



Comparison of visual functions without and with Iris-colored and transparent soft contact lenses

Author's Affiliation

Agha Saad Saeed Khan

Rabia Mobeen

Correspondence Author:

Correspondence to:

Rabia Mobeen

Optometrist

College of Ophthalmology &

Allied Vision Sciences (COAVS)

Purpose: To determine the effect of transparent and iris colored soft contact lenses on basic visual functions of human eyes.

Method: In 50 eyes of 25 healthy emmetropes (11 males and 14 females) having age between 15-30 years visual functions i.e. visual acuity, contrast sensitivity, color vision, visual field and glare sensitivity were assessed with both transparent and iris colored soft contact lenses and compared with visual functions measured without wearing any contact lens. Visual acuity measured with Snellen acuity chart, color vision with Ishihara, contrast sensitivity on Lea symbols, visual field by using Confrontation method and glare sensitivity with the help of Brightness acuity test.

Results: Visual acuity values were not significantly reduced with both transparent and iris colored contact lenses then without wearing them. Contrast sensitivity significantly reduced almost more than 1.25% with both transparent and colored contact lenses as compared to naked eye but no difference between transparent and colored contact lenses. Color vision is constant with and without wearing both transparent and soft contact lenses. Inferior visual field was partially reduced to very small extent with both transparent and colored soft contact lenses. Brightness acuity test results in decrease of visual acuity of one line more with both transparent and iris colored soft contact lens than without any contact lens after bright light stimulus.

Conclusion: Contrast sensitivity and inferior visual field were significantly reduced and visual acuity values after bright light stimulus was lower with both transparent and iris colored contact lenses as compared without wearing any contact lenses.

Key Words: Vision, Visual performance, Contact lenses



Introduction:

Vision is a complex integration of light sense, form sense, contrast sense and color sense by which qualities of objects (color, luminosity, size and shape) constituting its appearance can be recognized and as such it plays an important role in daily life activities. Light having wavelength between 400-700 nm is the stimulus for vision. The visual functions include visual acuity, visual field, contrast sensitivity, color vision and glare. Visual acuity is considered a measure of form sense, so it refers to the spatial limits of visual discrimination, in terms of visual angle it is the reciprocal of the minimum resolvable visual angle measured in minutes of arc for a standard test pattern.¹

When a person looks straight forward without moving the eyes the area that can be seen is known as its visual field. Extends of normal visual field are 50 degree superiorly, 60 degree nasally, 70 degree inferiorly, 90 degree temporally. Contrast sensitivity refers to the ability of the visual system to distinguish between an object and its background. A person with maximum visual acuity may have reduced contrast sensitivity and vice versa. Factors influences the contrast sensitivity measurement are background luminance, stimuli size and orientation, pupil size, dioptric blur and astigmatism.²

Glare is light that is not useful; it comes from oblique sources and enters the periphery of the eye thus increasing the background illumination and decreasing contrast. It is a normal response to bright light and causes visual fatigue and strain. Color vision is a function of three populations of retinal cones to recognize objects on the basis of light they reflect to the eye of specific wavelength: blue (tritan) at 414-424nm, green (deutran) 522-539 nm and red (protan) at 549-570nm. A normal person requires all these primary colors to match those within the spectrum.³

Contact lens is an optical device or a lens which is applied directly on the eye to correct refractive errors, for cosmetic and therapeutic purposes. On the basis of material they can be classified as: **Hard, Soft and Rigid Gas Permeable lens contact lens**. On the basis of uses they can be classified as: Therapeutics and Cosmetic contact lens. On the basis of mode of wear contact lenses can be classified as: Daily, Extended and Continuous wear. On the basis of their design they can be classified as: Spheric, Aspheric, Toric, Bifocals and Hybrid contact lens.⁴

Recent survey in United Kingdom reported in 2015 concludes that in independent practices there is greater portion of rigid than soft contact lenses fits. Among total soft contact lenses fits there is greater portion of soft extend wear and multifocal contact lenses.⁵ In Pakistan a study in 2010 shows 77 % of contact lens wearers were female, 75% use them for the purpose to neutralize their myopia, 24% aware of

its cleaning method.⁶ In Saudi Arabia a study in 2013 shows 38.7% of contact lens users use them without an eye care professional consultation. About 50% purchase contact lens from optical shops, 38% from beauty salons and 11% from pharmacies. More than 80 % of shops sold their contact lens to the patient without any prescription.⁷

Technological advancements in contact lens designs, manufacturing and availability in various materials the use of contact lens is increased for various purposes in modern ophthalmology and also for cosmetic reason. So they have different impacts on visual performance of the contact lens users so it is important to evaluate the effect of contact lens on basic visual functions of the healthy eye. In some fitting patterns of contact lenses patient may have good vision in normal illumination level but faces problem in poor illumination level. This is due to decrease in pupil size in high illumination level but increase in size when illumination is low. Pharmacological control of pupil size is effective in reducing such visual problems in contact lens wearer.⁸

Aims & Objective:

1. To compare the visual functions without and with transparent and iris colored soft contact lenses.
2. To find out variation in optical performance while wearing soft transparent and iris colored contact lens.

