

THE IMPACT OF SPORT-TINTED CONTACT LENSES ON HOCKEY PLAYER
PERFORMANCE

by

Michael Evan DeWit
and
Paul Hubert Payant

This paper is submitted in partial fulfillment of the
requirements for the degree of
Doctorate of Optometry

Ferris State University
Michigan College of Optometry

May, 2016

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Has been approved
 May, 2016

APPROVED:

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ACCEPTED:

Faculty Course Supervisor

Ferris State University
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ABSTRACT

Background: This research study explored the effect of sport-tinted contact lenses on collegiate hockey performance. Tinted contact lenses have been used in many outdoor sports, but little research has been done with these lenses indoors. Hockey is an indoor sport with very good lighting, and the ice surface can create visual distractions such as glare. For these reasons, testing was performed to uncover if sport-tinted contact lenses would improve hockey players visual acuity, contrast sensitivity, and subjective performance.

Methods: Seven hockey players were fit in Frequency-55 soft lenses. Using the Softchrome® tinting set, each player was given an amber, yellow, and clear set of lenses. LogMAR visual acuity was measured, along with contrast sensitivity using a Pelli-Robson chart. After wearing each lens at practice for one week, a survey was given asking the participant to evaluate their visual performance during practice.

Results: Statistical analysis showed no difference in mean LogMAR visual acuity or contrast sensitivity between clear and tinted lenses. The sole exception was a statistically significant difference in LogMAR visual acuity between clear and yellow lenses in the right eye. The surveys showed varied responses not favoring any particular lens.

Conclusions: Although tinted lenses did not objectively improve visual function, some players believed that the tinted lenses did improve performance. For hockey players competing at a high level, any way to improve visual performance is worth pursuing.

ACKNOWLEDGEMENTS

- 1) Statistical analysis was performed by Dr. Robert Buckingham, OD, PhD, FAAO
Michigan College of Optometry
- 2) Action hockey photos were taken by Dr. Philip Walling, OD Michigan College of
Optometry
- 3) Coordination of hockey players and rink availability by Bob Daniels, Head Coach,
Ferris State University Men's Hockey

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CHAPTER 1

INTRODUCTION OF SPORT-TINTED CONTACT LENSES

How might a contact lens improve an athlete's performance? To answer this question, it is important to first describe the vision of an athlete. It is easy to understand how the visual demands of an athlete may differ from that of the average person, but what exactly is different? Because of increased visual demands of the sport, it is necessary that an athlete's vision be superior - specifically that an athlete's visual acuity and contrast sensitivity be superior.¹ Do athletes exhibit superior visual acuity over the general population? The answer is yes, but only slightly. By comparing a study by Laby et al. (a study which measured the visual acuities of Los Angeles Dodgers) to a study by Elliott et al. (a study which measured the visual acuities of 18-24 year olds and 25-29 year olds), it was shown that the athletes did have better visual acuity, but only by a letter or two.¹ Do athletes exhibit superior contrast sensitivity over the general population? Again, the answer is yes, but these findings are worthy of further study. Laby et al. and Hoffman et al. found slightly superior contrast sensitivity in athletes but both studies used methods with inherent errors.¹ Kirschen et al. suggested that the superior vision found in athletes may be due to lower ocular aberrations. Therefore, they measured higher order ocular aberrations in professional baseball players and compared them to published norms, but only found a statistically significant difference in the trefoil. The difference, however, was equivalent to only a 0.031D spherical difference which is not considered clinically significant.¹ Studies have

shown that a professional athlete's vision is only slightly superior to the average person. Professional athletes may be looking for a way to further their visual advantage, and the general public's athlete may be looking for a way to improve his or her vision to match that of the professional athlete. This is where tinted contact lenses come in.

Perhaps the most notable tinted contact lens, that is no longer produced, was the Nike Maxsight®. The Maxsight® came in an amber tint and a grey-green tint. Nike and many other tinted lens manufacturers claim the lenses decrease glare and increase contrast sensitivity leading to improved vision. There are many tinted contact lens products available today. A simple internet search reveals many manufacturers which market amber, green, blue, grey-green, and yellow tinted lenses. According to one manufacturer, Orion Vision Group,² amber tinted lenses are ideal for baseball, softball, football, skiing, and watersports because the lenses block blue light (reduce glare) and accentuated red (aids a baseball player in seeing the stitches of the baseball). Blue tinted lenses also block blue light, but enhance yellow rather than red. A blue tinted lens is said to be ideal for tennis players. The grey-green lenses increase contrast sensitivity and offer sun protection and are marketed toward runners and golfers.² Spectral transmission curves of the Nike Maxsight® amber and grey-green lenses make it obvious that the contact lenses do, indeed, block certain wavelengths of light.³ The question that remains, however, is does this provide any measurable visual advantage?

