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Professional soccer goalkeepers performance: Study of goalkeeping performance with Nike Maxsight contact lenses

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Methods: Fifteen goalkeepers (13 first time contact lens wearers) at the Professional Goalkeepers Camp in Alsagers, England, aged 18-41, practiced for one week wearing the Amber MaxSight CL and completed a subjective questionnaire. During that week, 9 goalkeepers participated in a controlled study of goalkeeping performance while wearing the MaxSight CLs compared to clear Optima 38 CLs. Each athlete defended the goal from a simulated obstructed-view free kick; the goal keeper acting as his own control. A subjective questionnaire was completed after participating in the study.

Results: Goalkeeping performance was not enhanced while wearing MaxSight CLs compared to clear Optima 38 CLs ($p<0.21$) under varying natural light conditions. Subjectively, athletes did report an improvement in visual comfort in varying weather conditions, a mean value of 4.46 (SE 0.13) in sunny conditions and 4.36 (SE 0.22) in overcast, rainy conditions on a 5-point scale of visual comfort. The goalkeepers preferred the MaxSight CL to the clear Optima 38 graded on the same 5 point visual comfort scale. While wearing the MaxSight CLs, the participants reported no distortions, physical discomfort, and improved ability to track the ball.

Conclusions: There was no statistical difference in objective performance by the goalkeepers while wearing the Amber Maxsight CL compared to clear Optima 38 CL in varying weather conditions. There was a subjective difference in visual comfort while wearing the MaxSight SCL.

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Professional Soccer Goalkeepers Performance: Study of Goalkeeping Performance with Nike MaxSight Contact Lenses

By

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Yer Vue

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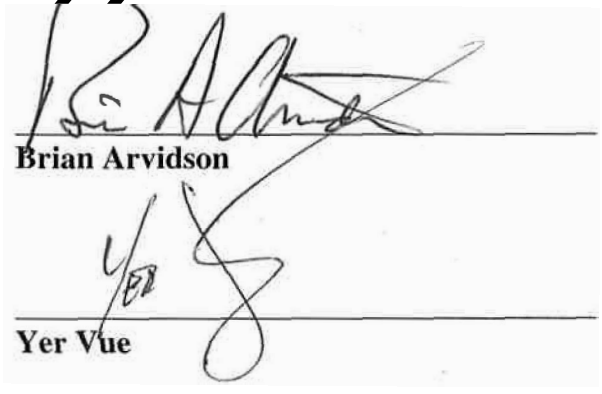

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Brian Arvidson was born in Ellsworth, Maine, but grew up in Pendleton, Oregon. He traveled extensively in South America while attending Lewis & Clark College where he earned a degree in biochemistry in 1999. After working as an American Heart Association Fellow in a retrovirology laboratory, he accepted a position as a researcher at Oregon Health and Sciences University.

Brian will earn his doctorate in optometry from Pacific University in 2007. As an optometry student Brian was an active member of AOSA, coordinating the Pacific lecture series which brought guest speakers to address the student body. He was involved in sports vision participating in projects coordinated with Nike and traveled to Guatemala with the humanitarian Arnigos group. Brian accepted a position at State University of New York College of Optometry where he did research on psychometric glaucoma test protocols and presented the initial findings at the AAO annual conference in San Diego. His current projects include a case study on new treatments of CNV with angoid streaks for publication and applications for residency programs. He is also a member of Beta Sigma Kappa National Honors Society and plans to complete a residency in ocular disease after graduation. He currently lives in Portland, Oregon with his wife and son.

Yer Vue was born in Thailand and raised in Spokane, Washington. He attended Eastern Washington University where he earned his B.S.W in Social Work. As an undergraduate student, Yer was involved in a biology research group which studied the growth patterns of snowberries in unburned and burned habitats. Yer will earn his doctorate in optometry from Pacific University in 2008. Currently, he is involved in a research thesis on developmental eye movements with the Reading Plus Program. He is currently a member of the AOA, NOSA, AMIGOS, and Sports Vision Club. He plans to return to Washington to practice optometry.

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Conclusions: There was no statistical difference in objective performance by the goalkeepers while wearing the Amber Maxsight CL compared to clear Optima 38 CL in varying weather conditions. There was a subjective difference in visual comfort while wearing the MaxSight SCL.

