An Evaluation of Anisometropia and Amblyopia using the Playstation 3D

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Purpose

The use of 3D technology has been increasingly used to provide viewers with a more real life experience. We see this in movies all the way down to handheld devices like the Nintendo DS. Recently the use of 3D technology is also being used in the classroom to teach kids about math and science. It is a very powerful tool that can be used in helping kids to visualize what they are learning helping them to receive a better education. However, according to the AOA, up to 1 in 3 viewers cannot appreciate the use of 3D in many mediums. This is due to undetected visual problems that a person may not even know they have.

Anisometropia is one such visual problem that can cause a person to not appreciate 3D. Anisometropia can lead to suppression, which inhibits binocularity, a precursor for seeing 3D. Some cases of anisometropia can lead to amblyopia. Amblyopia can have a significant impact on the ability to learn and can even limit career opportunities which require good visual acuity in both eyes.

3D technology can be used as a screening tool to detect amblyopia. If caught early and treated, according to the AOA, 83% of cases of anisometropia can lead to amblyopia. Amblyopia can affect the ability to appreciate stereopsis using the Playstation 3D. Even anisometropia of just 0.50D or decreased acuity of only 20/25 in one eye caused an individual to be unable to see depth in applications of 3D. Additional studies should be performed to evaluate whether similar results can be found with other 3D technology such as movies, television, and phones and with a younger population of children. The results suggest that 3D technology can be a powerful tool in the early detection of visual disorders such as amblyopia and anisometropia in children. With proper education of parents, teachers, pediatricians, and other key players in childhood development, 3D technology may become a valuable probe into the visual system that can help to signal an issue and get those in need appropriate optometric care and therapy.

Methods

Fifty subjects ages 22-32 (avg. 25) were recruited from the student population at Southern College of Optometry. All participants exhibited minimal corrected visual acuity of 20/20 OD, OS, OU at near and stereoaucity of 25 seconds of arc on the Wirt circles using the Randot Stereotest. Subjects wore their habitual prescription glasses or contact lenses throughout testing.

The Playstation 3D game Sonic Generations used with stereopsis at 30%. Subjects were shown the Playstation game and were asked whether or not they could appreciate the stereopsis; only subjects that could appreciate the stereopsis on the game from the start continued. The dominant eye of each subject was identified by using the triangle test. The order of Procedures 1 and 2 alternated to reduce bias.

Procedure 1

While the subject played the Sonic Generations game, Bangerter occlusion foils were introduced in front of the subject’s dominant eye in the following powers in ascending strength: +0.50, +1.00, +1.50, +2.00, +2.50, +3.00, +3.50, +4.00, +4.50, +5.00, +5.50, +6.00, +6.50, +7.00, +7.50, +8.00. These powers were selected as they are the available foil powers. After 30 seconds, the subjects were asked to identify if they still appreciated stereopsis.

Procedure 2

While the subject played the Sonic Generations game, plus lenses were introduced in front of the subject’s dominant eye in the following powers in ascending strength: +0.50, +1.00, +1.50, +2.00, +2.50, +3.00, +3.50, +4.00, +4.50, +5.00, +5.50, +6.00, +6.50, +7.00, +7.50, +8.00. After 30 seconds, the subjects will be asked to identify if they still appreciated stereopsis.

Both procedures were continued until the subject reported a loss of stereopsis.

Results

The mean Bangerter foil endpoint at which subjects lost the ability to appreciate stereopsis was 0.288372 (SD=0.1066) and the mode was 0.3 (Snellen equivalent ~20/70). The mean plus lens endpoint at which subjects lost the ability to appreciate stereopsis was +2.04D (SD=0.741D) and the mode was +2.00D. Of the 50 subjects, 23 (46%) lost stereopsis at either 0.3 (20/70 Snellen equivalent) or 0.2 (20/100 Snellen equivalent) on the Bangerter foils. With the plus lenses, 48 of the 50 subjects (96%) lost stereopsis with lenses between +1.00 D and +3.50D. Subjects lost the ability to see stereo with as little as a 0.8 Bangerter foil (20/25 Snellen equivalent) and a +0.50 D lens in front of their dominant eye.

Conclusion

This study demonstrated that uncorrected anisometropia of 2.00D to 2.25D or a reduction in visual acuity to 20/70 in one eye affects the ability to appreciate stereopsis using the Playstation 3D. Even anisometropia of just 0.50D or decreased acuity of only

References

1. American Optometric Association [Internet]. http://3deyehealth.org/