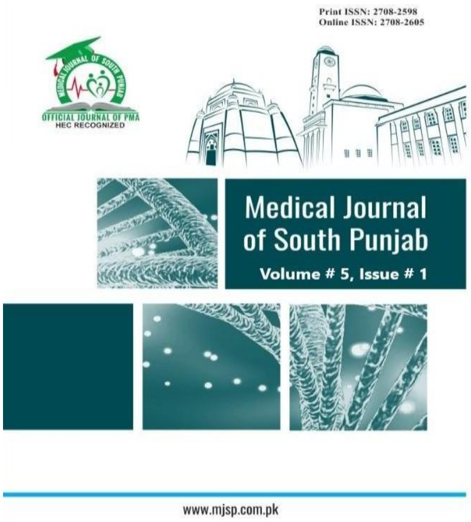
ISSN (E): 2708-2601
ISSN (P): 2708-2598

Medical Journal of South Punjab
Article DOI:10.61581/MJSP.VOL05/03/02

Volume 5, Issue 3, 2024



Comparison of filter lenses versus non filter lens on stereoacuity in high myopic patients

Publication History

Received: Jan, 27, 2024 Revised: May 23, 2024
Accepted: August 01, 2024 Published: Sep 30, 2024

Authors and Affiliation:

Nayab Bashir[1], Muhammad Anwar Awan[2], Wajeeha Boota[3], Aliya Khalid[4], Agha Saad[5], Sahla Riaz[6]

[1-4]The Superior University Lahore, Pakistan,
[5]Asif Eye Clinic, Lahore, Pakistan,
[6]Shalamar Institute of Health Sciences, Lahore, Pakistan

[*]**Corresponding Author Email**: drnayab8047@gmail.com

Conflict of Interest:

Author(s) declared no conflict of interest.

Acknowledgment:

No Funding received.

Citation: Bashir N, Awan MA, Boota W, Khalid A , Saad A, Riaz S. Comparison of filter lenses versus non filter lens on stereoacuity in high myopic patients. Medical Journal of South Punjab. 2024 September 30; 5(3):6-12.

Please scan me to access online.

An official publication of
Medteach Private Limited, Multan, Pakistan.
Email: farman@mjsp.com.pk, Website: https://mjsp.com.pk/index.php/mjsp

Medical Journal of South Punjab
Volume 5, Issue 3, 2024; pp: 6-12
Original Article

Comparison of filter lenses versus non filter lens on stereoacuity in high myopic patients

Nayab Bashir[1], Muhammad Anwar Awan[2], Wajeeha Boota[3], Aliya Khalid[4], Agha Saad[5],Sahla Riaz[6]
[1-4]The Superior University Lahore, Pakistan,
[5]Asif Eye Clinic, Lahore, Pakistan,
[6]Shalamar Institute of Health Sciences, Lahore, Pakistan
[*]**Corresponding Author Email**: drnayab8047@gmail.com

ABSTRACT

Objective: *To determine whether filter lenses improve stereoacuity in high myopic patients compared to non-filter lens.*

Methods: *It was a comparative cross sectional study. This study was conducted in Asif Eye Clinic, Lahore. The study included 66 high myopic patients (40 males and 26 females) aged 18 to 60 years, with myopia ranging from -6.00D to -10.00D. The TNO test, a well-known tool for testing depth perception using random dot stereograms, was used to determine stereoacuity. Initially, each patient's baseline stereoacuity was measured without filter lenses. Further assessments were taken out using red, green, blue, and yellow filters to see if there were any differences in stereoacuity. To study the variations and estimate the possible benefits associated with each filter, repeated measures ANOVA and paired t-tests were used for statistical purposes.*

Results: *The results indicated that using blue filters in high myopic patients significantly improved their stereoacuity (p = 0.001). Yellow filters also resulted in a slight improvements, with a a p-value of 0.04. However, when applied red or green filters on them, there were no statistically significant differences in stereoacuity were found compared to the non-filter baseline.*

