in determining skating performance. This may also be a reflection of the drills chosen to test the performance of the different profiles. The drills were chosen to reflect the performance nature of the game of ice hockey and were not specifically designed to distinguish the contribution of the different sharpening profiles to velocity. This was important in order for the new innovation to be recognized as a real innovation that will make a difference in skating performance. The results definitely supported this with both the questionnaire and post test interviews. A number of subjects remarked that even when they chose their previous blade profile the Blackstone sharpening was superior to their existing sharpening.

CONCLUSION: As in most well crafted research this study created more questions then it answered. Even though we were able to establish that the Black Stone profile system provided real performance benefits the interaction between the blade profile characteristics and skating performance benefits remains vague.

It seems clear that there is an opportunity to tie the runner profile characteristics to specific skating characteristics. Research needs to be undertaken to identify the relationship between skate blade profile characteristics and specific improvements in skating performance. Presently the vast majority of ice hockey player use a ½ inch radius because it is what is available.

Future research

The first part would entail the development of precise measures to characterize the physical interaction between the various blade profiles (width of the flat bottom, the height of the edge and the angle of the edge) and the ice. There is also a need to document the expected performance characteristics of the profiles being developed. The second part would look at the development of a more refined test protocol to document the perceived performance benefits as well as the actual skating improvements. Once these relationships are understood it would allow Black Stone the opportunity to develop profiles for player using different styles of skating, different weight and needs.

REFERENCES:

Federolf, P.A., Mills, R. and Nigg, B., (2008), Ice Friction of Flared ice hockey skate blades, Journal of Sports Sciences, September; 26(11); 1201-1208.
Hoshizaki T.B., Kirchner R.K. & Hall K. (1989). Kinematic analysis of the talocrural and subtalar joints during the hockey skating stride. In C.R. Castaldi and E.F. Hoerner (Eds.), *Safety in Ice Hockey, ASTM STP 1050*, pp. 141-149.

Acknowledgement: Special thanks to Black Stone Sports for their support in this study.