A study by Eric Porisch investigated whether tinted contact lenses improved contrast sensitivity in 35 collegiate or professional football players.⁴ Utilizing an indoor clinical testing facility, Porisch found that although there was a statistically significant difference between the contrast sensitivity of an amber versus a clear lenses, there did not

appear to be a clinically significant difference.⁴ A study by Erickson et al.³ was completed to see if results similar to Porisch's study would be found if the testing was done outside - in sunny conditions similar to those experienced by athletes when on the field. Erickson's study compared both an amber lens and grey-green lens to clear lenses. As in Porisch's study, the amber and grey-green lenses showed statistically significant improvements over the clear lenses - this time in visual acuity and contrast sensitivity testing in natural sunlight conditions.

After reading these studies, the investigators of this report were curious how tinted contact lenses might affect visual function in an indoor, non-clinical, scenario. Hockey arenas are well lit and, therefore, have possible glare off both ice and boards. Hockey is a fast paced game, and one would surmise that any visual advantage one player might have over another would be valued. Knowing that tinted contact lenses have potential to improve visual function, this report investigates the impact of such lenses on collegiate level hockey.

CHAPTER 2

METHODS

Pretesting: Ten players from a division 1 collegiate male hockey team volunteered to participate in this IRB approved study (Appendix A). Volunteers were found with promotional material (Appendix B) after obtaining permission from the head coach of the hockey team. The participants consisted of both previous contact lens wearers and non-wearers. They all received a comprehensive eye exam from the Ferris State University Eye Center. Each player was fit in daily wear soft contact lenses (Frequency 55 contact lens produced by CooperVision®). Three pairs of lenses were ordered for each participant. Using the Softchrome® tinting set, one set of contact lenses was tinted amber and another set was tinted yellow. Photometry readings were obtained with all the amber contact lenses to measure the transmission of light through the lenses. This was performed to ensure that the same amount of tint was absorbed by each of the lenses. This same procedure was done with the yellow and clear lenses. Mean transmission achieved was $T=93.00\%$ through the clear lenses, $T=92.05\%$ through the yellow lenses, and $T=55.47\%$ through the amber lenses.

Visual Analysis: Once all of the lenses were tinted, visual acuity, contrast sensitivity, and BAT (Brightness Acuity Testing) was performed on each participant. All visual testing was done at the FSU hockey arena on the ice under game-time lighting conditions. Visual acuity was tested using a LogMAR chart at 20 feet, while a Pelli-Robson chart

was used to determine contrast sensitivity. BAT testing was performed monocularly over each set of contact lenses using the LogMAR chart as well as the Pelli-Robson chart.

Player Survey: Once all objective testing was done, the participants wore each tint of lenses to practice for one week, then filled out a survey (Appendix C) describing how they thought the lenses affected their vision and overall performance. The order of lenses tried by the participant was randomly selected (clear, yellow, or amber). Once the participant was finished with all three pairs of lenses, they were asked if they had a preference as to which lens improved their performance.

CHAPTER 3

RESULTS

Over the course of the study, two of the initial participants were dismissed from the team, and therefore out of the study. One participant was a new contact lens fit, and was unable to adapt to contact lens wear, and was excluded from the study.

The mean LogMAR acuities for the right eyes of the participants were 0.17, 0.23, and 0.19 for the clear lens, yellow lens, and amber lens respectively (Table 1). The mean LogMAR acuities for the left eyes of the participants were 0.25, 0.21, and 0.19, while for both eyes the acuities were 0.16, 0.17, and 0.17 for the clear lens, yellow lens, and amber lenses respectively (Table 2).