Materials and Methodology:

This comparative cross-sectional study was conducted at College of Ophthalmology and Allied Vision Sciences (COAVS), Lahore, from August 2014 to November 2014. Fifty eyes of twenty five healthy emmetropes were included in study by using non probability purposive sampling method. Contact lens users between 15 to 30 years of age of either sex having no ocular pathology were included in study. Patients who were mentally retarded, non cooperative and undergone any surgical process were excluded. An informed consent was obtain describing the detail of the study and implication thereof the subjects were assured of their confidentiality of information and outcome. Visual functions i.e. visual acuity, contrast sensitivity, color vision, visual field and glare sensitivity were assessed with both transparent and iris colored soft contact lenses and compared with visual functions measured without wearing any contact lens. Visual acuity measured with Snellen acuity chart, color vision with Ishihara, contrast sensitivity on Lea symbols, visual field by using Confrontation method and glare sensitivity with the help



of Brightness acuity test. Data was recorded on the performance and entered in statistical package for social science (SPSS version 20.0). The results were analyzed and tabulated by using same software.

Results:

Visual acuity values were not significantly reduced with both transparent and iris colored contact lenses then without wearing them. Contrast sensitivity significantly reduced almost more than 1.25% with both transparent and colored contact lenses as compared to naked eye but no difference between transparent and colored contact lenses. Color vision is constant with and without wearing both transparent and soft contact lenses. Inferior visual field was partially reduced to very small extent with both transparent and colored soft contact lenses. Brightness acuity test results in decrease of visual acuity of one line more with both transparent and iris colored soft contact lens than without any contact lens after bright light stimulus.

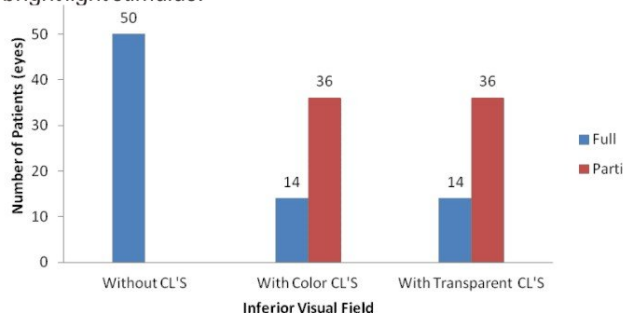


Figure No: 1

The figure shows that the difference between the inferior visual field without wearing contact lens and after wearing color and transparent contact lens is significant but no difference among color and transparent contact lenses.

Table No: 1(a)

		Contrast sensitivity without CL's			Total
		5%	2.5%	1.25%	
Contrast sensitivity with color CL's	10%	2	0	0	2
	5%	1	12	0	13
	2.5%	0	6	17	23
	1.25%	0	0	1	12
Total		3	18	2	50

Table No: 1(b)

		Contrast sensitivity without CL's			Total
		5%	2.5%	1.25%	
Contrast sensitivity with transparent CL's	10%	2	0	0	2
	5%	1	12	0	13
	2.5%	0	6	17	23
	1.25%	0	0	12	12
Total		3	18	29	50

In table no: 1 (a) & (b) our calculated p-value is $0.000 \leq 0.05$ so the difference between the contrast sensitivity without wearing contact lens and after wearing color and transparent contact lens is significant but no difference among color and transparent contact lenses.

Table No: 2(a)

		Visual acuity without with color CL's after bright light stimulus				Total
		6/12	6/12P	6/18	6/24P	
Visual acuity without with color CL's after bright light stimulus	6/12	17	2	6	2	25
	6/18	3	0	18	13	21
	6/24	0	0	2	23	2
	6/24P	0	0	0	12	2
Total		20	2	26	50	50

Table No: 2(b)

		Visual acuity without with transparent color CL's after bright light stimulus				Total
		6/12	6/12P	6/18	6/24P	
Visual acuity without with transparent color CL's after bright light stimulus	6/12	17	2	6	2	25
	6/18	3	0	18	13	21
	6/24	0	0	2	23	2
	6/24P	0	0	0	12	2
Total		20	2	26	50	50

In table no: 2 (a) & (b) our calculated p-value is $0.000 \leq 0.05$ so the difference of visual acuity after light stimulus without wearing contact lens and after wearing color and transparent contact lens is significant but no significant difference among color and transparent contact lenses.

