Comparison of Performance Standards Between Unifocal And Multifocal Intraocular Lenses Following Cataract Surgery

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ABSTRACT *Aim: To compare post operative parameters like uncorrected visual acuity (UCVA), best corrected visual acuity(BCVA), Near Vision, Contrast sensitivity between unifocal and multifocal intra ocular lenses(IOLs) following cataract surgery.*

Materials & Methods: This randomized clinical study was conducted on 66 patients with loss of vision due to only cataract attending outpatient clinics of Department of Ophthalmology at Sri Ramachandra Medical College, Porur during Aug 2007 to Aug 2009. Out of 66 patients 33 patients were operated with unifocal IOL, 33 patients with multifocal IOL. All were operated using conventional co axial Phacoemulsification. Patients were examined on 1st post operative day, at end of 1st week and 8th week.

Results: The mean age of patients in unifocal group was 55 years, while in multifocal group was 56.5 years. At end of 8th week, 85% unifocal group had UCVA of 6/9 or better and76% of multifocals had UCVA of 6/9 or better. The BCVA of 6/6 at end of 8th week was found in 100% of unifocal group and 91 % of multifocal group. Drop in vision of remaining patients was due to cystoid macular oedema. On analysis of near vision, at the end of 8th week, 0% unifocal patients had N6 vision while nearly 52% of multifocal group had N6 vision. Near vision add for unifocals was 2-2.5D and for multifocals 1-1.25D to enable patients to see N6 vision at 33cm. Unifocals patients retained their BCVA with reduction of contrast to 10-14% while multifocal patients found it difficult to retain BCVA with drop in contrast to 20-25%.

Conclusion: The distance visual acuity was similar in patients implanted with Unifocal and Multifocal IOLs where most of them had a BCVA of 6/9 or better. Unaided near vision was better in Multifocal IOLs who were able to read N6 at end of 8th week compared to unifocal IOLs who had N8 or N10. There was significant reduction in Contrast sensitivity and subjective experience of halos among multifocal group.

INTRODUCTION

From the days of Susrutha to the era of Charles Kelman there has been a constant change in the face of cataract surgery, largely dictated by not only newer advances and innovations in technology, but also an increase in the level of patient's expectations and demands. Therefore cataract procedures today have smoothly shifted over from a visual restoration procedure to a refractive procedure restoring not only the patient's vision but also bestowing upon him the ability to see well for all distances. In this unfolding era of excellence in cataract surgery we have attempted to compare the performance of the unifocal IOL with the multifocal IOL following cataract surgery.[4]

MATERIALS AND METHODS:

This prospective randomised clinical study was conducted on 66 eyes of 66 patients with loss of vision due to cataract only attending to outpatient clinics of the department of Ophthalmology at Sri Ramachandra Medical College during the period of Aug 2007 to Aug 2009. Patients were randomly assigned to receive either a multifocal or unifocal IOL implant. Informed consent and ethical clearance was obtained. Patients were recruited in a consecutive fashion provided they met the inclusion and exclusion criteria. At the end of the recruitment period after excluding patients who did not fit the criteria or those who were lost to follow up, patients in each group were analysed. All patients were operated using conventional coaxial Phacoemulsification[2]. Patients were examined on the first post operative day, at end of first week and eight week with respect to UCVA, BCVA, Near Vision and Contrast sensitivity. Results were computed at the end of eighth week. The inclusion criteria were patients in the age group of 40-80 years with visually disabling cataract(BCVA<6/12), Pupil size more than 2.5mm under photopic conditions, and Astigmatism less than or equal to 0.75 D . The exclusion criteria were patients with pupillary anomalies, irregular astigmatism, corneal opacities, exfoliation syndrome, glaucoma, uveitis and macular degeneration.

Documentation of uncorrected and best corrected visual acuity was done using Snellen's visual acuity chart. Intraocular pressure was measured by Goldmann Applanation Tonometer. Cataract was graded according to the Lens Opacity Classification System(LOCS III)[4]. Contrast sensitivity was checked in both groups of patients on the 8th post operative week using the Appasamy i-chart[4] . The lowest contrast at which the patient could retain his BCVA was taken to represent the contrast sensitivity for the patient. A 3rd generation IOL formula was used to do the IOL calculation[3].

