5-1984

Consumer's choice in protective eyewear

John E. Picard
Pacific University

Christen Jankowski
Pacific University

Consumer's choice in protective eyewear

Abstract

Seventeen pairs of racquetball eyewear were tested for distortion and loss of field. Four of the seventeen eyewear produced twenty five percent or greater loss of field. Two of the eyewears produced less than one percent loss of field. None produced measurable distortion utilized by our measurement techniques.

Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

Norman S. Stern

Keywords

high velocity sports, distortion, visual field

Subject Categories

Optometry

Consumer's Choice in Protective Eyewear

In Partial Fulfillment of

the Requirements for

Doctor of Optometry Degree

Pacific University College of Optometry

May 1984

By

John E. Picard

Christen Jankowski

Advised by Norman S. Stern, O.D., Ph.D.

Consumer's Choice in Protective Eyewear

Grade A

By

John E. Picard

Christen Jankowski

Advisor

Norman S. Stern, O.D., Ph.D.

Acknowledgements

Our special thanks to the folllowing:

Dr. Norman Stern, who provided the guidance and stimulation of ideas which kept this paper going. Moreover, we'd like to give him our special thanks for the time, patience, and consideration that he has shown us. In all aspects, he is a true professional!

Penn Rubber Company, for providing equipment in support of our efforts.

Abstract

Seventeen pairs of racquetball eyewear were tested for distortion and loss of field. Four of the seventeen eyewear produced twenty five percent or greater loss of field. Two of the eyewears produced less than one percent loss of field. None produced measurable distortion utilized by our measurement techniques.

Key words: high velocity sports, distortion, visual field

Consumer's Choice in Protective Eyewear

Introduction

In the past fifteen years, there has been a large increase in the number of health oriented people. One of the consequences of this, is a growing number of participants in high velocity racquet sports. High velocity sports are those such as racquetball, handball, squash, and tennis, in which the ball travels upwards to ninety miles per hour. It has been estimated that the number of racquetball players alone has increased from 170,000 in 1972 to 1,400,000 in 1975.[1] Hirschfelder has estimated 30 million people play racquet sports. With this tremendous gain in the number of players, there has been an increase in the number of eye injuries produced from such sports.[2,7,8] In 1980, over 4,000 people reported to emergency rooms with racquet sports related injuries. The greatest rise in eye injuries has come from increased participation in racquetball, because the ball has a high peak velocity. However, this is not the only hazard since hitting oneself or being hit with the racquet is a distinct possibility. Insurance companies are beginning to recognize this increase in injuries and are strongly suggesting that racquet clubs insist players wear eye protection. If the clubs do not enforce such a policy, they may end up paying prohibitive liability insurance premiums.[5]

Eye protectors are especially necessary for racquet games, such as tennis, racquetball, and squash. The National Society to Prevent Blindness says that racquet sports are the leading catalysts to eye injuries. The eyeguard should optimally not only protect the eyes, but the temple area of the head as well. One of the problems cited in the Pacific University College of Optometry research thesis titled "The Consumer's Choice in Athletic Eyewear"[12] is that the optimum eyewear protection device may produce both distortion and/or loss of the visual field. What we have attempted to do in our study is to evaluate seventeen popular eyewear devices and determine objectively the amount of field loss and distortion that each one produced.

Methodology

The seventeen pairs of eyewear were subdivided into four categories. The four categories were predetermined by previous research done at Pacific University College of Optometry.[12] The categories were:

1. Protectors with lenses and temple bows molded into one piece.
2. Protectors that are lensless faceguards.
3. Protectors that are designed to be worn over street glasses.
4. Protectors with lenses, either plano or prescription (approximately conventional eyeglasses).

The eyewear was held in place by a device constructed at Pacific University that is normally used to instruct students in all aspects of frame adjustment. A Pentax Spotmatic

camera was mounted on a tripod behind the protective eyewear. A wide angle lens (28 mm) was mounted on the camera body and positioned fifteen millimeters behind the eyewear in an attempt to most closely approximate the human eye relative to the spectacle plane. The purpose of the camera was to give an objective measure of the distortion in the field and the decrease in the natural visual field. A grid consisting of equally spaced vertical and horizontal lines was focused at the near point of the lens.

Three pictures of the grid were taken monocularly without any eyewear in front of the camera. After counting the number of clear grid boxes that were present in all three pictures, an average was taken. This average value became our standard.

