

Effect of Cataract Extraction with Intraocular Lens Implant on Contrast Sensitivity, Colour Vision and Photostress Recovery Time

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ABSTRACT

A cataract is a cloudy area in the lens of the eye that can lead to a reduction in vision and visual functions. This study was a clinical study aimed at determining the effect of cataract extraction with intraocular lens (IOL) implant on contrast sensitivity, color vision and photostress recovery time. A total of 70 patients who visited Ajeromi General Hospital, Lagos, Nigeria was used for the study. Contrast sensitivity was assessed using the Pelli-Robson contrast sensitivity chart. The colour vision of the subjects was assessed using Ishihara Pseudochromatic colour vision chart and the photostress recovery time was assessed using a bright ophthalmoscope light. Results showed that the mean contrast sensitivity of the subjects before cataract extraction with IOL implant was 1.04 ± 0.08 . After cataract extraction, the mean was 2.19 ± 0.07 . The mean colour vision test value before cataract extraction with IOL implant was 14.41 ± 0.53 . After cataract extraction, the mean was 16.00 ± 0.00 . The mean Photostress Recovery Time before cataract extraction with IOL implant was 55.77 ± 1.81 seconds. After cataract extraction, the mean was 29.11 ± 0.83 seconds. SPSS data analysis with the Paired sample T-Test at 0.05 level of significance showed a significant improvement ($P < 0.05$) in contrast sensitivity, color vision and photostress recovery time before and after cataract extraction with IOL implant. It was recommended that all patients with monocular and bilateral cataract be referred for cataract extraction with intraocular lens (IOL) implant.

Key words: Cataract, Intraocular lens, Contrast sensitivity, Color vision, Photostress recovery time

INTRODUCTION

A cataract is a cloudy area in the lens of the eye that leads to a decrease in vision. Cataracts often develop slowly and can affect one or both eyes. Symptoms may include faded colors, blurry or double vision, halos around light, trouble with bright lights, and trouble seeing at night. ^[1] This may result in difficulty seeing well while driving, reading, or recognizing faces. Poor vision caused by cataracts may also result in an increased risk of falling and depression. Cataracts cause half of all cases of blindness and 33% of visual impairment worldwide. ^[2] Cataracts are most commonly due to aging but may also occur due to trauma or radiation exposure. It may be present from birth, or may occur following eye surgery for other problems. Risk factors include diabetes, longstanding use of corticosteroid medication, smoking tobacco, prolonged exposure to sunlight, and alcohol intake. ^[3] The underlying mechanism involves accumulation of clumps of protein or yellow-brown pigment in the lens that reduces transmission of light to the retina at the back of the eye. ^[4] Diagnosis is by a pen light eye examination. Surgery to remove the cloudy lens and replace it with an artificial lens is the only effective treatment.

In Nigeria, cataracts occur in 68% of those over the age of 80 years. Additionally, they are more common in women, and less common in Hispanic and Black people. [5] Age is the most common cause. Lens proteins denature and degrade over time, and this process is accelerated by diseases such as diabetes mellitus and hypertension. Environmental factors, including toxins, radiation, and ultraviolet light have cumulative effects which are worsened by the loss of protective and restorative mechanisms due to alterations in gene expression and chemical processes within the eye. Blunt trauma causes swelling, thickening, and whitening of the lens fibers. While the swelling normally resolves with time, the white colour may remain. In severe blunt trauma, or in injuries that penetrate the eye, the capsule in which the lens sits can be damaged. This damage allows fluid from other parts of the eye to rapidly enter the lens leading to swelling and then whitening, obstructing light from reaching the retina at the back of the eye. [6] In all types of cataract surgery, the cataractous lens is removed and replaced with an artificial lens, known as an intraocular lens, which stays in the eye permanently. Intraocular lenses are usually monofocal, correcting for either distance or near vision. Multifocal lenses may be implanted to improve near and distance vision simultaneously, but these lenses may increase the chance of unsatisfactory vision. [7] Serious complications of cataract surgery include retinal detachment and endophthalmitis. In both cases, patients notice a sudden decrease in vision. In endophthalmitis, patients often describe pain. Retinal detachment frequently presents with unilateral visual field defects, blurring of vision, flashes of light, or floating spots. [8] Photostress recovery time (PSRT) is the time taken for visual acuity to return to normal levels after the retina has been bleached by a bright light source. Photostress recovery time measurement procedure is known as photostress test.