Conclusion: *The outcomes of this study show that using filter lenses, particularly blue ones, can improve stereoacuity in patients with high myopia. This could possibility result in improved performance of vision for those with high myopia. However, more research is required tto validate the findings with a larger and more wide group of patients.*

Keywords: *Stereoacuity, filter lenses, TNO test, high myopia, color filter.*

1. INTRODUCTION

Stereopsis, also known as 3D vision or depth perception, is a refined visual ability that helps us see the world in three dimensions. It is an essential component of binocular vision, help us with everyday tasks such as judging distances and identifying objects. Interestingly, we are not born with this ability; it evolves over time as our visual experiences expand.[1,2] Binocular retinal disparity plays a crucial role in the perception of depth through stereopsis. [3,4] Conditions like amblyopia, anisometropia, or aniseikonia can disrupt typical binocular fusion, reducing stereoacuity. This, in turn, may affect the development of precise visual-motor skills and spatial resolution.[5,6] Clinicians often evaluate stereoacuity using tests like Frisby and Titmus stereo test in a clinical setting.[7,8]

Myopia ranks among the prevalent eye conditions in humans.[9] The incidence of high myopia is on the rise, with a notable number of individuals experiencing binocular vision impairments [10,11] High myopia is typically diagnosed when an individual's myopia advances to a point where they require −5 dioptres (D) or more of spherical correction, although there is variability in the definitions used to grade myopia [12,13]

Studies suggest that by 2050, the number of people with vision loss from high myopia could increase seven times compared to the year 2000, making myopia a major cause of permanent blindness worldwide.[14] Researchers have found that as the eyeball grows longer, which is called axial length elongation, the severity of myopia worsens, increasing the risk of high myopia.[15] The World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) have mentioned refractive error as the second most common cause of blindness (first being cataract) [16,17].

Specialized filter lenses for low vision are designed to improve visual acuity under specific lighting conditions by mitigating glare, boosting color discrimination, and optimizing contrast. Typically, these filters are prescribed by a low vision specialist subsequent to an eye examination assessing color contrast deficiencies.[18] With the rising number of myopia patients, many also exhibit binocular vision disorders. This study aims to compare the impact of filter lenses versus non-filter lenses on stereoacuity in high myopic patients and assess their role in improving vision, providing valuable insights for clinicians.

2. METHODOLOGY

A Comparative Cross-Sectional study was conducted from December 2023 – May 2024 in Asif Eye Clinic, Lahore. The study involved 66 high myopic patients, comprising 40 males and 26 females, aged between 18 and 60 years.

Sample size was calculated by using given formula

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where,

n = sample size

Z = Confidence Interval = 95% = 1.96

d = error = 5% = 0.05

P = Prevalence Value = 0.03 [19]

So,

$$n = \frac{(1.96)^2\, 0.03(1-0.03)}{(0.05)^2} = 43.73 \approx 66$$

Participants were recruited using non-probability purposive sampling technique. Patients with myopia ranging from -6.00D to -10.00D, aged between 18 and 60 years, and no history of ocular surgery or other ocular pathologies were in inclusion criteria. Patients with amblyopia, strabismus, or any other condition affecting binocular vision were among the exclusion criteria. Stereoacuity was assessed using the TNO test, which evaluates depth perception through random dot stereograms. To establish a baseline, we initially assessed each patient's stereoacuity without the use of any filter lenses. After that, we used red, green, blue, and yellow filters to measure their stereoacuity. We performed a repeated measures ANOVA to examine the changes in stereoacuity with each filter and determine whether the improvements were statistically significant. In order to compare the stereoacuity for each filter to the baseline findings obtained without filters, we also performed paired t-tests.

3. RESULTS

The chart illustrates the stereoacuity levels with and without different colored filters (Red, Blue, Green, Yellow) in high myopic patients. The results indicate that the blue filter leads to a significant improvement in stereoacuity, surpassing the other filters. While the yellow filter show some enhancements, but the blue filter demonstrates the most substantial impact. This visual representation reinforces the finding that blue filter lenses are the most effective in enhancing stereoacuity in high myopic patients.

