Corneal transplants are the main procedures performed to treat corneal blindness. Traditionally, penetrating keratoplasty (PKP) has been the procedure selected for corneal diseases such as suppurative keratitis, keratoconus and corneal stromal dystrophy. However, immune rejection, which can lead to graft opacity, remains a major problem after PKP. Even "normal" graft may have chronic corneal allograft dysfunction. With the accumulation of knowledge on corneal diseases, corneal endothelia and corneal surgery procedures, as well as the development of microsurgical technology, lamellar keratoplasty (LKP) has become more valued. Although today it is well accepted that LKP should be preferred over PKP in as many cases without major problems with the corneal endothelia as it is possible to prevent endothelium-related problems such as immune rejection and chronic corneal allograft dysfunction, we have not yet seen a clinical report with a large number of cases to support the existence of this shift. To track this spontaneous change in procedure preference, we retrospectively reviewed the corneal transplantation cases from Shandong Eye Institute over 12 years and evaluated procedural shifts and indications for each operative procedure.

Methods

Medical records of patients who received corneal transplantation at Shandong Eye Institute, including Qingdao Eye Hospital and Shandong Eye Hospital, from January 1996 to December 2007 were reviewed. Shandong Eye Institute is an important clinical centre for corneal diseases in north China, with patients mainly from across the northern provinces. The corneal diseases were categorised into suppurative keratitis (fungal, bacterial and amoebic infections), viral and other keratitis (viral infection, Mooren ulcer and stromal keratitis), corneal degeneration, dystrophy and congenital anomaly, keratoconus, corneal injury and others.2 All data were divided into four time intervals according to the admission date: January 1996 to December 1998, January 1999 to December 2001, January 2002 to December 2004 and January 2005 to December 2007. Clinical features of patients, preoperative diagnosis and surgical procedure were collected. Proportions of LKP versus PKP within each interval and major preoperative diagnoses were analysed.

The $\chi^2$ test was used for statistical analysis with SPSS10.0. A $p$ value of less than 0.05 was considered statistically significant.

Results

A total of 4346 patients (5316 eyes) were included. They were 1312 women and 3034 men, aged from 6 months to 91 years. LKP and PKP were performed on 1558 eyes (29.3%) and 3758 eyes (70.7%), respectively. The ratio of LKP to PKP operations tended to increase.

Conclusion: Following proper indications, the use of LKP has increased in number in north China and has become particularly frequent in the management of corneal infections, keratoconus, corneal degeneration, and stromal dystrophy.

Changes in procedural preference

There were 982 corneal transplantations including 236 LKPs (24.0%) and 746 PKPs (76.0%) during the period 1996-8, 1300 transplantations including 352 LKPs (27.1%) and 948 PKPs (72.9%) during 1999 and 2001, 1641 transplantations including 438 LKPs (26.7%) and 1203 PKPs (73.3%) during 2002 and 2004, and 1393 transplantations including 532 LKPs (38.2%) and 861 PKPs (61.8%) during 2005 and 2007 ($x^2 = 74.79, p = 0.00$). The proportions of LKP to PKP increased (figs 1, 2).

Trends in major preoperative diagnoses

Over the 12 years, 1631 eyes with suppurative keratitis underwent corneal transplantation, including 1046 eyes (64.1%) with fungal keratitis, 563 (34.5%) with bacterial keratitis and 22 (1.3%) with amoebic keratitis. Across the four time intervals, LKP was given in 7.5%, 33.7%, 29.9% and 36.9% of eyes with fungal infection ($x^2 = 47.70, p = 0.01$), 7.6%, 32.3%, 30.8% and 36.9% respectively.
ABSTRACT