Table 1

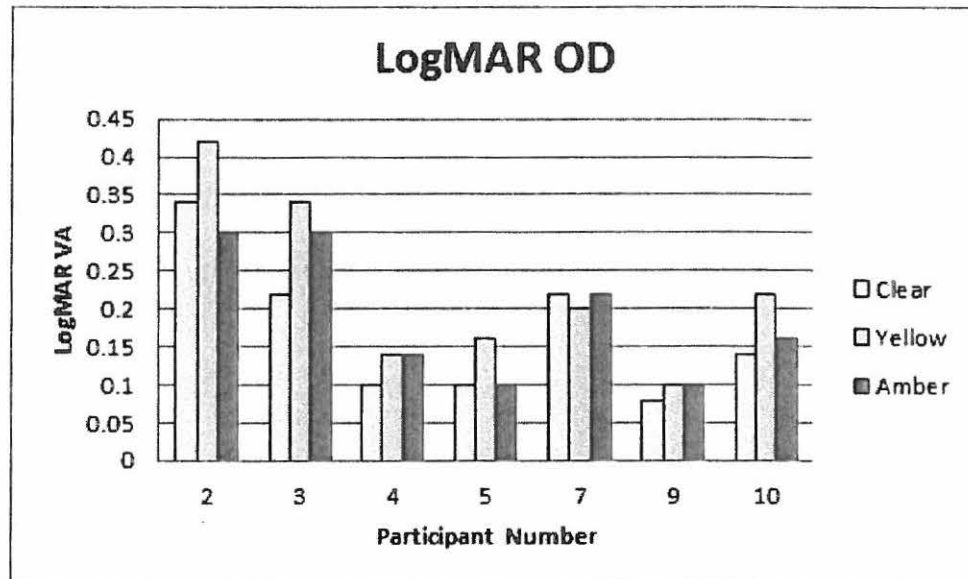
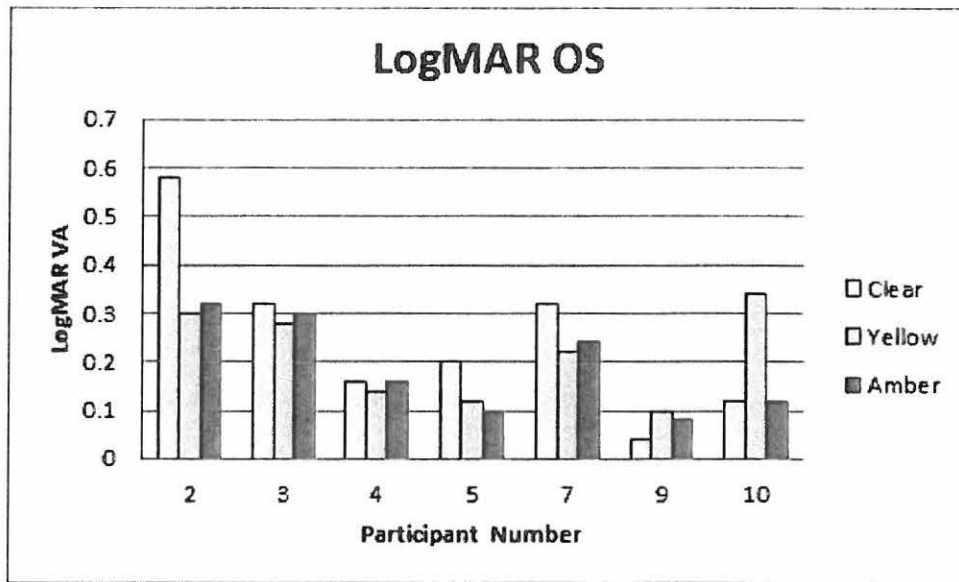


Table 2



The mean LogMAR acuity with the BAT (Brightness Acuity Tester) for the right eye was 0.19, 0.23, and 0.18 for the clear lens, yellow lens, and amber lens respectively. BAT testing done with the LogMAR chart over the left eye yielded acuities of 0.21, 0.20, and 0.19 for the clear lens, yellow lens, and amber lens respectively.

The mean contrast sensitivity for the right eye was 1.82, 1.78, and 1.82, while for the left eye it was 1.78, 1.82, and 1.86 for the clear, yellow, and amber lenses respectively (Table 3, Table 4). Mean contrast sensitivity for both eyes was 1.86, 1.95, and 1.93 for the clear, yellow, and amber lenses respectively.