SURGICAL PROCEDURE :

The cataract surgery was performed using conventional co axial phacoemulsification under Topical or Peribulbar Anaesthesia[1]. Nucleus was emulsified by direct phaco chop technique. A plate haptic IOL of 6mm optical diameter was implanted in the unifocal group(figure1). A zonal progressive plate haptic IOL of

6mm optical diameter with six concentric zones and a aspherically modified refractive multifocal optic design was implanted in the multifocal group(figure2). The IOL was injected through 2.8mm incision & positioned into the capsular bag[4]. All lenses were oriented in vertical position in the study. The visco elastic was thoroughly washed out of the capsular bag till the point where radial folds running from 7 to 1`o clock position across the posterior capsule was visualized which was indicative of complete removal of viscoelastic. Anterior chamber was reformed with sterile Ringer Lactate solution and wound inspected for integrity and tightness. Post OP patients were started on antibiotic-steroid eye drops hourly for first day and gradually tapered over one month.

ANALYSIS AND DISCUSSION
The average age group of patients in the study were 40-80 years. In the unifocal group, majority of patients were in the age group of 41-50 years(36%) and 51-60 years(39%). In the multifocal group, majority of patients were in the age group of 51-60 years(48%) and 60-70years(21%). In the unifocal group, 52% were male and 48% female patients while in the multifocal group, 24% were male and 76% female patients. On the first post operative day, 58% had UCVA of 6/12 or better with a unifocal lens and 70% with a multifocal lens. The most common cause for decreased Visual acuity on 1st post operative day was striate keratopathy. At the end of eight week, 85% had UCVA of 6/9 or better with unifocal lens and 76% with multifocal lens(figure3). 100% of the patients had BCVA of 6/6 with the unifocal lens and 91% of patients with the multifocal lens. The reason for this drop in vision was cystoid macular oedema. The post operative residual spherical error was largely zero and a maximum of +0.5 D sphere was noticed. Most of the patients had induced post operative Astigmatism less than 1 D.

On checking the near vision on 1st Post operative day in the Unifocal group, 18% had N6 , 18% had N8, 28% had N10 , 12% had N12 , 18% had N18 and 6% had N36 vision. In the Multifocal group, 21% had N6 , 43% had N8, 30% had N10, 3% had N12 and 3% had N18 vision.

At the end of eight week in the unifocal group, 9% had N8 , 58% had N10 , 21% had N12 , 9% had N18 and 3% had N36 vision(figure4). In the Multifocal group, 52% had N6 , 33% had N8 and 15% had N10 vision(figure5). Patients with multifocal IOLs were found to have better unaided near vision of N6 which could be attributed to zonal progressive design of IOL and the in built near vision add which offer the patients spectacle independence. This also explains the reason behind the reduced near vision add needed for patients in the multifocal group compared to unifocal group.

It was noticed that patients implanted with unifocal IOL needed a near vision add between 2-2.5D(figure6) and those with multifocal IOL needed a near vision add between 1-1.25 D(figure7) to read comfortably at a distance of 33cm.

In the unifocal lens of the same design patients retained their best corrected visual acuity with reduction of contrast of 10-14%(figure8) however with multifocal lens patients found it difficult to retain best corrected visual acuity with a drop in contrast to 20-25%(figure9). This indicates that there is a certain amount of drop in contrast sensitivity of these patients. Multifocality aims at the concept of restoring patient to near normal vision helping to retain good distance, intermediate and near vision. There is bound to be a reduction in contrast in a multifocal IOL because at any given distance 100% of light is not focussed on the retina.

According to Leyland M[8] et al, distance acuity was similar in multifocal and monofocal IOLs. Unaided near vision tended to improve with multifocal IOLs. multifocal IOLs were designed to avoid the need for glasses by providing two or more points of focus. Adverse effects of multifocal IOLs were reduced contrast sensitivity and experience of halos around lights. Javitt JC[5,6] et al concluded that patients who received multifocal IOLs obtained better uncorrected and distance corrected near visual acuity and reported better overall vision. Steinert RF[9] et al concluded that patients with multifocal IOL achieved significantly better uncorrected near vision than monofocal IOL. In a study by Hayashi K[10] et al, smaller pupil size correlated significantly with worse near vision in multifocal IOLs. However pupil size did not influence visual acuity in patients with monofocal IOLs. Ravalico G[11] et al found that there was a significant drop in contrast in patients with multifocal IOL despite the good visual acuity and this can affect the quality of vision.

CONCLUSION:
We found that distance visual acuity was similar in patients implanted with unifocal and multifocal IOLs where most of them had BCVA of 6/9 or better. Unaided near vision was better in patients with multifocal IOLs with majority able to read N6 at end of 8th week and unifocal group had near vision of N8/N10. The near vision add required to enable patient to have N6 vision at 33cms was less in Multifocal(1-1.25D) than in Unifocal(2-2.25D) IOLs. There was significant reduction in contrast sensitivity(20-25%) and subjective experience of halos among patients in multifocal group. There was also decreased spectacle dependence with the use of multifocal IOL. In conclusion, the advantages of Multifocal IOL are better unaided near vision and decreased spectacle dependence while the disadvantages are reduced contrast sensitivity and halos.