Aims: To measure spectacle dependence following bilateral monofocal intraocular lens (IOL) implantation and assess how it is predicted by postoperative refraction. Methods: 300 cataract patients had bilateral phacoemulsification surgery with monofocal IOL implantation. A spherical equivalent of 0 to -0.5 D was targeted. Three months after surgery, patients answered a questionnaire and had a spectacle refraction. Refractions were converted into vector notation. Logistic regression was used to evaluate whether spectacle dependence for near and distance was related to overall refractive error, spherical error, signed spherical error and astigmatic error. Results: 169 patients attended for assessment. 38 wore distance glasses, and 160 wore reading glasses either some or all of the time. The mean right spherical equivalent was -0.03 D, and the mean right cylinder was -0.64 D. Left outcomes were similar. Patients were 34 times more likely to always use distance glasses per dioptre of astigmatic error in the better eye (p<0.003), but there was no significant increase in the likelihood of wearing distance glasses with spherical error (odds ratio = 3.85, p>0.15). Similar effects were seen for both the better and worse eyes. Near-spectacle use was not dependent on astigmatic error (odds ratio = 0.22, p>0.12). It was only related to the signed spherical error in the worse eye with hypermetropic patients 6.74 times more likely to always wear spectacles per dioptre of positive spherical error (p<0.005). Conclusions: Following bilateral monofocal intraocular lens implantation, small levels of overall refractive error, in either eye, particularly astigmatism, predict distance-spectacle dependence, whereas spherical ammetropia in the range of ±1.0 D does not. Hypermetropia in the worse eye, but not astigmatism, predicts reading-spectacle dependence.

The standard treatment for patients undergoing routine cataract surgery is to insert a monofocal or fixed focus intraocular lens (IOL). When inserting such an IOL we frequently select an IOL power that will leave the patient with an emmetropic or low myopic prescription. Following bilateral phacoemulsification surgery where emmetropia has been targeted, spectacle dependence for distance is at least 40%. What is not clear is what factors in the postoperative refraction predict whether a patient will be spectacle-dependent for near or distance. Knowledge of such factors would allow the surgeon, by changing the IOL power selected, or by managing preoperative astigmatism, to reduce spectacle dependence.

METHODS

To examine vision-related quality of life after routine bilateral sequential phacoemulsification, three hundred cataract patients were entered into a prospective study of visual outcomes after bilateral cataract surgery. Patients were randomised to sequential implantation with either the Tecnis Z9000 or the Acrysof MA60AC monofocal intraocular lenses. Computer-generated randomisation using a non-blocked coin-toss protocol was used to allocate patients to sequential bilateral implantation of the Z9000 IOL or MA60AC IOL. A spherical equivalent from 0 to -0.5 D was targeted in each eye. This study has been reported in detail elsewhere. Inclusion criteria were: age 30 years and above and presence of bilateral visually significant cataracts. Exclusion criteria were: ocular co-pathology which might influence postoperative vision, congenital cataracts or a history indicative of amблиопia and preoperative astigmatism greater than 1.5 D as measured by the IOLMaster keratometer. Wherever cataract density permitted, biometry was performed using the IOLMaster; otherwise A-scan biometry was performed. Manufacturers' ultrasound A constants were used throughout. Information on the biometry technique used was retrospectively collected by examining the notes.

Four months after the second eye was operated on, patients were interviewed about whether they wore spectacles for near and distance visual tasks and underwent a subjective refraction. Patients were asked whether they wore distance-spectacles “always,” “for driving/TV only” or “never.” They were also asked if they wore reading glasses “always,” “for fine print only,” or “never.” Monocular uncorrected visual acuity (UCVA) and binocular best spectacle corrected visual acuity (BSCVA) were tested using Early Treatment of Diabetic Retinopathy Study (ETDRS) log minimum angle of resolution (logMAR) letter charts projected on a high-resolution liquid crystal display 4 m from the subject. Refractions were performed by two trained ophthalmic technicians, using a precise protocol. The duochrome technique was not used. All refractions were recorded in minus cylinder format. Near acuities were not recorded, as the original primary aim of the study was to assess the effect of two IOL designs on distance vision-related quality of life.

Spherocylindrical powers were converted to a three-dimensional vector notation that included astigmatism and sphere powers (M, Jo and J45). The spherical error (M) refers to the spherical equivalent; JO and J45 refer to Jackson crossed cylinders with orientations of 0 and 45° respectively. The values for M, Jo and J45 specify a point in space, and the distance of this point from the origin represents overall refractive error (D). The astigmatic error (J) is half the cylindrical power.
Ten years after photorefractive keratectomy (PRK) and Saser in situ keratomileusis (LASIK) for moderate to high myopia (control-matched study)

J L Alio,1 D Ortiz,1 O Muftuoglu,2 M J Garcia1

ABSTRACT

Objective: To compare the long-term outcomes of photorefractive keratectomy (PRK) and laser in situ keratomileusis (LASIK) for myopia between -6 and -10 D.