Key Words: sports, performance enhancement, tinted contact lens, soccer, MaxSight, sun eyewear, vision

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Introduction

Visual information processing plays an important role in sports performance. Individuals who are able to perceive objects clearly can react to the stimulus much quicker and more efficiently, thereby reducing visual reaction time. Visual reaction time is the minimum amount of time necessary for a person to respond to a given visual stimulus.' A short visual reaction time is especially desirable for those involved in professional sports. If an athlete can reduce their reaction time during a competition, he or she will have a greater advantage over their opponent. For example, in a soccer match, a split-second decision for a goal keeper can result in a world class save or a heartbreaking loss.

One important factor that may significantly reduce visual reaction time is with the use of sun eyewear. Sun eyewear can help reduce glare, brightness and help improve visual reaction time. The use of sunglasses in bright conditions is often recommended because it potentially enhances visual performance by reducing undesirable glare and illumination that can affect an individual's performance. Moreover, sunglasses can help prevent premature aging of the eye by filtering out harmful rays emitted by the sun. The ocular structures such as the cornea, lens, and retina absorb certain wavelengths of solar radiation that may be potentially hazardous. The blue end of the visible spectrum and UV light have been implicated in causing retinal photodamage.[3] Despite the filtering effects of the other ocular structures, the retina is still exposed to radiation between 400 and 1400nm. Prolonged exposure to high levels of blue and UV light may be related to the development of age-related macular degeneration and has been suggested to have a deleterious effect in certain retinal dystrophies.[4]

The use of sunglasses has been mostly limited to non-contact sports because of the increased risk of ocular injuries associated with frame and lens breakage. Therefore, athletes who participate in contact sports are more susceptible to ocular injuries and certain retinal dystrophies due to prolonged sun exposure. Tinted contact lenses (CLs) offer a potential solution to the need for light filtration in sports. Many athletes who participate in outdoor sports also have to contend with a significant amount of glare from the sun or artificial lighting. A study on lighting in sports arenas states that excessive luminance contrast in an interior can cause glare.[2] Moreover, an unacceptably high

luminance source in a field of view will react negatively on the human visual system. The luminance contrast is important in sports lighting because it incorporates the variation in luminance between an object and its background. Therefore, tinted CLs would be very advantageous for athletes who compete in stadiums where they must react in the shortest amount of time possible. A study by Richards states that the optimum level of lighting for good, comfortable vision is about 1400 cd/m^2, which is equivalent to the intensity of full sunlight under a shade.[9]

Aside from the many advantages sunglasses provide, there are many disadvantages that we also must consider. Disadvantages include peripheral lens distortion, lens edge image doubling or scotoma, restricted/reduced field of view, peripheral light leakage, lens surface reflections, frame discomfort, fogging or scratching of the lens, and sweat, precipitation, and debris build-up on the surfaces of the lens.[8] Due to these and many other contributing factors, sunglasses are not often the recommended eyewear modality in contact sports. .

The use of tinted CLs is emerging as an excellent alternative to sun eyewear because it eliminates many of the disadvantages of sunglasses. More importantly, tinted CLs still possess all of the important features while giving more comfort, visual performance, and weight reduction. The Nike MaxSight tinted contact lens is a recent product designed to enhance visual performance in bright light. However there has not been any previously published studies demonstrating a distinct performance advantage for a soccer goalkeeper while wearing a tinted contact lens. The purpose of this study is to determine whether a goalkeeper will perform better on objective and subjective measures of goalkeeping performance with the Nike MaxSight CL compared to a clear contact lens.

Materials and Methods

All testing was performed at Manchester Metropolitan University at Alsagers, Cheshire, United Kingdom; Latitude 53°1'52" N and Longitude 2°17'28"W at 700 ft above sea level on July 6 and July 7,2005 between the hours of 2:00 and 5:00PM. The weather conditions varied from sun breaks to heavy overcast skies with occasional light and heavy rain. The illuminance of on-field conditions was measured with a photometer

and varied from 1,600 Lux to 14,000 Lux in the open and 120 Lux to 1800 Lux under artificial shade conditions created by a standard 20ft long, 12ft wide and 8ft tall green canopy manufactured by Coleman.