Table 3

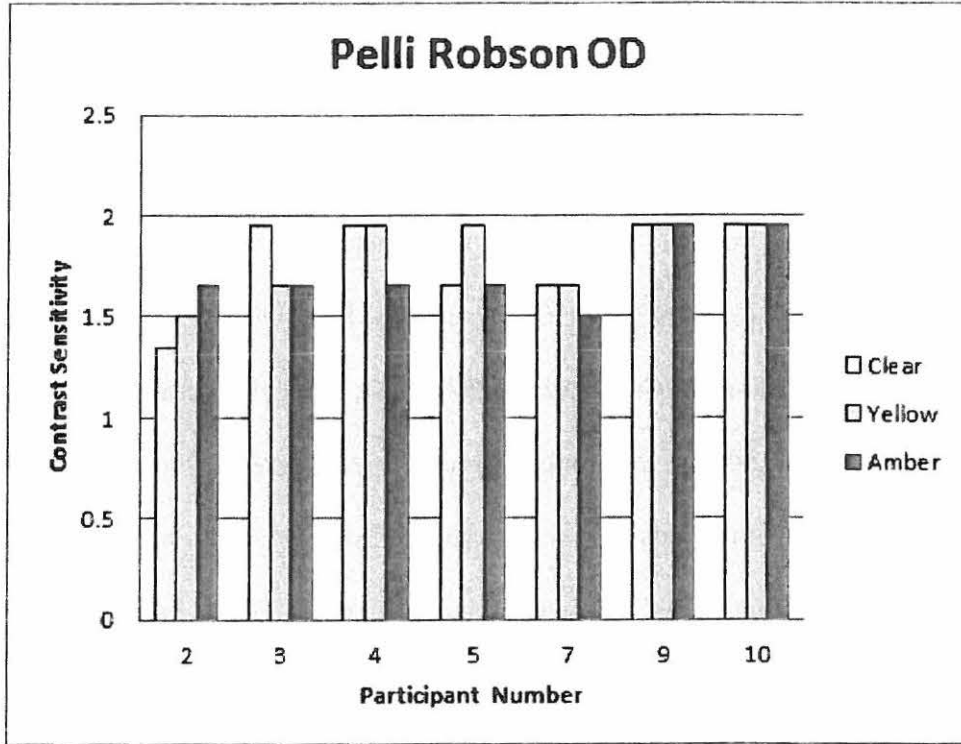
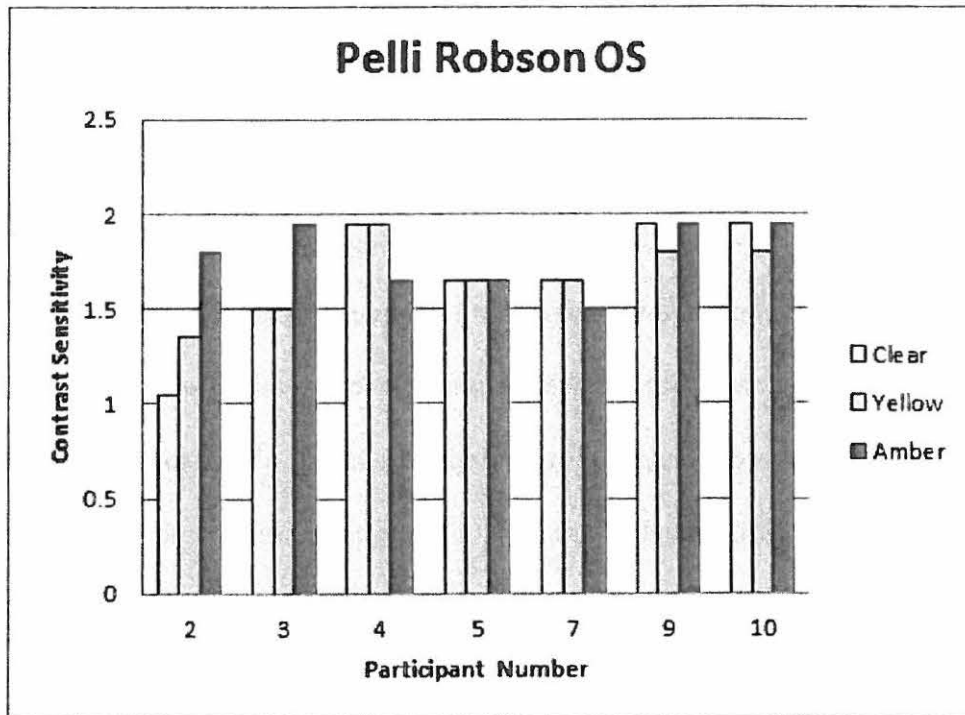