Methods: A retrospective, control-matched study including 68 eyes, 34 which underwent PRK and 34 LASIK, with myopia between -6 and -10 D, operated using the VISX 20/20 excimer laser, was performed. Optical zones of 5.5 to 6 mm were used. All PRK-treated eyes were matched with LASIK-treated eyes of the same age, spherical equivalent within ±1.25 D, sphere within ±1.5 D and cylinder within ±2.5 D. All patients were evaluated 3 months, 1 year, 2 years, 5 years and 10 years after surgery. The main outcomes measures were refractive predictability and stability, safety, efficacy and re-treatment rate.

Results: At 10 years, 20 (71%) and 23 (88%) were within ± 1.00 D after PRK and LASIK respectively. The re-treatment rate was 35% and 18% respectively. No eye lost more than two lines of BSCVA in both groups. The efficacy was 0.90 for PRK and 0.95 for LASIK. Conclusions: Both PRK and LASIK were safe for moderate myopia. LASIK demonstrated slightly better efficacy, predictability, and less rate of re-treatment after 10 years. The technical improvements should be taken into account when comparing these results with those obtained more recently.

Photorefractive keratectomy (PRK) to correct myopia was introduced in the late 1980s. Because of severe postoperative pain and relatively slow recovery after FRK, laser in situ keratomileusis (LASIK) was introduced in the early 1990s and became the most performed refractive surgery modality in the 2000s with claimed advantages over PRK such as quick visual rehabilitation, higher predictability, minimal postoperative discomfort and absence of corneal haze. Although, studies with short-term follow-up reported that the risks associated with LASIK were considered to be low, postoperative flap-related complications and corneal ectasia can be sight-threatening. Consequently, excimer laser superficial keratectomy techniques such as photorefractive keratectomy (FRK), laser subepithelial keratectomy (LASEK) and epithelial laser in situ keratomileusis (Epi-LASIK) have gained popularity in recent years to correct myopia to refrain from possible complications of LASIK such as corneal ectasia.
efficacy are the greatest concerns. Despite millions of procedures having been performed, there is a great lack of data about the long-term comparison of PRK and LASIK. Previous studies comparing PRK and LASIK outcomes, up to 1 year after surgery, found similar or slightly better safety and efficacy outcomes for LASIK. The aim of the present study is to perform a comparative analysis of the evolution of the corneal curvature and the refractive stability 10 years after myopic PRK and LASIK for moderate myopia by means of a control-matched retrospective study.

METHODS Patient population
A total of 4800 charts of eyes that underwent PRK or LASIK between April 1992 to December 1995 at the Institute Oftalmologico de Alicante (Spain; were reviewed. Our database was compiled including 509 eyes of 356 patients treated with myopic PRK and 294 eyes of 178 patients treated with myopic LASIK that returned for follow-up at 3 months, 1 year, 2 years, 5 years and 10 years after the initial procedure, either spontaneously or after telephone calls (particularly at 10 years). Among this group, 34 (17 right, 17 left) PRK-treated eyes of 33 patients and 34 (15 right, 19 left) LASIK-treated eyes of 32 patients who had a preoperative spherical equivalent between $-6$ and $10$ D were matched using the following criteria: (1) same age, (2) preoperative spherical equivalent (SE) within $\pm 1.25$ D, (3) preoperative sphere (S) within $\pm 1.50$ D and (4) preoperative cylinder (C) within $\pm 2.50$D. Patient demographics, refraction, mean optical zone and ablation depth at the time of treatment are given in table 1. The study was approved by the institutional review board (Ethical Committee of Clinical Investigation of Institute Oftalmologico de Alicante) and followed the tenets of Helsinki Declaration.

Surgical procedure
Inclusion criteria for surgery were: no contact lens wear 4 weeks before the surgery and stable refractive error for at least 6 months before surgery, normal peripheral retina or treated with photocoagulation when necessary, no previous ocular surgery, and no corneal diseases, glaucoma or history of ocular trauma. Exclusion criteria for surgery were: evidence of keratoconus or kerato-conus suspect as evidenced by corneal topography, active ocular or systemic disease likely to affect corneal wound healing, pregnancy and nursing.