Fifteen male subjects ranging in age from 18 to 41 participating in the Professional Goalkeepers Camp held at Manchester Metropolitan University at Alsagers were selected to participate in the study; two had previously worn contact lenses and 13 were first time contact lens wearers. Each subject had better than 20125 visual acuity as measured on a Bailey-Lovie acuity chart at 10 feet. Six subjects wore the Amber MaxSight CLs only during training sessions and completed a Post-Camp questionnaire (Appendix 1) regarding subjective impressions of the lens; nine subjects participated in a controlled experiment to assess goalkeeping performance while wearing Amber MaxSight CLs and clear Bausch & Lomb (B&L) Optima 38 CLs. The Nike MaxSight CL is a specially tinted Optima 38 lens. The athletes participating in the controlled experiment were also asked to complete a MaxSight goalkeeping study questionnaire (Appendix 2) regarding subjective impressions of the two lenses during the testing.

Procedure

Each subject was asked to defend a standard sized regulation soccer goal wearing the Amber MaxSight CLs for one trial, and the clear B&L Optima 38 CLs for the other trial. The subjects defended the goal while regulation balls were delivered toward the goal using a JUGS soccer ball delivery system manufactured by JUGS International, Tualatin, Oregon, USA (Figure 1). The balls were launched to four specific locations within the goal. The location within the goal where the ball was delivered and the sequence of CL testing was predetermined via counter balancing to insure equality of target presentations at each test location and to counterbalance any learning effects.

A platform was designed with four unique stop positions for the JUGS delivery system to launch soccer balls to the identical four areas within the goal for each trial. The apparatus was staked into the ground to insure that the initial delivery point remained constant (Figure 2). The unique set positions were designed so that the ball could be delivered to the same four designated locations (upper left corner, upper right corner,

lower left corner and lower right corner) within the face of the goal each time the ball was launched.

A solid green screen (33 inches wide by 72 inches tall) was constructed to obstruct the goalkeepers view of the JUGS platform limiting visual cues as to initial ball trajectory until a designated distance from the face of the goal (Figure 3). Each trial was designed to simulate a free kick opportunity in which the goal keeper's view of the shot trajectory was blocked by a human wall. To further facilitate the scenario, the goal keeper was given a verbal count down (3-2-1 and then the ball was released) to prepare the athlete before the ball was served, simulating the keeper's ability to see a player approach the free kick before it is struck, but obscure the initial trajectory until the ball clears the wall.

The JUGS ball delivery system was positioned 67 feet from the end line and centered with respect to the goal face. The solid, adjustable green screen was located 17 feet in front of the JUGS system and 50 ft from the face of the goal. The canopy was positioned to create an artificial shadow over the JUGS and the obstruction. Each ball was delivered at 60 MPH (verified by a speed gun positioned directly behind the goal face) creating a very challenging scenario in which the goalkeeper has roughly 568 ms to recognize the ball trajectory, process the information and make a defensive motion to defend the goal.

The testing protocol consisted of three practice shots (red soccer balls) to get the subject acquainted with the task requirements, and 2 sets of 27 test shots (white soccer balls) to the four predetermined locations; one set of 27 test shots were performed with the Amber MaxSight CLs and one set with the clear B&L Optima 38 CLs (Appendix 3). Scoring of the athlete's performance was developed by a former goalkeeper with a strong working knowledge of the demands of a goalkeeper; the former goalkeeper was the sole individual grading all trials. A score was assigned to the athlete's performance on each target presentation. The score was based on a nine point grading criterion developed by the scorer for all participant trials (Appendix 4).

The following instruction set was given to each participant before the first red, practice soccer ball was launched:

"Please listen carefully to the following instructions. Please let me know if you need me to repeat any of the instructions, because I cannot elaborate beyond these set of instructions.
"For each shot, assume that you are defending against an obstructed-view free kick from about 20 meters directly in front of the goal. Just before each shot, a verbal countdown of '3-2-1' will be given. The ball will be struck and you will see the ball as it passes the obstruction. You will face 2 series of 27 shots, one series while wearing the MaxSight contact lenses and one series while wearing clear contact lenses. You will be given a rest periodically throughout the testing. Remember, you must be prepared to defend the entire goal. If for any reason you need to pause during a series of shots, please let us know.
"You will be given **3** practice shots to familiarize you with the test protocol. .
"Do you have any questions?"