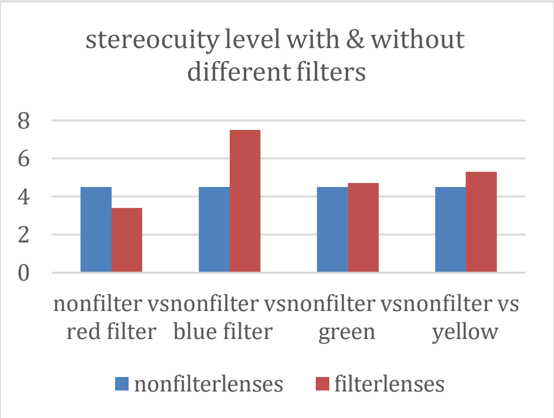


Table 1 shows the improvements in stereoacuity of red, blue, green, and yellow colored filters without without filter for patients with high myopia. Using a very significant p-value of 0.001 and a mean difference of 562.903, the paired t-test analysis demonstrated that the blue filter considerably increased stereoacuity when compared to non-filter lenses. In addition, with a p-value of 0.04, the yellow filter indicated a minor improvement. These results show that in high myopia patients, blue filters are more useful for improving stereoacuity.

It was found that neither the red nor the green filters significantly improved stereoacuity when compared to the non-filter lenses, in comparison with the blue filter. Despite a few minor improvements,they weren't strong enough to make any real difference in our findings.

Table 1. Stereoacuity comparison with and without various colored filters.

Comparison	Mean Difference± SD	Confidence Interval – 95% (Lower+Upper)	t	df	sig
Non-filter with Red Filter	500.484 ±7.22	55.21523-69.31546	19.124	65	0.09
Non-filter with Blue Filter	562.903 ±9.51	144.21546-168.012361	26.624	65	0.001
Non-filter with Green Filter	406.452 ±4.25	32.28549-44.32145	16.245	65	0.06
Non-filter with Yellow Filter	524.355 ±6.88	104.012451-127.879620	20.133	65	0.04

The pairwise comparison results, as shown in Table 2, highlight the differences between the various filters and non-filter lenses. The blue filter consistently showed the significant improvement across few comparisons.

This pairwise table shows the comparison between different filter lenses and non-filter lenses on stereoacuity in high myopic patients. The findings revealed that blue filters led to a significant improvement in stereoacuity with a p-value of 0.001 which shows the results are highly significant. Yellow filters also demonstrated a slight improvement with a p-value of 0.04. However, red and green filters did not show statistically significant improvements. The blue filter consistently provided the greatest enhancement in stereoacuity across all comparisons, as detailed in the pairwise comparison results.

Table 3: Pairwise comparisons between filters and non filter lenses.

Filters Compared	Mean Difference	Significance (p-value)	95% Confidence Interval
Non-filter vs. Red	38.548	0.06	29.332 to 47.765
Non-filter vs. Green	62.419	0.05	51.678 to 73.161
Non-filter vs. Blue	156.452	0.001	139.269 to 173.635
Non-filter vs. Yellow	115.806	0.01	98.907 to 132.706
Red vs. Non-filter	-38.548	0.06	-47.765 to -29.332
Red vs. Green	23.871	0.05	19.564 to 28.178
Red vs. Blue	117.903	0.001	104.707 to 131.099
Red vs. Yellow	77.258	0.01	65.124 to 89.392
Green vs. Non-filter	-62.419	0.05	-73.161 to -51.678
Green vs. Red	-23.871	0.05	-28.178 to -19.564
Green vs. Blue	94.032	0.001	82.735 to 105.329
Green vs. Yellow	53.387	0.01	43.499 to 63.276
Blue vs. Non-filter	-156.452	0.001	-173.635 to -139.269
Blue vs. Red	-117.903	0.001	-131.099 to -104.707
Blue vs. Green	-94.032	0.001	-105.329 to -82.735
Blue vs. Yellow	-40.645	0.01	-49.114 to -32.176
Yellow vs. Non-filter	-115.806	0.01	-132.706 to -98.907
Yellow vs. Red	-77.258	0.01	-89.392 to -65.124
Yellow vs. Green	-53.387	0.01	-63.276 to -43.499
Yellow vs. Blue	40.645	0.001	32.176 to 49.114