Table 4



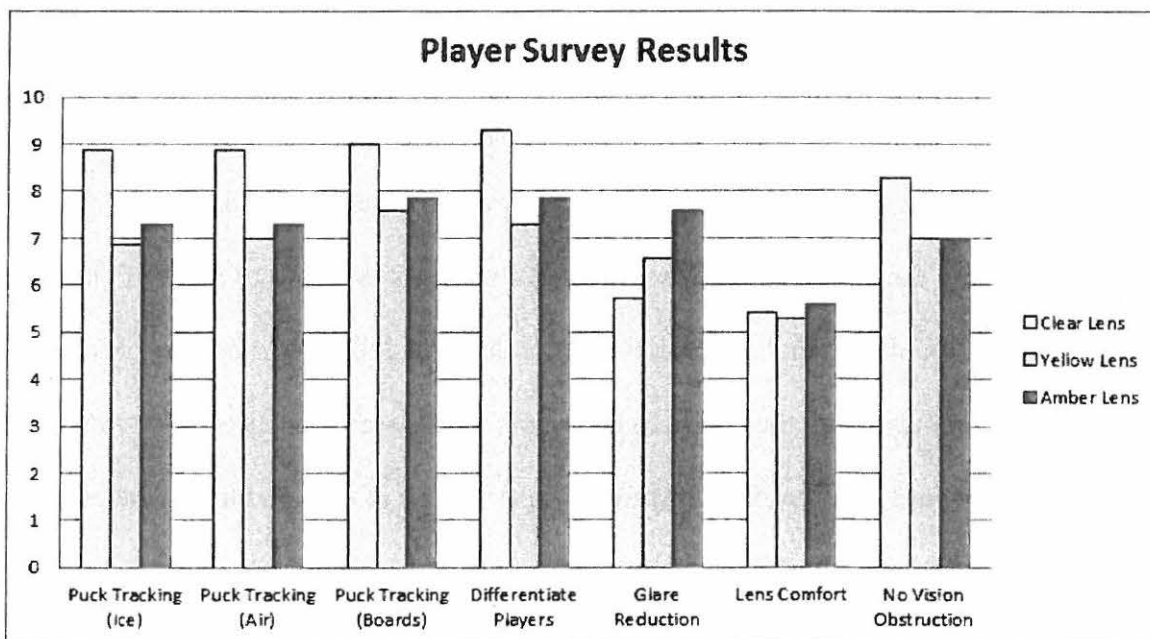
Lastly, the mean contrast sensitivity with the BAT for the right eye was 1.78, 1.90, and 1.71, while for the left eye contrast sensitivity was 1.67, 1.67, and 1.78 for the clear, yellow, and amber lenses respectively.

A one-way repeated measures analysis of variance (ANOVA) was conducted to compare clear, yellow, and amber contact lenses on LogMAR OD, LogMAR OS, LogMAR OU, LogMAR BAT OD, LogMAR BAT OS, Pelli-Robson OD, Pelli-Robson OS, Pelli-Robson OU, Pelli-Robson BAT OD, and Pelli-Robson BAT OS. The only statistically significant difference found in this study was a decrease in LogMAR visual acuity in the yellow lens OD when compared with the clear lens OD. A paired samples T-Test revealed there was a statistically significant difference in the mean logMAR OD for clear contact lenses ($M=.1714$, $SD=.09371$) and logMAR OD for yellow tinted contact lenses ($M=.2257$, $SD=.11473$); $t(6) = -3.138$, $p = 0.020$. There was not a statistically significant difference in the mean LogMAR OS, LogMAR OU, LogMAR BAT OD, LogMAR BAT OS, Pelli-Robson OD, Pelli-Robson OS, Pelli-Robson OU, Pelli-Robson BAT OD, and Pelli-Robson BAT OS for any combination of clear, yellow, and amber contact lenses.

The survey results varied widely from participant to participant. The mean score between all participants was taken for each question (Table 5). Overall the clear lenses scored highest on ability to track the puck on ice, in the air and on the boards. The clear lenses also scored highest on improving the player's ability to differentiate players as well as decreasing visual obstruction. The amber lenses scored highest on overall glare reduction as well as lens comfort. When asked which lens the player preferred overall,

two players preferred the clear lenses, two players preferred the amber lenses, one preferred the yellow lens, one preferred no lenses, and one had no preference.