After completing each trial, the subjects were given a MaxSight Goalkeeping Study Questionnaire (Appendix 2) for a subjective comparison of performance while wearing the different contact lenses.

Results

The experimental procedure provided three objective conditions to be compared individually, paired and as a whole to determine the significance and interaction of the different conditions using ANOVA statistics. The type of contact lens worn (MaxSight versus clear Optima 38) was condition 1. The location of the shot position within the goal face (upper right, upper left, lower right and lower left) was condition 2. The number of test presentations (shot 1 through 54) was condition 3. A set of subjective questionnaires was developed to quantify the participant's feedback regarding performance enhancement and ocular comfort while wearing the lenses. The objective and subjective results are summarized below.

Objective Results

In condition 1, the goal keeper performance was compared without regard to shot location or test shot within the sequence while wearing the Amber MaxSight and Clear

B&L Optima 38 contacts with a result of 16.41 sum of squares and mean sum of squares with 1 degree of freedom. The interaction effect within the group was 1.86 and a p-value of 0.210. No statistical difference was determined based on athlete performance while wearing the MaxSight versus the Optima 38 CLs.

The variance of condition 2 within the performance of the goalkeepers with respect to the location of the shot within the goal face regardless of which contact lens the subject was wearing or which trial within the sequence was compared. The variance resulted in a sum of squares of 196.88 and a mean sum of squares of 65.62. The interaction effect was 8.81 and a p-value of 0.00 demonstrating that test location was a determining factor in athlete performance. Participants performed better on targets presented to the lower right in the goal.

The performance on each shot within a set of 27 presentations, condition 3, was compared to assess the within group variance to rule out fatigue or a learning curve regardless of the goal keepers contact lens or the location of the shot within the goal face. The results were a sum of squares equal to 28.145, and a mean sum of squares equal to 4.69 with 6 degrees of freedom. The individual trial interaction effect within the group was 1.31 and a p-value of 0.273 showing that fatigue and/or a learning curve were not altering performance throughout the testing protocol.

The between group variance was analyzed to assess the influence of each individual factor on the statistical results. When looking at the effect of Condition 1 . (MaxSight vs clear Optima 38) and Condition 2 (shot location) on each other in terms of interaction and statistical significance, the sum of squares was 5.12 and the mean sum of squares was 1.71 with 3 degrees of freedom. The between group interaction effect was 0.27 with a p-value of 0.850 demonstrating that the test shot location had no underlying bearing on the athlete's performance while wearing MaxSight or Optima 38 CLs.

The influence of Condition 1 (MaxSight versus clear Optima 38) and Condition 3 (presentation within the trial sequence) were compared to see the influence between the two groups. The results were 23.64 sum of squares and 3.94 mean sum of squares with 6 degrees of freedom. The between group interaction effect was 0.92 with a p-value of 0.488 with no change in athlete performance throughout the test while wearing either the MaxSight or Optima 38 CLs.

Condition 2 (shot location) and Condition 3 (presentation within the trial sequence) were analyzed and resulted in a sum of squares of 74.94 and mean sum of squares of 4.16 with 18 degrees of freedom. The between group interaction effect was 1.23 with a p-value of 0.246 showing that performance was not affected based on test location and number of test shots presented throughout the testing protocol.

When all factors (Condition 1, 2, and 3) were compared for significance using ANOVA, the sum of squares equals 160.13 and the mean sum of squares equals 8.89 with 18 degrees of freedom. The between group interaction effect was 2.32 with a p-value of 0.003 when considering all variables and their influence on each other. The contact lens worn, shot location and test presentation did have an overall influence on performance most likely due to the statistically significant improvement in performance when the ball was launched to the lower right corner of the goal (See Table 1 for summary of results.)

Subjective Results

Each athlete was given a Post-camp questionnaire and a Study questionnaire evaluating subjective visual comfort while wearing MaxSight in various environmental conditions and while participating in the study. Visual comfort was grade on a scale from 1 (lenses performed poorly) to *5* (lenses performed well) with 3 being median visual comfort. In the Post-camp questionnaire the comparison was between visual comfort with the MaxSight lens versus without any lens, and the Study questionnaire looked at visual comfort during the controlled study with the MaxSight lens versus with the clear Optima 38 lens.

