A STUDY OF CONTRAST SENSITIVITY AND QUALITY OF LIFE FOLLOWING PHACOEMULSIFICATION WITH TWO DIFFERENT TYPES OF ASPHERIC LENSES

By

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DISCLAIMER

I hereby certify that the work in this dissertation is my own except for quotations and summaries which have been duly acknowledged.

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ABSTRAK

Pengenalan: Kanta aspheric telah muncul sebagai landasan baru dalam perekaan kanta dalam usaha untuk memberi kualiti penglihatan yang lebih baik. Pengukuran kepekaan kontras dan kualiti kehidupan berkaitan penglihatan akan menilai keupayaan optic dan penglihatan kanta ini.

Objektif: untuk membandingkan ketajaman penglihatan, kepekaan kontras dan kualiti kehidupan berkaitan penglihatan selepas phakoemulsifikasi dan implantasi dua kanta aspherik di kalangan pesakit yang mengidapi selaput mata berkaitan penuaan yang menghadiri klinik mata di Hospital Universiti Sains Malaysia, Kubang Kerian dan Hospital Raja Perempuan Zainab II(HRPZ II), Kota Bharu, Kelantan.

Tatacara: Sebanyak 112 mata dari 112 pesakit dipilih secara rawak untuk menerima samada Akreos Adapt Advanced Optic (n=61) atau Tecnis Z9003 (n=51). Pesakit dipilih berdasarkan kepada kriteria kemasukan dan pengecualian. Tiga bulan selepas pembedahan, pesakit dinilai untuk kepekaan kontras di bawah pencahayaan 'photopic' dan 'mesopic' menggunakan CSV-1000 dan VF-14 yang diubahsuai untuk menilai kualiti kehidupan berkaitan penglihatan. Kualiti kehidupan berkaitan penglihatan menggunakan VF-14 telah dibahagikan seterusnya kepada penglihatan dekat, penglihatan jarak sederhana dan penglihatan jarak jauh. Perbandingan purata pada setiap parameter dibuat di antara dua kanta. Data dianalisa menggunakan samada Chi square atau independent t test dengan nilai p kurang dari 0.05 dianggap signifikan.

Keputusan: Purata ketajaman penglihatan dan kepekaan kontras pada 3,6,12 dan 18 cpd dalam pencahayaan 'photopic' atau 'mesopic' di antara Akreos Adapt AO dan Tecnis Z9003 menunjukkan keputusan hampir sama.Tiada perbezaan yang signifikan di antara dua kanta. Purata skor VF-14 pada Akreos Adapt AO adalah 98.57 (2.51) manakala Tecnis Z9003 mempunyai purata 97.18 (5.46). Jumlah skor kualiti kehidupan juga menunjukkan tiada perbezaan yang signifikan.

Kesimpulan: Ketajaman penglihatan dan kepekaan kontras selepas pembedahan dalam kedua-dua kanta adalah hampir setara. Akreos Adapt AO atau Tecnis Z9003 tidak menunjukkan perbezaan yang signifikan dalam kepekaan kontras dan kualiti kehidupan berkaitan penglihatan pada 3 bulan selepas pembedahan.

ABSTRACT

Introduction: Aspheric lens has emerged as a new landscape of intraocular design in order to provide a better quality of vision. Measurement of contrast sensitivity and vision related quality of life would assess the optical and visual performance of these aspheric lenses.

Objectives: To compare the visual acuity, contrast sensitivity and vision related quality of life following phacoemulsification and implantation of two aspheric lenses among age related senile cataract patients attending ophthalmology clinic in Hospital Universiti Sains Malaysia, Kubang Kerian and Hospital Raja Perempuan Zainab II (HRPZ II), Kota Bharu, Kelantan.

Methodology: A total of 112 eyes of 112 patients were randomized to receive either Akreos Adapt Advanced Optic (n=61) or Tecnis Z9003 (n=51). Patients were selected according to the inclusion and exclusion criteria. At 3 months postoperative period, patients were assessed for contrast sensitivity under photopic and mesopic using CSV1000 and modified VF-14 questionnaires was used to assess the vision related quality of life. Comparison of means of each parameter was made between the intraocular lenses. Data was analyzed by either Chi-square or independent t test with p value less than 0.05 was considered significant. The vision related quality of life using the VF-14 scores were further divided into near vision, intermediate vision and distant vision items.

Results: The mean visual acuity and contrast sensitivity in photopic and mesopic lightning at 3, 6, 12 and 18 cpd showed very similar results in Akreos Adapt AO and Tecnis Z9003. There was no significant difference between the two intraocular lenses. The VF-14 scores in Akreos Adapt AO has a mean of 98.57 (2.51) whereas the Tecnis Z9003 has a mean of 97.18 (5.46). The total quality of life scores also revealed no significant difference.