Use of Anterior Segment Optical Coherence Tomography to Study Corneal Changes After Collagen Cross-linking

MURIEL DOORS, NAYY1RIH G. TAHZIB, FRED A. EGGINK, TOS T. J. M. BERENDSCHOT, CARROLL A. B. WEBERS, AND RUDY M. M. A. NUIJTS

• PURPOSE: To investigate the stromal demarcation line after corneal cross-linking using anterior segment optical coherence tomography (AS-OCT) and its influence on the short-term results of cross-linking in patients with progressive keratoconus.
• DESIGN: Prospective, nonrandomized study.
• METHODS: Twenty-nine eyes of 29 patients with progressive keratoconus (n = 28) or after laser in situ keratomileusis ectasia (n =1) were included and treated with corneal cross-linking at our institution. Measurements at 1, 3, 6, and 12 months after corneal cross-linking were: refraction, best-corrected visual acuity (BCVA), tonometry, corneal topography, AS-OCT, specular microscopy, and aberrometry. Demarcation line depth was measured centrally, 2 mm temporally, and 2 mm nasally by two independent observers using AS-OCT and was correlated with clinical parameters.
• RESULTS: The stromal demarcation line was visible with AS-OCT at 1 month after surgery in 28 of 29 eyes. Pairwise comparisons between the two observers of the AS-OCT measurements did not show a statistically significant difference. After an initial steepening of maximal keratometry values and a decrease in BCVA at 1 month after surgery (both with P < .012), no significant changes were found at 3, 6, and 12 months after surgery compared with before surgery. Refractive cylinder, topographic astigmatism, aberration values, endothelial cell density, and intraocular pressure remained stable during all postoperative visits. A deeper demarcation line depth was associated with a larger decrease in corneal thickness (r = -0.506; P = .012).
• CONCLUSIONS: AS-OCT is a useful device to detect the stromal demarcation line after corneal cross-linking. At 3 to 12 months follow-up, all clinical parameters remained stable, indicating stabilization of the keratoconic disease. (Am J Ophthalmol 2009;148:844-851. © 2009 by Elsevier Inc. All rights reserved.)
M. ELLZH

PURPOSE: To measure aqueous vascular endothelial growth factor and insulin-like growth factor-1 in diabetic patients with long-lasting macular edema following phacoemulsification and intraocular lens implantation.

METHODS: A prospective, nonrandomized, clinical trial was conducted. Four patients with diabetic macular edema (DME) received intravitreal bevacizumab (Avastin; Genentech Inc, South San Francisco, California, USA) for clinically significant macular edema (CSME) before cataract surgery. Aqueous samples were collected during surgery and CSME status and macular edema severity were assessed by optical coherence tomography (OCT) and fundus photography at baseline and postoperatively.

RESULTS: In patients with diabetes, intravitreal bevacizumab treatment significantly reduced aqueous VEGF and IL-6 levels, decreased central subfield thickness, and improved visual acuity postoperatively.

CONCLUSION: Intravitreal bevacizumab treatment can reduce aqueous levels of VEGF, IL-6, and protein and improve visual acuity in patients with diabetes following cataract surgery.

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A simple and evolutional approach proven to recanalise the nasolacrimal duct obstruction

D Chen,1 J Ge,2 L Wang,2 Q Gao,2 P Ma,2 N Li,2 D-Q Li,3 Z Wang2

ABSTRACT Aini: To evaluate a new approach of recanalisation of nasolacrimal duct obstruction (RC-NLDO) in the treatment of the nasolacrimal duct obstruction (NLDO) and chronic dacryocystitis.

Methods: 583 patients with 641 eyes suffering from NLDO and chronic dacryocystitis were enrolled in this study. The RC-NLDO was performed in 506 eyes, with 135 eyes undergoing external dacryocystorhinostomy (EX-DCR) as controls. Patient follow-up for 54 months was evaluated by symptoms, dye disappearance test, lacrimal irrigation and digital subtraction dacryocystogram. The RC-NLDO was also performed in 12 rhesus monkeys for histopathological examination.