The 15 athletes who tried the MaxSight lens during practice throughout the week of the Professional Goalkeepers camp were given the Post-camp questionnaire and asked to evaluate their visual comfort. Participants were asked to rate their visual comfort in bright, sunny conditions and overcast conditions while wearing the MaxSight lens. In both environmental scenarios, the athletes responded that their visual comfort was well above average receiving a mean score of 4.46 in sunny conditions with a standard error of 0.13 and 4.36 in overcast conditions with a standard error of 0.22 (Figure 4).

Visual comfort was also assesseded after the athletes participated in the controlled performance study with the Amber MaxSight and the clear Optima 38 CLs. The mean visual comfort while wearing the MaxSight lens was rated as 4.375 with a standard error of 0.154, and 3.125 with a standard error of 0.375 while wearing the Optima 38 lens (Figure 5). The difference in visual comfort was statistically significant; the comfort with the MaxSight lens was rated more than 2 standard errors better than the Optima 38 while participating in the study.

Discussion

The Professional Goalkeepers MaxSight study was designed to objectively and subjectively evaluate whether a soccer goalkeeper has a performance edge defending a simulated free kick when the ball is played from shadows into bright sunlight while wearing the Amber MaxSight CL. Statistical analyses demonstrated that a goalkeepers performance was not significantly different based on the type of contact lens the participant wore. An objective performance benefit to the athlete was not supported by the statistics; the Amber MaxSight lens or the clear Optima 38 lens did not confer a significant advantage. As the weather was continuously changing from sunbreaks to light rain, we can further say that there was not a degrading effect on performance as a result of the contact lens being worn under any natural lighting conditions.

The location of the simulated shot on goal was significant, with the goalkeeper performing better on shots that were located down and to the right corner of the goal. This better performance was independent of the type of contact lens the athlete was wearing. As this was not the variable that we were investigating, the significance of this information is merely noteworthy.

The information that was more relevant to our investigation were the subjective comments of the goalkeepers regarding perceived performance enhancement or benefit from the use of the MaxSight lens. Upon analysis of the responses to our questionnaires, the athletes observed that the MaxSight lens did offer more visual comfort while practicing and participating in the controlled study. While wearing the MaxSight lens, the goalkeepers responded that their visual comfort was well above the median in both the bright sunlight and overcast conditions experienced during the week-long training

camp. The physical comfort of the lenses was also rated as comfortable which is significant since 13 of the 15 participants had never worn contact lenses before. No visual distortions were reported as a result of wearing either of the contact lenses.

There was a statistically significant difference between the visual comfort with the MaxSight lens versus the clear Optima 38 lens during testing, with the participants preferring the MaxSight lens. The athletes reported that "it does help in contrasting weather, the ball contrast is better" and that the lens "prevents squinting" and individuals "found them easy to use and beneficial." There were no negative comments recorded on the questionnaires regarding physical comfort, visual comfort o distortions. A testament to the perceived benefit of the lenses is that all 9 surveyed professional goalkeepers after the objective testing would be willing to use the MaxSight lenses during competition.

The original parameters of the study had to be modified due to significant variations in weather conditions ranging from momentary bright, sunny skies to overcast and light rain throughout the testing and training of the athletes participating in the study. This led to a lack of continuity of illumination conditions between participants, or even during individual trials. The variations in illumination did not allow for the MaxSight lenses to be tested under the original study parameters, but the modified study did show that there was no statistical drop-off in performance under any lighting conditions that a goalkeeper might face in competition while wearing the lenses. Furthermore, the athletes themselves subjectively felt that the lenses did enhance visual comfort during their practice sessions, and would consider using the lenses during competition because of the perceived benefit.

The hypothesis may still be valid that the MaxSight lens potentially provides performance enhancement by increasing contrast and reducing glare enabling faster visual information processing and a quicker response. This was a pilot study with a small sample size, and it was not conducted under the specific lighting conditions for which the study was originally designed. It is reasonable to assume that under better weather conditions with a larger sample size, the statistical analysis may reveal the MaxSight lens to have a measurable performance benefit. **A** ball played from out of a shadow into full sunlight may truly be detected, tracked and reacted to quicker by an athlete wearing the MaxSight lens; however, the conditions under which this study was performed at the

Professional Goalkeepers **Camp did** not **reveal** this benefit, **A** subsequent study under **more desirable conditions may** demonstrate **a measureable advantage for** the athlete.