Conclusion: Postoperative visual acuity and contrast sensitivity in both intraocular lenses were almost comparable. Neither Akreos Adapt AO nor Tecnis Z9003 showed a significant difference in contrast sensitivity and vision related quality of life at 3 months postoperative period.

Chapter 1
Introduction

INTRODUCTION

1.0 BACKGROUND

Cataract is the major cause of preventable blindness all over the world. Malaysia has a cataract prevalence of 39.11% of the total estimated cases of bilateral blindness (Zainal et al., 2002). Removal of cataract had been a successful treatment worldwide. Gain of visual function and quality of life after cataract surgery had been studied and showed significant improvement (Desai et al., 1996, Thulasiraj et al., 2002). The modern cataract surgery, phacoemulsification, is a technique whereby the cataract is removed by using an ultrasonic device and foldable posterior chamber intraocular lens is inserted in the capsular bag. This technique has the advantages of faster wound healing, early visual rehabilitation, less astigmatism and better visual outcome.

Visual acuity has been the mainstay of vision assessment in optometric and ophthalmology practice. Practitioners often made clinical decisions based on the changes in visual acuity. However visual acuity is one of the aspects in clinical visual performance. It is a measure of recognition of small (high spatial frequency) of high contrast letters (Woods RL, 1995). The conventional chart of visual acuity is limited for refractive error measurement because in spite of fully corrected refractive error, patient still complains of visual anomalies. This is a common presentation in patients with early cataract and contact lens patients. This small complain can be distressing to patients and confusing to practitioners.

The real world is composed of objects of varying size and contrasts. Therefore the measurement of visual acuity is too simple as an assessment of visual performance for everyday visual tasks. Contrast sensitivity measurement which give rise to a complete visual assessment may be used to detect visual problems at early stage, to understand the patient' s problems and helps in managing the problem for example by advising a patient of increased risks of driving in low contrast environment (Woods RL, 1995).

Dr Charles D. Kellman introduced the new evolution in cataract surgery. He introduced the ultrasonic device that is used to remove the cataract. The procedure is known as phacoemulsification. This sophisticated procedure uses a tiny probe with a vibrating tip to gently break the cataract and wash it away. Nowadays phacoemulsification has become the preferred method of cataract surgery owing to numerous advantages such as small self-sealing incision, early visual rehabilitation, less surgical-induced astigmatism and a closed chamber with controlled capsular surgery. Advances in surgical techniques and equipments have led to a dramatic increase in popularity of phacoemulsification with increase level of safety and efficiency.

In the global world with advanced technology, the evolution of various intraocular lenses with a smaller optic size, the foldable intraocular lens also represent a major development in modern cataract surgery. Foldable intraocular lens can take advantage of smaller incision, even further shortening the time to visual recovery. As we know, following cataract extraction, patients lost accommodative property along with contrast sensitivity. In the present era, with the latest and advances in technology, there are various types of new

intraocular lenses that claimed to provide better quality of vision which promotes increase in quality of life.

The emergence of aspheric lens had created a new evolution in intraocular design. The intraocular lens was designed to compensate the positive cornea aberration. However, one important consideration in choosing traditional intraocular lens versus aspheric lens was to understand the degree to which a patient might benefit from the new aspheric lenses. Therefore a more precise measurement of functional vision which was contrast sensitivity is warranted.

1.1 VISUAL ACUITY

Visual acuity is the most commonly used test to assess visual function. The Snellen chart is the universally accepted tool for testing visual acuity despite its poor reliability and reproducibility. Snellen charts are named after the Dutch Ophthalmologist Herman Snellen who developed the chart in 1862 (Figure 1.1).

Newer logMAR charts are now available that have negated the disadvantages of the Snellen chart. However, these charts are not being used regularly in daily practice. LogMAR stands for Minimum Angle of Resolution. The charts were designed by Bailie and Lovie and were used as a basis for the ETDRS study. The smaller the letters on the chart, and the further away they are, the smaller will be the angle subtended to the eye by the letters and therefore the smaller the value of the LogMAR score associated with it (Figure1.2).

The use of LogMAR allows analysis of visual acuity scores more effectively and comparisons of results more precisely. It offers this because the equal linear steps of the LogMAR scale represent equal ratios in the standard size sequence(Hussain et al, 2006). The charts have been designed using high contrast lettering on washable polystyrene and based on the 'Bailey and Lovie'work. Table below showed the comparison of visual acuity of Snellen and LogMAR chart.