4. DISCUSSION

A comparative cross-sectional study was conducted to compare the effects of different colored filters on stereoacuity (red, green, blue, and yellow) to non-filter lenses in high myopic patients The study included 66 patients, with 40 males and 26 females, all having high myopia (≥ 6D). The results showed a significant improvement in stereoacuity for patients using blue filters, with a p-value of 0.001 which highlights the strong impact of this filter. Additionally, yellow filters also showed a slight improvement in stereoacuity with a p-value of 0.04. Red and green filters did not demonstrate statistically significant improvements in stereoacuity.

Previous studies focus was on the effect of different filters on visual performance, but no one have specifically compared the impact of 4 colored filters on stereoacuity in high myopic patients collectively. This study showed the influence of blue and yellow filters on contrast sensitivity but did not evaluate stereoacuity.[19] In this study, we found that blue filters were especially effective, with a statistically significant improvement in stereoacuity (p-value = 0.001). This shows that blue filters may enhance depth perception in high myopic individuals more effectively than other colored filters. In comparison, the results of the previous study indicate a significant improvement in visual acuity among amblyopic patients using blue filters (P = 0.00), emphasizing the potential clinical significance of blue filters in managing visual impairments. [20] Our study's results revealed a significant improvement in stereoacuity with blue filters which had a mean score of 562.903 ± 9.51 (P = 0.001) in high myopic patients validating the findings of increased clarity and sharpness reported by participants.

In our study, the yellow filter showed very slight improvements in stereoacuity, with a (p-value of 0.04). While the improvement was statistically significant, it was not as strong as the results seen with the blue filters. Their findings aligns with our study, where the yellow filter offered only slight improvement in stereoacuity compared to the more substantial benefits observed with blue filters. [21] Another previous study found that yellow-tinted lenses, could affect various visual functions, including contrast sensitivity and the time of reaction. While their study focused on emmetropic individuals, this present research extends these findings to high myopic patients.[22]

Another research on myopic patients who underwent implantable Collamer lens (ICL) surgery revealed improvements in their near and distance stereoacuity following the surgical procedure.[23] On the other hand, the present study concentrates on filter lenses, which present a less invasive alternative that may prove particularly beneficial for patients who are unsuitable for surgery or who would prefer to avoid surgery. Furthermore, the fact that many colored filters have distinct effects raises the possibility that a customized strategy may be required because patients may react differently to each filter. The limitations of this study include a small number of participants, a short duration, and a non-randomly selected sample.

5. CONCLUSION

This study shows that blue filters may help improve stereoacuity in people with high myopia. These results open up new possibilities for investigation into how best to use visual aids and improve the lives of people with high myopia. In order to guarantee better and more personalized solutions in the future, further research is required to completely understand and utilize these developments in clinical practice.

6. REFERENCES

1. Kani, W. A. L. I. A., 2008. Stereopsis and spatial perception in amblyopes and uncorrected ametropes. British Journal of Ophthalmology, 62(11), pp.756-762. 8.
2. Rogers BJ, Bradshaw MF. Vertical disparities, differential perspective and binocular stereopsis. Nature 1993;361: 253–255.
3. Burian HM. Stereopsis. Doc Ophthalmol 1951;5–6:169–183 .
4. Hong SW, Park SC. Development of distant stereoacuity in visually normal children as measured by the Frisby-Davis distance stereotest. Br J Ophthalmol 2008;92:1186–1189. 10.1136/bjo.2008.138362 .
5. Dandona, R. and Dandona, L., 2001. Refractive error blindness. Bulletin of the World Health Organization, 79, pp.237-243. 5.
6. Dobson, V., Miller, J. M., Clifford-Donaldson, C. E. and Harvey, E. M., 2008. Associations between anisometropia, amblyopia, and reduced stereoacuity in a school-aged population with a high

prevalence of astigmatism. Investigative ophthalmology & visual science, 49(10), pp.4427-4436.