Results: The clinical success rates were 93.1% in 506 cases of RC-NLDO and 91.11% in 135 cases of EX-DCR. The success rates for second surgery were achieved in 85.19% on RC-NLDO and 40.0% on EX-DCR. No major intra- or postoperative complications were created in 1994.5-8 Since then, this approach has been widely adopted by many ophthalmologists in China for its simplicity, safety, efficacy and minimal invasion.9-11 In the present study, we report the long-term follow-up results of RC-NLDO in the clinical treatment for 506 cases of NLDO and chronic dacryocystitis, as well as the histopathological evidence from animal experiments. The relative indication, contraindication, surgical technique, postoperative care, complications, advantages and disadvantages of the RC-NLDO are discussed.

MATERIALS AND METHODS Patients

This study adhered to the tenets of the Declaration of Helsinki and was approved by the Institutional Review Board (IEJB)/Ethics Committee of Zhongshan Ophthalmic Center, Sun Yat-sen University. All cases were chosen from outpatients who were diagnosed as having NLDO and/or chronic dacryocystitis. Every patient underwent preoperatively comprehensive ophthalmic and intranasal examination. Dacryocystogram or digital subtraction dacryocystogram was performed in some cases.

A total of 641 eyes of 583 consecutive patients were recruited from July 2003 to June 2006 with their signed informed consent forms, including 135 eyes of 126 patients undergoing the EX-DCR and 506 eyes of 457 patients undergoing the RC-NLDO. There were no statistical differences in patient demographics between these two groups. The male-to-female ratio was approximately 1:3, and the average age was 50 years. The duration of symptoms ranged from 6 months to 26 years (mean 5.1 years) in the RC-NLDO group and from 6 months to 17 years (mean 4.7 years) in the EX-DCR group.

instrument used for RC-NLDO

The instrument used for recanalisation of nasolacrimal duct obstruction was the lacrimal canaliser consisting of a console and its accessories (fig 1). The console can discharge a power current (50-150 W) with 500kHz frequency. The high-frequent lacrimal (HFL) probe is made of copper-silver alloy 1.2 mm in diameter and 140 mm in length. Its tip is 2.0 mm long, smooth, blunt and naked (without an insulating coat on the surface), features allowing it to cauterise blocked tissue in a nasolacrimal duct.

Surgical procedures

EX-DCR was performed under local anaesthesia in a standardised fashion.7 The RC-NLDO was

Nasolacrimal duct obstruction (NLDO) and chronic dacryocystitis are common ophthalmic diseases. The external dacryocystorhinostomy (EX-DCR) has been the most effective and standard surgery in treating these conditions since 1904 when it was reported by Toti.5 However, EX-DCR is an invasive, relatively complex and time-consuming procedure that causes a facial cutaneous scar. Many patients prefer to undergo a less invasive, relatively simple and time-saving procedure when it was reported by Toti. However, EX-DCR is an invasive, relatively complex and time-consuming procedure that causes a facial cutaneous scar. Many patients prefer to undergo a less invasive, relatively simple and time-saving procedure.
Macular thickness decreases with age in normal eyes: a study on the macular thickness map protocol in the Stratus OCT

U Eriksson, A Aim

ABSTRACT

Background/aim: Retinal and retinal nerve fibre layer (RNFL) thinning with age have been described in histological studies. In vivo techniques like optical coherence tomography (OCT) have shown thinning of optic nerve RNFL and the retina in specific areas. One would expect thinning of the total macula, but so far, no correlation with the quantitative OCT macular map tool and age has been found.

Methods: Sixty-seven healthy individuals underwent three repeated scans in both eyes with the macular thickness map protocol in the Stratus OCT. That protocol divides the macula area into nine ETDRS fields. The RNFL was measured in one specific location close to the optic disc. Correlations between retinal, RNFL thickness, macular volume and age were determined.

Results: We found a statistically significant negative relationship between retinal thickness and age for all ETDRS areas, total macular volume and RNFL thickness. Retinal thickness decreased by 0.26-0.46 µm, macula volume 0.01 mm³ and RNFL 0.09 00m per year.