Table 1.1: Comparison of Snellen and logMAR visual acuity charts

Snellen visual acuity				
Metric	**Imperial**	**Decimal**	**MAR**	**Log MAR**
6/60	20/200	0.10	10.00	1.0
6/48	20/160	0.13	8.00	0.9
6/38	20/125	0.16	6.30	0.8
6/30	20/100	0.20	5.00	0.7
6/24	20/80	0.25	4.00	0.6
6/19	20/60	0.32	3.20	0.5
6/15	20/50	0.40	2.50	0.4
6/12	20/40	0.50	2.00	0.3
6/9.5	20/30	0.63	1.60	0.2
6/7.5	20/25	0.80	1.25	0.1
6/6	20/20	1.00	0.63	0
6/4.8	20/16	1.25	0.80	-0.1
6/3.8	20/12.5	1.58	0.63	-0.2
6/3	20/10	2.00	0.50	-0.3

1.2 CONTRAST SENSITIVITY

Contrast sensitivity function is a more precise and accurate method in assessing the visual performance although the utility of the charts had been debated and argued. However it is superior compared to Snellen acuity chart in assessing subtle changes.

Contrast sensitivity is a precise measurement that determines the lowest contrast level, which can be detected by patient of, given target size with variable size and contrast. Therefore it measures two variables, which are size and target. Contrast sensitivity is the inverse of contrast level. The higher the contrast level, the lower the contrast sensitivity. The advantages of measuring the contrast sensitivity is, it quantified the contrast level by using a sinusoidal grafting which give a complete assessment of visual function (Campbell, 1983). Contrast sensitivity is determined by the product of optical and neural modulation transfer (Nio et al., 2003).

Many instances in which losses in contrast sensitivity were detected when visual acuity (one point on the contrast sensitivity functions) was normal have been reported. These include amblyopia, neuro-ophthalmology, retina, anterior segment disease, and glaucoma. Therefore, contrast sensitivity testing enables the clinician to diagnose selective deficits in visual processing at an earlier stage than is possible with conventional testing methods.

1.2.1 Contrast Sensitivity and Ocular Diseases

Contrast sensitivity is affected in patients with dry eye, glaucoma, myopia and post LASIK. It was noted by one study done by Puell et al., (2006). They concluded contrast sensitivity with or without glare were significantly reduced in patient with dry eye. Therefore, the treatment with artificial tears improved the contrast sensitivity in these patients (Akin et al., 2006). Dry eye is also one of the complications of LASIK which give rise to impaired contrast sensitivity especially to patients with myopia. Corneal irregular astigmatism after photorefractive keratectomy contributed to impairment of contrast sensitivity in patients (Tomidokoro et al., 2001).

A study by a Brazilian researchers concluded that the effect of age on visual acuity and contrast sensitivity only became evident in persons aged at least 60 years (Chua et al., 2004). It was noted that late posterior subcapsular cataract caused the greatest reduction in visual acuity. Early grade cataract caused significant reduction in contrast sensitivity at intermediate and high spatial frequencies. However, late grade cataract reduced contrast sensitivity across all spatial frequencies to visual acuity for both cortical and nuclear cataracts but not for the posterior subcapsular type (Stifter et al., 2006). Axial and superotemporally located cortical cataract had the greatest effect on visual function tests.

1.2.2 Contrast Sensitivity and Systemic Diseases

Diabetes Mellitus causes impairment of contrast sensitivity even though in the absence of retinopathy. Impairment in the measurement of contrast sensitivity would suggest capillary drop out in retina as evidenced by fundus fluorescence angiography even though in the absence of retinopathy clinically. It is suggested that contrast sensitivity in diabetic patients without retinopathy is not solely due to diabetes induced lens optical density. Abnormalities of retina and its neural connections occurring before the onset of clinically detectable retinopathy may be involved. The risks factors for these deficits are advanced age, high systolic blood pressure and nephropathy (Sokol et al., 1985).

Leprosy is a systemic disease caused by *Mycobacterium leprae*. Impairment in contrast sensitivity is thought secondary to dry eyes (Daniel et al., 2005). Abnormal contrast sensitivity and abnormal colour vision can also occur independently in HIV-infected individuals and can be present in the absence of severe immunosuppression (Shah et al., 2006).

1.2.3 Contrast Sensitivity and Neuro- Ophthalmic Diseases

Contrast sensitivity is affected in optic neuritis which can be secondary to multiple sclerosis and acute demyelinating encephalomyelitis. Optic neuritis, optic atrophy and Parkinson disease also cause impairment of contrast sensitivity. A study of contrast sensitivity among the pseudotumour cerebri patients was conducted and it was found that