Randomised clinical investigation of the Bi flex M multifocal Intraocular lens

Research Protocol

Version 1.0

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Proposed Site:

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Introduction

With an ageing population, cataract surgery has become the most common surgical procedure carried out in the developed world. Approximately 2.5 million surgeries are preformed in the USA each year and approximately 250,000 are preformed in the UK.[1] Cataract surgery is also known as phacoemulsification and involves the extraction of the natural lens from its capsular bag and implantation of an artificial intraocular lens (IOL). The evolution of IOL designs has been rapid and extensive development of new advanced IOLs has occurred in recent years; spherical monofocal IOL designs are no longer the only pseudophakic option. Multifocal IOLs (MIOLs) are popular for the surgical correction of presbyopia because their mechanism of action is independent of ciliary body function. MIOLs provide high levels of spectacle independence[2] and currently are the most reliable lens for attaining both distance and near vision. This has lead to refractive lens exchange gaining popularity as increasing numbers of presbyopic patients look for refractive solutions. Monofocal intraocular lenses are the staple of cataract surgery providing excellent distance vision, however as patients expectations and demands rise, the need for correction of intermediate and near vision has become increasingly important. MIOLs restore some visual function at different distances by creating at least two focal points within the eye, corresponding to different working distances. Several mechanisms can be employed to create the simultaneous focal points and it is important to consider an MIOL's method of action as each lens has its own unique optical properties. The design of the MIOL affects the light distribution, the number of focal points, the distance of their separation, and ultimately the quality of the images. MIOLs can be divided into diffractive and refractive designs. Refractive designs can be subdivided into concentric and sectorial, while diffractive designs can be categorised as fully diffractive or partially diffractive.

Intermediate visual function has posed a problem with MIOL implantation. A drop in acuity in the intermediate range has been reported with bifocal multifocal lenses. [3-5] Good intermediate vision is a requirement for certain individuals for occupational or recreational purposes and a sub-optimal acuity in the intermediate range can have a negative influence on the individual's quality of life[6] To this end recent MIOLs have been designed to improve intermediate vision by the use of a

lower add. These lenses provided good distance and near acuity as well as acceptable intermediate vision.[7-10]

With intermediate and near vision being essential in most individual's daily routine, it is clear that a solution is required and an IOL that can provide good vision at intermediate and near, without detriment to distance vision is needed.
Visual acuity alone is not an adequate measure of success with MIOLs. All MIOLs create two or more simultaneous focal points within the eye. Therefore, at any one time at least one focal point will not be convergent on the retina. This defocused image causes a reduction in contrast and a distinctive photopic phenomenon known as Dysphotopsia.[2,12] This phenomenon, is one of the most common complaints with multifocal implantation and needs to be investigated to fully understand how the optical properties of an MIOL affect this photopic phenomenon.

Aims:

This study aims to evaluate the visual function and patient satisfaction of patients who have been implanted with the BiFlex M Multifocal IOL (Medicontur) and to compare the results with patients implanted with the BiFlex 1.8 monofocal IOL.

Methodology:

This prospective randomised control study will evaluate 100 patients (200 eyes) having undergone bilateral implantation with either the multifocal or monofocal IOLs for either cataract or clear lens extraction surgery.

Preoperatively all patients have comprehensive ophthalmological examination, including detailed history, refraction, dilated fundus examination, tonometry and slit lamp examination to exclude pre-existing conditions which may limit the refractive outcome. IOL power calculations will be performed using a Haag Streit LS900 Lenstar biometer. All patients will be adequately informed and sign a consent form.

Inclusion Criteria:

Age 50-75 years, bilateral IOL implantation.

Exclusion Criteria:

Amblyopia, post-op corneal astigmatism of ≥1.50D, visual axis eccentricity of greater than 0.7mm, macular pathology, glaucoma, retinal disease, corneal disease, abnormal iris, pupil deformation and any previous corneal or intraocular surgery.

Surgical Technique:

All surgeries will be performed by one of two experienced ophthalmic surgeons using a standard, sutureless, microincision, phacoemulsification technique under topical anaesthesia. Routine post-op drug regime will be followed.