Discussion:

Our assessment of visual functions with naked eyes and their comparison while wearing transparent and iris colored contact lenses among emmetropes confirms many previous studies that some of the visual functions are significantly reduced when measured along with the soft contact lenses on the eyes in healthy normal and accurate visual performance persons and the difference among the visual performance of both iris colored and transparent contact was not significant.⁹

Contrast sensitivity comparison with and without soft contact lenses result in significant difference when measured with Lea Numbers. Considerable reduction in contrast was noticed with soft (iris colored and transparent) contact lenses when compared with contrast sensitivity function of naked eyes of emmetropes. It was estimated that more than 1.25% contrast of most of the patient was reduced while wearing both transparent and iris colored contact lenses than the contrast recorded without contact lenses and



also there was no different among the contrast detected by both iris colored and transparent contact lenses.¹⁰

Visual field measured with confrontation shows that only inferior visual field of most of the emmetropes slightly reduced with soft iris colored and transparent contact lenses despite having full visual field in all meridian with naked eye and also there is no significant difference between transparent and iris colored contact lenses. **Glare sensitivity** measurement with soft iris colored and transparent contact lenses are normal in patient which also shows normal glare sensitivity measurement with naked eye. But visual acuity after bright light stimulus was less than one line on Snellen chart in most of the emmetropes with soft iris colored and transparent contact lenses as compared to the visual acuity value measured without contact lenses after bright light stimulus.

Conclusion:

Contrast sensitivity and inferior visual field were significantly reduced and visual acuity values after bright light stimulus was lower with both transparent and iris colored contact lenses as compared without wearing any contact lenses. Patients who already have constricted visual fields and low contrast sensitivity should be selected carefully for contact lens use. Proper counseling is needed before dispensing contact lenses to patients.

References:

1. Khurana AK. Theory and Practice of Optics and Refraction. Visual acuity, Contrast Sensitivity and Tests for Potential Vision 2nd edition. ELSEVIER; 2008. Pg (39).
2. Chris A.Jhonson. Evaluation of Visual Function.[Online]. No date [cited 2014 June 23]. Available from : <http://www.eyecalcs.com/DWAN/pages/v8/v8c017.html#top>
3. Purves D, Augustine GJ, Fitzpatrick D, et al., editors. Neuroscience. 2nd edition. Sunderland (MA): Sinauer Associates; 2001. Cones and Color Vision. Available from : <http://www.ncbi.nlm.nih.gov/books/NBK11059/>
4. Contact Lens Basics [internet]. [Updated 2014 June; cited 2014 June 23]. Available from: http://www.allaboutvision.com/contacts/contact_len
5. Morgan PB, Efron N. Influence of practice setting on contact lens prescribing in the United Kingdom. Contact lens & anterior eye : the journal of the British Contact Lens Association. 2015;38(1):70-2.
6. Khan MH, Mubeen SM, Chaudhry TA, Khan SA. Contact lens use and its compliance for care among healthcare workers in Pakistan. Indian journal of ophthalmology. 2013;61(7):334-7.
7. Abahussin M, AlAnazi M, Ogbuehi KC, Osuagwu UL. Prevalence, use and sale of contact lenses in Saudi Arabia: survey on university women and non-ophthalmic stores. Contact lens & anterior eye : the journal of the British Contact Lens Association. 2014;37(3):185-90.
8. Mile Brujic, Jason Miller. Shedding Light on Pupil Size Dynamic [Internet]. 2013 October 15 [cited 2014 June 23]. Available from: <http://www.reviewofcontactlenses.com/content/c/44390/>
9. Spraul CW, Roth HJ, Baumert SE, Lang GK. [Motif expressing soft print lenses. Effect on visual function]. Der Ophthalmologe : Zeitschrift der Deutschen Ophthalmologischen Gesellschaft. 1999;96(1):30-3.
10. Ortiz C, Jimenez R. Optical quality and vision with iris-coloring soft contact lenses. Optometry and vision science : official publication of the American Academy of Optometry. 2014;91(5):564-9.