7. Hrisos S, Clarke MP, Kelly T, Henderson J, Wright CM. Unilateral visual impairment and neurodevelopmental performance in preschool children. Br J Ophthalmol 2006;90:836–838.
8. Wallace DK, Lazar EL, Melia M, Birch EE, Holmes JM, Hopkins KB, et al. Stereoacuity in children with anisometropic amblyopia. J AAPOS 2011;15:455–461. 10.1016/j.jaapos.2011.06.007 .
9. Ciner EB, Ying GS, Kulp MT, Maguire MG, Quinn GE, Orel-Bixler D, et al. Stereoacuity of preschool children with and without vision disorders. Optom Vis Sci 2014;91:351–358. 10.1097/OPX.0000000000000165.
10. Morgan I. G., Ohno-Matsui K., Saw S.-M. Myopia. The Lancet. 2012;379(9827):1739–1748. doi: 10.1016/S0140-6736(12)60272-4.
11. Jones D., Luensmann D. The prevalence and impact of high myopia. Eye & Contact Lens: Science & Clinical Practice. 2012;38(3):188–196. doi: 10.1097/ICL.0b013e31824ccbc3.
12. Tian Y., Jiang H.-B., Jiang J., Wen D., Xia X.-B., Song W.-T. Comparison of implantable collamer lens visian ICL V4 and ICL V4c for high myopia. Medicine. 2017;96(25) doi: 10.1097/md.0000000000007294.e7294 .
13. Flaxman, S.R.; Bourne, R.R.A.; Resnikoff, S.; Ackland, P.; Braithwaite, T.; Cicinelli, M.V.; Das, A.; Jonas, J.B.; Keeffe, J.; Kempen, J.H.; et al. Global Causes of Blindness and Distance Vision Impairment 1990–2020: A Systematic Review and Meta-Analysis. Lancet Glob. Health 2017, 5, e1221–e1234.
14. Meng, W.; Butterworth, J.; Malecaze, F.; Calvas, P. Axial Length of Myopia: A Review of Current Research. Ophthalmologica 2011, 225, 127–134.
15. Morgan, I.G.; Ohno-Matsui, K.; Saw, S.-M. Myopia. Lancet 2012, 379, 1739–1748.
16. Dolgin E. The myopia boom. Nature. 2015;519(7543):276–8.
17. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, et al. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. Ophthalmology. 2016;123(5):1036–42.
18. Vasconcelos G, Fernandes LC. Low-Vision Aids.
19. Majeed A, Yousaf F, Sharif H, Dilbar I, Iqbal F. Assessment of Visual Acuity by Using Blue and Yellow Light Filters in Amblyopic Eye. Pakistan Journal of Ophthalmology. 2023 Jun 30;39(3).
20. Wald, G. (1964). The receptors of human color vision. Science, 145(3636), 1007-1016.
21. Wolffsohn, J. S., & Cochrane, A. (2002). The influence of tinted lenses on contrast sensitivity and visual comfort. Clinical and Experimental Optometry, 85(4), 204-208.
22. SS, Pachiyappan T, Kumaran SL. Impact of Tinted Lenses on Contrast Sensitivity, Color Vision, and Visual Reaction Time in Young Adults. Cureus. 2023 Nov;15(11).
23. ICL in Treatment of Myopia (ITM) Study Group. United States Food and Drug Administration clinical trial of the Implantable Collamer Lens (ICL) for moderate to high myopia: three-year follow-up.

Ophthalmology. 2004 Sep 1;111(9):1683-92.