Methods

Each subject will be evaluated at three visits following IOL implantation; visit 1 (1 month), Visit 2 (3-6 months) and visit 3 (12-18 months).

At each visit the following non-invasive visual function tests will be conducted:

Monocular and binocular Unaided (UCVA) and Best Corrected Visual Acuity (BCVA) will be measured at 6 meters in LogMAR units using a calibrated computerised test chart.

Subjective and objective refraction will be used to determine if there is any residual refractive error.

Defocus curve profiles (visual acuity over imposed defocus) will be measured for each patient over a defocus range of +1.50D to -5.00D in 0.50D steps. The presentation of the letters and lenses will be randomised.

Contrast sensitivity will be evaluated monocularly under photopic and mesopic conditions using the Pelli-Robson Contrast Sensitivity Chart and CSV-1000.

Best distance corrected near and intermediate reading performance will be evaluated using the Radner Reading Charts and LogMAR charts and reading speed will be assessed in photopic conditions

Uncorrected and best distance corrected near acuity will be measured at 40cm

Uncorrected and best distance corrected intermediate acuity will be measured at 70cm.

The subject will be shown the Glare Simulator (Carl Zeiss Meditec) in order to assess the type of dysphotopsia present at each visit

A Halometer will be used to determine the size of the dysphotopsia

In order to assess the ocular biometry and record features of the IOL, at each visit the following imaging tests will be conducted following instillation of Tropicamide 1% to dilate the pupil:

- The Lenstar (Haagstreit) will be used to determine the post-operative axial position of the IOL following implantation.
- The A digital slit lamp camera will be used to image the IOL. This image will be used to determine if any decentration is present and if posterior supcapsular opacification is present using the EPCO 2000 software programme.

At each visit the following subjective assessment tests will be given to the patient to complete:

- The Visual satisfaction questionnaire will be used to determine the patient's overall satisfaction with their vision
- Near Assessment Visual Questionnaire (NAVQ) will be used to assess the patients satisfaction with their near and intermediate vision[14]

Statistical Analysis:

Normal distribution will be determined through examining histogram plots and with the Kolmogorov-Smirnov test. For analysis of the defocus curves the data will first be transformed into the defocus area metric[15] and the Radner reading chart data will also be converted according to the reading performance index.[16] Following this the means from each group will be assessed using two-way repeated measures ANOVA and a Pearson's coefficient will be used to look for correlations within the data. The results from the visual satisfaction questionnaire and NAVQ will be converted into Log RASCH units to provide a linear scale.

Sample Size

Using GPower 3 a sample size of 50 subjects (100 eyes) per group was calculated for this study, therefore a total of 100 subjects will be recruited for the study.

Ethics & Regulatory Approvals

The study will be conducted in compliance with the principles of the Declaration of Helsinki (1996), the principles of GCP and in accordance with all applicable regulatory requirements including but not limited to the Research Governance Framework. Ethical approval will be sought from Plymouth University

Data Handling

All of the investigators are UK registered optometrists or UK registered Ophthalmologists who are bound by a code of conduct for confidentiality and data protection.

The information collected during this study will be stored electronically on a password protected hard drive on the chief investigator's computer, in a document file which is also password protected. Data will be backed-up on CD-ROMs as encrypted files, stored in a locked cabinet in a locked office.

Data will only be used for this research study and will be archived at BMI Southend for the recommended 10-year period. This may be looked at during this time by an auditing team for monitoring purposes.

To ensure anonymity is maintained throughout this study, subjects will be allocated a participant number to which their individual data will be assigned too. A key for participant numbers will be kept securely electronically on a memory stick, which will be kept in a locked cupboard in a locked room. Access to this key will be limited to the principle investigators and co-investigators.

Any research data generated from electronic equipment will be coded and anonymised.

Dissemination

It is intended that the results of the study will be reported and disseminated at national and international conferences and in peer-reviewed scientific journals.