Normal recovery time is about 15–30 seconds. [9] The photostress test is a simple, easy and quick clinical technique that can differentiate between retinal (macular) and optic nerve disease. The photostress test is clinically useful in diabetes, glaucoma, macular degeneration etc. Visual contrast sensitivity is a measure of the ability of the visual system to distinguish objects from the background. [10] Tests usually involve the presentation of letters or digits that are adjusted to become increasingly similar in brightness to the background until they can no longer be seen. Colour vision is the ability of an organism to distinguish objects based on the wavelengths (or frequencies) of the light they reflect, emit or transmit. [11] Colour perception in humans is a sensitive and subjective process. The brain responds to the stimuli produced when incoming light reacts with the several types of photoreceptor cells in the retina and signals are sent through to the occipital cortex of the brain. [12] The objective of this study is to determine the effect of cataract extraction with intraocular lens (IOL) implant on contrast sensitivity, color vision and photostress recovery time.

MATERIALS AND METHODS

This study was a clinical study carried out on patients diagnosed of monocular or bilateral cataract who visited Ajeromi General Hospital, Lagos, Nigeria. The patients gave an informed consent to be part of the study. Cataract extraction was carried out using phacoemulsification with intraocular lens (IOL) implant. The contrast sensitivity of the subjects was assessed pre and one month post cataract extraction with IOL implant using Pelli-Robson contrast sensitivity chart. The colour vision of the subjects was assessed pre and one month post cataract extraction with IOL implant using Ishihara Pseudochromatic colour vision chart. The photostress recovery time was also assessed pre and one month post cataract extraction with IOL implant using a bright ophthalmoscope light.

RESULTS

A total of 70 patients (35 males and 35 females) were used for this study. Table 1 showed the contrast sensitivity (CS) distribution of the subjects before and after cataract extraction. The table showed that before cataract extraction, 14(20.00%) subjects had a CS of 0.90; 48(68.57%) had a CS of 1.05; and 8(11.43%) had a CS of 1.20. The mean CS was 1.04 ± 0.08 . After cataract extraction, 30(42.86%) had a CS of 2.10; and 40(57.14%) had a CS of 2.25. The mean was CS was 2.19 ± 0.07 . Table 2 showed the colour vision (CV) test distribution of the subjects before and after cataract extraction. The table showed that before cataract extraction, 42(60.00%) subjects had a CV test value of 14; 27(38.57%) had a CV test value of 15; and 1(1.43%) had a CV test value of 16. The mean CV was 14.41 ± 0.53 . After cataract extraction, 70(100.00%) had a CV test value of 16. The mean CV was 16.00 ± 0.00 . Table 3 showed the Photostress Recovery Time (PSRT) distribution of the subjects before and after cataract extraction. The table showed that before cataract extraction, 8(11.43%) subjects had a PSRT of 52 seconds, 5(7.14%) had 54 seconds; 10(14.29%) had 55 seconds; 29(41.43%) had 56 seconds; and 18(25.71%) had 58 seconds. The mean PSRT was 55.77 ± 1.81 seconds. After cataract extraction, 20(28.57%) had a PSRT of 28 seconds; 22(31.34%) had 29 seconds; and 28(40.00%) had 30 seconds. The mean PSRT was 29.11 ± 0.83 seconds. Table 4 showed the P values for testing of hypotheses using the Paired Sample T-test at 0.05 level of significance. The table showed that there was a significant difference ($P < 0.05$) in contrast sensitivity, color vision and photostress recovery time before and after cataract extraction with IOL implant.