Conclusion: Retinal thickness within the area covered by the macular map significantly decreases with age. In the area examined in the papillomacular bundle, 20% of the retinal thinning is due to the RNFL, and 80% is due to thinning of other layers of the retina.

Histological studies of the human retina and optic nerve have shown a decreased density of photoreceptors, ganglion cells, retinal pigment epithelium and optic nerve fibres with age.*
also found that retinal thickness decreases with age. None of these investigators, however, used the OCT mapping technique. Based on the findings in postmortem and in vivo studies, one would expect a slight thinning of the total retina. Surprisingly, studies on normal retinal thickness with the mapping protocol have so far not shown any significant correlation between retinal thickness and age. Therefore, we wanted to examine the relation between retinal thickness and age with the macular map technique.

SUBJECTS
The study was conducted in accordance with the guidelines of the Declaration of Helsinki, and the protocol was approved by the ethics committee of Uppsala University. A total of 134 eyes from 67 healthy Caucasian subjects (43 women (64%) and 24 men (36%), median age 34.4 years (range 12-74)), recruited among the staff and their families at the department of ophthalmology, University Hospital, Uppsala, were included. All subjects underwent three measurements with the map protocol in both eyes. Before inclusion, a thorough medical history was obtained, and all subjects underwent a routine ophthalmological examination including visual acuity, slit-lamp examination and dilated fundus examination with the 60 dioptre lens in the slit lamp. Subjects with a history of any ophthalmological condition or positive findings on a routine eye examination were excluded. A visual acuity below 1.0 (20/20) and a refractive error of more than 6 dioptres spherical and/or more than 3 dioptres cylindrical were exclusion criteria.

METHODS
The pupils were dilated with 0.5% tropicamide, and all subjects underwent a dilated slit-lamp examination. The latest commercially available OCT model, Stratus OCT 3 (Carl Zeiss Meditec. Dublin, California) with software 4.0.1, was used. In Stratus OCT, there are three different map protocols. The macular thickness map protocol was used in this study.

OCT is a non-invasive, non-contact technique by which to obtain high-resolution images from the anterior and posterior segments of the eye. Utilising the principles of ultrasound, OCT measures backscattered low-coherent light from intraocular structures as an A-scan. Cross-sectional tomographic images (B-scans) are constructed from repetitive axial A-scans while the probe beam scans across the retina. The retinal thickness is defined as...
Intravitreal injection of pegaptanib sodium for proliferative diabetic retinopathy

V H Gonzalez, G P Giuliani, R M Banda, D A Guel
ABSTRACT

Background: To compare the efficacy of intravitreal pegaptanib (IVP) with panretinal laser photocoagulation (PRP) in the treatment of active proliferative diabetic retinopathy (PDR).

Methods: A prospective, randomised, controlled, open-label, exploratory study. Twenty subjects with active PDR were randomly assigned at a 1:1 ratio to receive treatment in one eye either with IVP (0.3 mg) every 6 weeks for 30 weeks or with PRP laser. Efficacy endpoints included regression of retinal neovascularisation (IW), changes from baseline in best-corrected visual acuity (BCVA) and foveal thickness. Safety outcomes included observed and reported adverse events. Results: In 90% of randomised eyes to IVP, retinal IW showed regression by week 3. By week 12, all IVP eyes were completely regressed and maintained through week 36. In the PRP-treated group, at week 36, two eyes demonstrated complete regression, two showed partial regression, and four showed persistent active PDR. The mean change in BCVA at 36 weeks was +5.8 letters in pegaptanib-treated eyes and -6.0 letters in PRP-treated eyes. Only mild to moderate transient ocular adverse events were reported with pegaptanib.

Conclusions: IVP produces short-term marked and rapid regression of diabetic retinal IW. Regression of NV was maintained throughout the study and at the final visit.

Diabetic retinopathy (DR) is a major cause of blindness in the Western world. Research into the aetiology of ocular neovascular diseases such as DR has identified a pivotal role for vascular endothelial growth factor (VEGF) in promoting both angiogenesis and increased vascular permeability.