References:

1 Dua HS, Said DG, Otri AM. Are we doing too many cataract operations? Cataract surgery: a global perspective. *Br J Ophthalmol* 2009;**93**:1–2. doi:10.1136/bjo.2008.143685

2 Packer M, Chu YR, Waltz KL, *et al.* Evaluation of the aspheric tecnis multifocal intraocular lens: one-year results from the first cohort of the food and drug administration clinical trial. *Am J Ophthalmol* 2010;**149**:577–584.e1. doi:10.1016/j.ajo.2009.10.022

3 Blaylock JF, Si Z, Vickers C. Visual and refractive status at different focal distances after implantation of the ReSTOR multifocal intraocular lens. *J Cataract Refract Surg* 2006;**32**:1464–73. doi:10.1016/j.jcrs.2006.04.011

4 Auffarth GU, Hunold W, Wesendahl TA, *et al.* Depth of focus and functional results in patients with multifocal intraocular lenses: a long-term follow-up. *J Cataract Refract Surg* 1993;**19**:685–9.

5 Weghaupt H, Pieh S, Skorpik C. Comparison of pseudoaccommodation and visual quality between a diffractive and refractive multifocal intraocular lens. *J Cataract Refract Surg* 1998;**24**:663–5.

6 Cochener B, Vryghem J, Rozot P, *et al.* Visual and refractive outcomes after implantation of a fully diffractive trifocal lens. *Clin Ophthalmol* 2012;**6**:1421–7. doi:10.2147/OPTH.S32343

7 Alfonso JF, Fernández-Vega L, Señaris A, *et al.* Prospective study of the Acri.LISA bifocal intraocular lens. *J Cataract Refract Surg* 2007;**33**:1930–5. doi:10.1016/j.jcrs.2007.06.067

8 Alfonso JF, Fernández-Vega L, Amhaz H, *et al.* Visual function after implantation of an aspheric bifocal intraocular lens. *J Cataract Refract Surg* 2009;**35**:885–92. doi:10.1016/j.jcrs.2009.01.014

9 Alfonso JF, Fernández-Vega L, Puchades C, *et al.* Intermediate visual function with different multifocal intraocular lens models. *J Cataract Refract Surg* 2010;**36**:733–9. doi:10.1016/j.jcrs.2009.11.018

10 Petermeier K, Messias A, Gekeler F, *et al.* Effect of +3.00 diopter and +4.00 diopter additions in multifocal intraocular lenses on defocus profiles, patient satisfaction, and contrast sensitivity. *J Cataract Refract Surg* 2011;**37**:720–6. doi:10.1016/j.jcrs.2010.11.027

11 Sen HN, Sarikkola A-U, Uusitalo RJ, *et al.* Quality of vision after AMO Array multifocal intraocular lens implantation. *J Cataract Refract Surg* 2004;**30**:2483–93. doi:10.1016/j.jcrs.2004.04.049

12 Pieh S, Lackner B, Hanselmayer G, *et al.* Halo size under distance and near conditions in refractive multifocal intraocular lenses. *Br J Ophthalmol* 2001;**85**:816–21.

13 Rosales P, De Castro A, Jiménez-Alfaro I, *et al.* Intraocular lens alignment from purkinje and Scheimpflug imaging. *Clin Exp Optom* 2010;**93**:400–8. doi:10.1111/j.1444-0938.2010.00514.x

14 Buckhurst PJ, Wolffsohn JS, Gupta N, *et al.* Development of a questionnaire to assess the relative subjective benefits of presbyopia correction. *J Cataract*

Refract Surg 2012;**38**:74–9. doi:10.1016/j.jcrs.2011.07.032

15 Buckhurst PJ, Wolffsohn JS, Naroo SA, *et al.* Multifocal Intraocular Lens Differentiation Using Defocus Curves. *Invest Ophthalmol Vis Sci* Published Online First: 15 May 2012. doi:10.1167/iovs.11-9234

16 Buckhurst PJ, Wolffsohn JS, Shah S, *et al.* Evaluation of multifocal and accommodating intraocular lenses using the reading performance index, a new MNRead metric. Proceedings of the XXIX congress of the European Society of Cataract and Refractive Surgeons 2012