Legends for figures:
1) Unifocal IOL
2) Multifocal IOL
3) Comparison of UCVA of unifocal and multifocal IOLs at the 8th postoperative week
4) Near vision@33cms in unifocal IOL group at the 8th postoperative week
5) Near vision@33cms in multifocal IOL group at the 8th postoperative week
6) Near vision add needed in unifocal IOL group
7) Near vision add needed in multifocal IOL group
8) Contrast sensitivity in unifocal IOL group
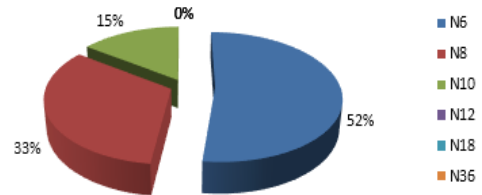9) Contrast sensitivity in multifocal IOL group.

1)Unifocal IOL

2)Multifocal IOL

4)NEAR VISION 8th WEEK @33CMS -UNIFOCALS
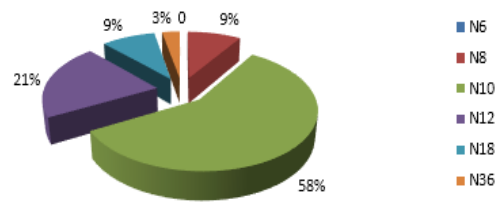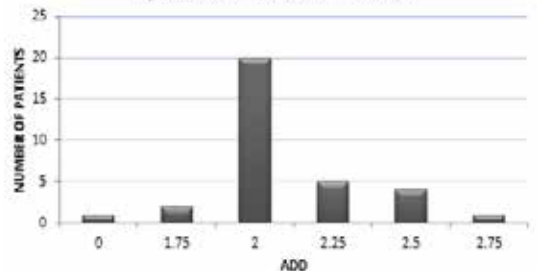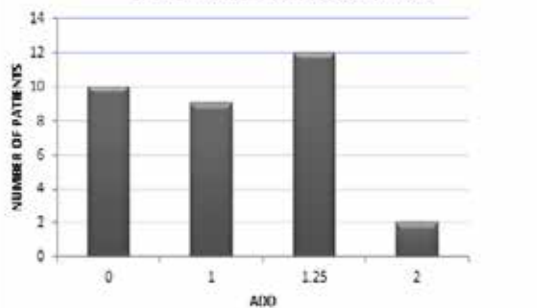

5)NEAR VISION 8tH WEEK @ 33CMS - MULTIFOCALS

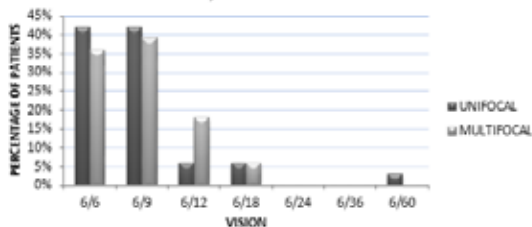

6)NEAR VISION ADD - UNIFOCAL

7)NEAR VISION ADD - MULTIFOCAL

3) UCVA 8TH WEEK

8)CONTRAST SENSITIVITY DISRTIBUTION - UNIFOCAL
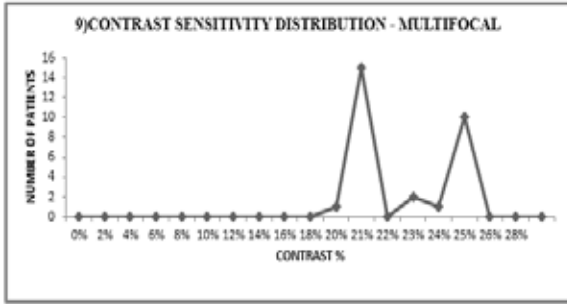
9)CONTRAST SENSITIVITY DISTRIBUTION - MULTIFOCAL
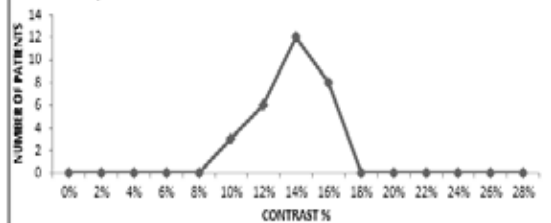
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