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APPENDIX A

MAXSIGHT GOALKEEPING POST-CAMP QUESTIONNAIRE
PRO KEEPERS CAMP
July 4-8, 2005
MMU Alsager

Name _____ Date of Birth _____

Circle the number/answer that best fits your opinion.

Have you ever worn contact lenses in the past?
Yes No

Please rate the physical comfort of the MAXSIGHT contact lenses.
(5 = very comfortable; 1 = very uncomfortable)
5 4 **3** 2 1

Comments:

_____
_____
_____
_____

While wearing the MAXSIGHT contact lenses in a BRIGHT, sunny environment, please rate your visual comfort (example: eyes feel relaxed with minimal squinting)
(5 = performed well; 3 = average; 1 = performed poorly)
5 4 **3** 2 1

Comments:

_____
_____
_____
_____

How do you feel you were able to track the ball coming out of SHADOW while wearing the MAXSIGHT lenses?
Easier No difference Harder

Comments:

_____
_____
_____
_____

While wearing the MAXSIGHT contact lenses on an OVERCAST day, please rate your visual comfort (example: eyes feel relaxed with minimal squinting)

(5 = performed well; 3 = average; 1 = performed poorly)

5 4 3 2 1

Comments:

Do you notice any visual distortions caused by the MAXSIGHT contact lenses?

Y N

If so, please describe the distortions noticed.

Do you have any additional comments?.

THANK YOU

APPENDIX B

Full Sun *Partly Cloudy* *Light Overcast* *Heavy Overcast*

MAXSIGHT GOALKEEPING STUDY QUESTIONNAIRE
PRO KEEPERS CAMP
July 4-8, *2005*
MMU Alsager

Name _____ Date of Birth _____

Circle the number/answer that best fits your opinion.

Have you ever worn contact lenses in the past?
Yes No

How do you feel you were able to see the ball coming out of shadow while wearing the MAXSIGHT lenses, as compared to the clear lenses?
Easier No difference Harder

Comments:

_____
_____
_____

Please rate the physical comfort of the contact lenses.
(5 = very comfortable; **3** = moderate comfort; 1 = very uncomfortable)
5 4 **3** *2* 1

Comments:

_____
_____
_____

Did you experience any distortion of your vision with the CLEAR lenses?
Always Sometimes Rarely Never

Did you experience any distortion of your vision with the MAXSIGHT lenses?
Always Sometimes Rarely Never

Comments:

_____
_____
_____

While wearing the CLEAR lenses, please rate your visual comfort (example: eyes feel relaxed **with minimal squinting)**

(5 = performed well; 3 =average; 1 = **performed poorly)**

5 4 3 2 1

While wearing the MAXSIGHT lenses, please rate your visual comfort (example: eyes feel relaxed with minimal squinting)

(5 = performed well; **3** = average; 1 = performed poorly)

5 4 **3** *2* 1

Comments:

_____

_____

_____

After participating in the **study would you** wear MAXSIGHT **lenses during a match?**

very likely **maybe** never

Comments:

_____

_____

_____

***THANK** YOU!*

APPENDIX **C**
Pro Keepers Camp
4-8 July 2005
MaxSight vs Clear CL

Quadrant:
UR – Upper Right
UL – Upper Left
LR – Lower Right
LL – Lower Left

Score:
1 – Left Standing
2 – Lame Bunny Hop
3 – Half-Hearted Lateral Stutter
4 – Misfired Initiated Sequence
5 – Good Look; Set; & Launch
6 – Deflection Goal
7 – Deflection Soft Save
8 – Deflection Strong Save
9 – The Ultimate Save

Subject 1: _____ Lens __**MaxSight**__ Reach w/Gloves: _____

Quadrant **Sequence,** Cycle 1:

1	2	3	4	5	6	7	8	9
UR	**UL**	**LR**	**LL**	**LL**	**LR**	**UL**	**UR**	**LR**

Quadrant **Sequence,** Cycle 2:

1	2	3	4	5	6	7	8	9
UL	**LL**	**UR**	**LR**	**LR**	**UR**	**LL**	**UL**	**UR**

Quadrant **Sequence,** Cycle 3:

1	2	3	4	5	6	7	8	9
LR	**UR**	**LL**	**UL**	**UL**	**LL**	**UR**	**LR**	**LL**

Subject 1: _____ Lens __**Clear Lens**__

Quadrant Sequence, Cycle 1:

1	2	3	4	5	6	7	8	9
LL	**LR**	**UL**	**UR**	**UR**	**UL**	**LR**	**LL**	**UL**

Quadrant **Sequence,** Cycle 2:

1	2	3	4	5	6	7	8	9
UR	UL	**LR**	**LL**	**LL**	**LR**	**UL**	**UR**	**LR**

Quadrant Sequence, Cycle 3:

1	2	3	4	5	6	7	8	9
UL	**LL**	**UR**	**LR**	**LR**	**UR**	**LL**	**UL**	**UR**

APPENDIX D: Scoring Criterion Descriptions

1- Left Standing
Completely beaten, essentially without having initiated movement of more than half a step. The keeper knows he is the victim from the first sighting of shot. The shot was not possible to save, the anatomic system recognized such, and shut down effort.

2 – Lame Bunny Hop
Large motor units were loaded, ready to spring, but the slightest misread or hesitation results in a half-hearted effort of the shortest airborne possible. Save was not possible to begin with.

3 – Half-Hearted Lateral Stutter
Keeper has decent view, has locked, loaded, and pulled the trigger but mentally has serious doubt due to the immediate read of ball's initial airborne phase velocity and vector. The body posture begins strong; with apparent power, but the energy seems to immediately evaporate. Evidenced by significant but not gross airborne lateral movement. Appears to be pending a strong leap, but turns into a few lateral recovery steps.

4 - Misfired Initiation Sequence
Large motor groups are loaded and a good look is provided. However, a disconnect in the requisite signal path leaves the keeper in immediate realization that this short burst of momentum has been misdirected or poorly timed. Evidenced by a fast step or two off-line with quick forward airborne phase to load muscles. Directional movement proves just in error enough to immediately slump, knowing they've read the situation incorrectly. Head often goes down and there is no acknowledgement of the ball's presence as it sails by. Save is possible, though it would be spectacular.

5 – Good Look Set & Launch
Really going for it, full effort, completely laid out, full stretch. Still miss it, with perhaps just a slight touch. Save was possible but keeper cannot be faulted. Heroic if performed successfully.

6 – Deflection Goal
Same as #5 but with obvious hand/finger-to-ball contact that could have resulted in a spectacular save, but the momentum of the shot carries the ball into the net.

7 – Deflection Soft Save
Same as #6 but excellent sequencing of requisite skills results in a fingertip save. Shot trickles or sails just wide of frame (perhaps contacts frame).

8 – Deflection **Strong Save**
Same **as #7 but** at the highest percentile of all **sequences.** Results in keeper **appearing** to **have** known **where the** ball would **be** before **it got** there. Not caught, **but parried away with authority.** Sometimes **attacking** team **is** already **beginning** to anticipate **celebration only to have rug pulled** out by **pesky and** obviously **superior** lifeform **–** the **keeper. A** three-or-so **save per** season event for **even goad** keepers **who had no business** pulling off the **save!**

9 – The Ultimate **Save**
The **save of a lifetime. The world stops, or is at least reduced** *to* **super slow** motion. The keeper is so **far ahead of the curve that he may** catch it **clean but** it **doesn't matter. A** two-or-three-in-a-career **type save.**

Abbreviated scoring:
1 – Left Standing
2 **–** Lame **Bunny Hop**
3 – Half-Hearted Lateral **Stutter**
4 **–** Misfired Initiated **Sequence**
5 **–** Good **Look; Set;** & Launch
4 **–** Deflection Goal.
7 – Deflection **Soft Save**
8 – Deflection **Strong** Save
9 – The **Ultimate Save**

Table 1. ANOVA **statistical analysis** of variables in the **Amber** MaxSight Goalkeeper Study. Table **looks at each variable independently and codependently.** n.s. = **no significance.** Significant at $p<0.005$.

	Sum of squares	degrees of freedom	mean sum of square	interaction effect	p-value	statistical significance
Subjects	105.21	8				
MaxSight vs. Optima 38 (C1)	18.42	1	16.42	1.86	0.21	n.s.
Test location (C2)	396.89	3	65.63	8.81	0.00	**
Trials within sequence (C3)	28.3 5	6	4.69	1.31	0.27	n.s.
C1xC2	5.12	3	1.71	0.27	0.85	n.s.
C1xC3	23.65	6	3.94	0.92	0.49	n.s.
C2xC3	74.94	18	4.16	1.23	0.25	n.s.
C1xC2xC3	160.13	18	8.90	2.32	0.00	**

Figure 1. JUGS soccer ball delivery system manufactured by JUGS International, Tualatin, Oregon, USA.