For our study, the standard grid consisted of two hundred sixteen clear boxes. Each of the seventeen eyewears was in turn placed in front of the camera (monocularly) and the grid was photographed three times. An average was taken, from the three photos per eyewear of the number of grid boxes missing. (In our study, half or more occlusion of a box constituted total field loss of that box.) The average number was then divided by the total number of clear boxes in the grid (216) and was multiplied by one hundred in order to obtain a percentage of field loss. To determine percentages of distortion, each of the three photos per eyewear was made into a transparency by a Thermofax process. These in turn were superimposed on a transparency of the standard

grid. In each superimposed photo, boxes that were not congruent with the standard grid were counted. All three countings (per eyewear) were totaled. A mean average (per eyewear) was taken and divided by the number of boxes in the standard grid. This was then multiplied by one hundred to give a percentage of the distortion of the eyewear.

Results

The results are listed below in tabular form.

Name of Eyewear	Category	# Missed Boxes	% of Field Loss
ProTec PTE 500	2	53	25
Criss Yank Sportsman	2	52	24
Criss S-10	2	48	22
Criss All-Amer (Blk)	2	38	18
Criss All-Amer (Wht)	2	20	9
Ektalon Court Goggles	1	11	5
ProTec Eye Armor	2	0	0
Pioneer Sports Specs	1	10	15
Ektalon Eye Sentry	4	3	1
PC Sportique Dix	4	6	3
Carrera Viper II	4	50	24
Uvex Sports Goggle	3	46	21
B&L Action Eyes	4	7	3
Rec Specs I-S	2	37	17
Rec Specs I-L	1	60	28
Mityguard-G	3	68	32
Rainbo All Sport	2	60	28

It can be seen from the table above, four of the eyewears produced twenty five percent or greater loss of visual field. These were the ProTec PTE 500, Rec Specs I-L,

Mityguard-G, and the Rainbo All Sport. Two of the eyewears produced field losses of one percent or less. These were the ProTec Eye Armor and the Ektalon Eye Sentry. None of the eyewear produced measurable distortion of the grid boxes as measured by our technique.

Discussion

One of the interesting points is that the loss of the visual field does not appear to be category dependent, but rather uniformly distributed. This would suggest that one particular category of eyewear does not appear to be better than another category. However, certain manufacturers eyewear in each category have a much larger field of view than the others. We don't know at this time what constitutes a significant loss of visual field, and how this effects the reaction time of the player. Further studies need to be conducted in order to determine how the decrease in the visual field correlates with the players performance. Since it stands to reason that the better racquet sports player hits the ball as far from center from the opponent as possible, this may require the use of the peripheral field in order to detect ball movement. Another finding is that there was no distortion, either barrel or pincushion, evidenced in the developed photographs. This is not to imply that such distortions do not exist, since the works of Matsuura and Thompson[12] give subjective evidence of such. Perhaps other testing methods of a more sensitivie nature could be employed to detect the amount of distortion generated.

Bibliography

1. Singerman, P. Racquetball: the hottest new game. Esquire, pp. 78-81, 1978.

2. Vinger, Paul F. Sports eye injuries - a preventable disease. Ophthalmology, February 1981.

3. Elmstrom, George. Advanced Management Strategies for Optometrists, p. 117, 1981.

4. Stone, Lois Greene. Eye-Eye, Sir. World Tennis, p. 17, February 1983.

5. Statement by International Collegiate Racquetball Association.

6. Eye protector study begun. Optometric Management, p. 5, March 1983.

7. Vinger, P.F. and Tolbin, D.W. Racquet sports an ocular hazard. JAMA, Vol. 239, pp. 2575-2577, 1978.

8. Stern, Norman S. The effects of racquetball impact on spectacles and lenses. Optometric Monthly, pp. 343-345, June 1978.

9. Frames catalog, December 1983.

10. Easterbrook, W. B&L Sports Vision Newsletter. Phys. and Sports Med., April/May 1981.

11. Farnsworth, C.L. Sports Vision Patients. Review of Optometry, pp. 64-68, March 1984.

12. Matsuura, S. and Thompson, D. The Consumers Choice in Athletic Eyewear. Unpublished doctoral thesis submitted in May 1983 at the Pacific University College of Optometry.