Table 5



CHAPTER 4

DISCUSSION

Although results are inconclusive, there does appear to be some individual preference for tinted contact lenses among hockey players. Other than a slight decrease in visual acuity for the right eye when wearing a yellow tint, this study found no deleterious effects from tinted lenses either on overall vision or hockey skill performance. In addition, the amber tinted lenses elicited comments in regard to reduced glare. Taking into account this small sample, it appears that tinted lenses for hockey players warrant further study. With the ability to tint lenses with varied transmissibility with the in-office kit, it would be interesting to study a larger variety of tints and transmissibility to perhaps obtain a “sweet spot” for hockey players. Another area of study could be related to position; for example, do goalies desire a different tint compared to other players?

As with any fast moving sport using a high velocity object such as a hockey puck, visual performance is vital to success, particularly at the higher levels. Players at the Division I college level are looking for any small edge to improve their performance, and tinted contact lenses may provide that edge.

REFERENCES

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APPDENDIX A

IRB APPROVAL LETTER

To: Dr. Bruce Morgan, Dr. Chad Rosen
From: Dr. Stephanie Thomson, IRB Chair
Re: IRB Application #140803 (Title: *Sport-tinted Contact Lenses Impact on Hockey Performance*)
Date: September 23, 2014

The Ferris State University Institutional Review Board (IRB) has reviewed your request for revisions to include a student investigator on your approved project, "*Sport-tinted Contact Lenses Impact on Hockey Performance*" (#140803) and approve these requests. As a reminder, your project was originally approved on August 29, 2014 under an expedited review and you may continue to collect data according to the procedures outlined until August 29, 2015

Your project will continue to be subject to the research protocols as mandated by Title 45 Code of Federal Regulations, Part 46 (45 CFR 46) for using human subjects in research. It is your obligation to inform the IRB of any changes in your research protocol that would substantially alter the methods and procedures reviewed and approved by the IRB in your application. Thank you for your compliance with these guidelines and best wishes for a successful research endeavor. Please let us know if the IRB can be of any future assistance.

Regards,
Ferris State University Institutional Review Board
Office of Academic Research, Academic Affairs

APPENDIX B

PLAYER RECRUITMENT FLYER

Sport-tinted Contact Lenses' Impact on Hockey Performance

The purpose of this study is to determine if sport-tinted contact lenses will improve hockey performance. Tinted contact lenses have been used in many outdoor sports, but there has been little research done with these lenses indoors. Hockey arenas are very well lit, so the researchers (Dr. Bruce Morgan, Dr. Chad Rosen, and Michael DeWit) believe the lighting is appropriate for the use of tinted lenses indoors.

Taking part in this study is completely voluntary. You do not have to participate in this study if you do not want to and you may leave at any time without consequence.

You are eligible to participate in this study because you play college hockey.

If you agree to be part of this study, you will be asked to complete a comprehensive eye examination, including being fit for contact lenses. High and low contrast visual acuity testing and brightness acuity testing will be performed while wearing differently tinted contact lenses at the ice arena. Additionally, you will be asked to wear each of three pairs of contact lenses while at practice for one week (contacts worn include a clear pair, a yellow pair, and an amber pair). At the end of each week, you will fill out a survey regarding the performance of the lenses worn during the past week.

The study will take place during the 2014-2015 pre-season. Your participation will be over once each of the three pairs of lenses have been worn for a week of practice and each survey has been completed.

If you're interested in participating in this study, please sign up below, participation will be limited to the first 12 players to volunteer:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

APPENDIX C
PLAYER SURVEY

Player's Survey

1. Which lenses did you wear this week during practice? Clear lenses Yellow Lenses Amber lenses

For questions 2-5, please rate your impressions of the lenses you wore this week during practice.

Please note: 1 = Very poor performance, 10 = Excellent performance

- | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|----|
| 2. Ability to track puck while it's on the ice | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3. Ability to track puck while it's in the air | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4. Ability to track puck while it's against the boards | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5. Ability to differentiate teammates and opponents | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

For questions 6 and 7, please rate your agreement with the given statements.

Please note: 1 = Strongly Disagree, 10 = Strongly Agree

- | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|----|
| 6. These lenses reduced the light reflected off the ice (reduced glare) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 7. These lenses were generally comfortable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 8. These lenses did not obstruct my vision | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
9. Please provide additional comments regarding the lenses you wore this week:

Please answer question 10 ONLY if this is your last survey to fill out (you've now worn each of the 3 pairs of lenses for a week of practice).

10. If you had to choose one pair of lenses to wear for the rest of the season, which lens would you pick?

Clear Lenses

Yellow Lenses

Amber Lenses

No Lenses

No Preference