Figure 2. Soccer delivery platform with JUGS ball machine located under artificial shade provided by a Coleman Canopy.

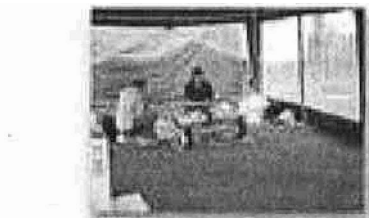

Figure 3. Image from Soccer ball delivery platform showing solid green adjustable screen and goal face in background.

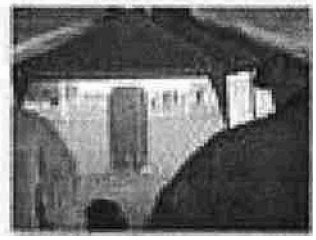

Figure 4. Subjective visual comfort of Goalkeepers while wearing Amber MaxSight soft contact lens during practice sessions at the Professional Goalkeepers Camp in varying weather conditions. Average visual comfort is noted for comparison with participants visual comfort while wearing the MaxSight contact lens. Two times the standard error is represented on the graph for significance.

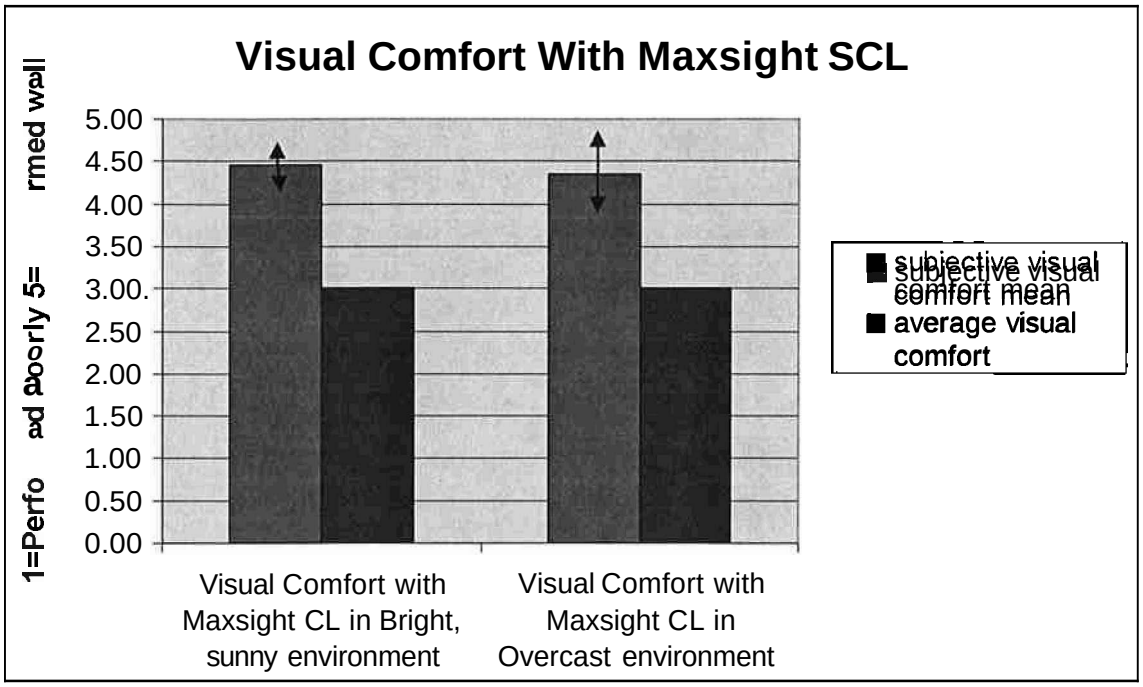

Figure 5. Subjective visual comfort of Goalkeepers **while wearing** either **the Clear** B&L Optima **38 SCL or Amber** MaxSight SCL during **testing. The** error **bars represent two times** the standard error.