Table 1: Distribution of contrast sensitivity (CS) of subjects before and after cataract extraction with IOL implant

CS Before	n	%
0.90	14	20.00
1.05	48	68.57
1.20	8	11.43
CS After		
2.10	30	42.86
2.25	40	57.14

Table 2: Distribution of colour vision (CV) test values of subjects before and after cataract extraction with IOL implant

CV Before	n	%
14	42	60.00
15	27	38.57
16	1	1.43
CV After		
16	70	100.00

Table 3: Distribution of Photostress Recovery Time (PSRT) of subjects before and after cataract extraction with IOL implant

PSRT (Sec) Before	n	%
52	8	11.43
53	0	0.00
54	5	7.14
55	10	14.29
56	29	41.43
57	0	0.00
58	18	25.71
PSRT (Sec) After		
28	20	28.57
29	22	31.43
30	28	40.00

Table 4: P values for hypotheses testing before and after cataract extraction with IOL implant

Variable	P-value
Contrast sensitivity	0.00
Color vision	0.00
Photostress recovery time	0.00

DISCUSSION

Blind people are among the poorest of the poor in many parts of the world. Cataract causes blindness which can lead to poverty, hunger and ill health. If left untreated, cataract can cause visual changes such as dull appearance of colour vibrancy.^[13] The findings obtained from this study showed a mean contrast sensitivity value of 1.04 before cataract extraction and a mean contrast sensitivity value of 2.19 after cataract extraction. Data analysis using the paired sample T-test at 0.05 level of significance showed a significant difference ($P < 0.05$) in contrast sensitivity before and after cataract extraction. This showed that there was an improvement of contrast sensitivity after cataract extraction with IOL implant. This is in line with the finding reported by Wogu and Okeke^[14] of which

mean values of contrast sensitivity after cataract extraction with IOL implant of the participants were higher than the values before cataract extraction. Furthermore, this finding correlated with findings reported by Skorkovská et al. [15], where they also concluded that there was a significant increase in the mean value of binocular contrast sensitivity in the study group after cataract surgery with IOL implants.

Results from this study showed a colour vision mean test value of 14.41 before cataract extraction and 16.00 after cataract extraction with IOL implant. Data analysis using the paired sample T-test at 0.05 level of significance showed a significant difference ($P < 0.05$) in colour vision before and after cataract extraction. There was an improvement in colour vision after cataract extraction with IOL implant. A similar observation has been reported by Uttah [16] of which mean values of colour vision test values after cataract extraction with IOL implant of the participants were higher. This finding also correlated with the findings reported by Elawad et al. [17], where they came to a conclusion that visual acuity and other retinal functions like colour vision were restored after cataract extraction.

Furthermore, this study showed a mean photostress recovery time of 55.77 seconds before cataract extraction and a mean value of 29.11 seconds after cataract extraction with IOL implant. Data analysis using the paired sample T-test at 0.05 level of significance showed a significant difference ($P < 0.05$) in photostress recover time before and after cataract extraction. There was an improvement in photostress recover time after cataract extraction with IOL implant. The finding in this study were similar to that reported by Wogu and Okeke [14] of which mean values of photostress recover time after cataract extraction with IOL implant of the subjects were lower. Also, Similar findings was reported by Uttah [16] where the result showed that photostress recovery time of subjects were affected by cataract and there was need to improve it with cataract extraction and IOL implant.

Although there was an improvement in the photostress recovery time after cataract extraction with IOL implant, the mean value was still above normal levels. Thus, follow up postoperative care is important in restoring vision and visual functions back to normal levels.

CONCLUSION

In conclusion, contrast sensitivity, colour vision and photostress recovery time of the subjects improved after cataract extraction with intraocular lens implant. Cataract extraction allows for improvement in visual functions and was recommended for all patients with monocular or bilateral cataract.

Declaration by Authors

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