Intravitreal injection of VEGF induces many of the pathological changes characteristic of DR, including intraretinal and preretinal neovascularisation, microaneurysm formation, intraretinal haemorrhage, macular oedema and areas of capillary non-perfusion with endothelial cell hyperplasia. Elevated intraocular levels of VEGF have been reported in patients with DR. Moreover, this elevation is more pronounced in PDR than in non-proliferative diabetic retinopathy (NPDR).

The Isoform 1.65 of VEGF-A (VEGF165) is particularly potent in promoting ocular neovascularisation and breakdown of the blood-retinal barrier (BRB) through a leucocyte-dependent mechanism. Pegaptanib sodium is a selective anti-VEGF aptamer that binds to VEGF. Preclinical studies demonstrated that intravitreal injections of pegaptanib (IVP) can inhibit pathological ocular neovascularisation while leaving physiological vascularisation unimpaired. In a recent Phase II
study of pegaptanib for the treatment of diabetic macular oedema (DME), findings suggested that this IVP may be capable of halting and even reversing pathological retinal neovascularisation (NV). We hypothesised that in patients with active PDR, IVP would cause marked reduction in vitreous levels of VEGF with regression or pathological NV, thereby hindering the progression of PDR. In this report we present the final results from our pilot study to test this hypothesis.

METHODS

Study design
This study was a randomised, prospective, open-label direct comparison of pegaptanib alone to PRP alone in patients with PDR. It was approved by the Sterling Institutional Review Board, and conducted in conformity to the principles of the Declaration of Helsinki.

Subject selection
Eligible subjects had active FDR, in one or both eyes, with at least one of the following high-risk characteristics as defined by the Diabetic Retinopathy Study (DRS): (1) new vessels within one disc diameter of the optic nerve head that are larger than a third of the disc area and/or (2) vitreous haemorrhage associated with either less extensive new vessels at the optic disc, or with new vessels elsewhere half the disc area or larger. In addition, at the screening visit, the best-corrected visual acuity (BCVA; measured by the Early Treatment Diabetic Retinopathy Study (ETDRS) chart) was ≤24 letters (approximately 20/320) and ≤85 letters (approximately 20/20). Eyes with mild preretinal haemorrhage or vitreous haemorrhage (VH) that did not interfere with visualisation of the macula and optic disc were eligible for inclusion. Subjects could participate in the study only if, in the opinion of the evaluating physician, PRP could be safely withheld for 4 weeks. Exclusion criteria included the following: haemorrhage or media opacity obscuring visualisation of the macula and optic nerve; significant epiretinal membranes (ERM) involving the macula; proliferative diabetic membranes along the major retinal arcades sufficiently extensive to cause either significant vitreomacular traction or significant impairment in BCVA; any tractional retinal detachment; severe ischaemia involving the foveal avascular zone; neovascular glaucoma; study eye treated with intravitreal steroid injections within 6 months prior to baseline and/or PRP treatment within 90 days of baseline.

ABSTRACT

Aim: Data on the outcome of surgery facilitate informed preoperative patient counselling. Most studies on the outcome of surgery for idiopathic full thickness macular hole surgery have concentrated on rates of anatomical closure. The aim of this study was to identify factors predicting visual success (better than 20/40; 6/12 Snellen) following macular hole surgery. Methods: A retrospective study of 133 patients undergoing standardised macular hole surgery with at least 3 months of postoperative follow-up. All patients underwent preoperative measurement of the maximum macular hole diameter using optical coherence tomography. Results: Multivariable regression analysis identified that age, preoperative visual acuity and macular hole size were significant predictors of visual success. The resulting model correctly classified the visual outcome of 80% of cases. Predicted rates of visual success varied from 93% in patients <60 years old with visual acuity better than 6/24 and a hole diameter of <350 μm, to 2% in patients those >79 years old with visual acuity of 6/60 or worse and hole diameter of >500 μm. Conclusion: The results provide a simple and clinically useful model to employ when counselling patients on macular hole surgery.
grade of operating surgeon, intra- and postoperative complications, postoperative anatomical sure and VA at 3 months (table 1).

Preoperative MLD of the IFTMH was measured using optical coherence tomography (OCT) (Stratus OCT, Zeiss (Carl Zeiss Meditec, Inc., Dublin, California, USA) and Topcon 3D OCT-1000 (Topcon Medical Systems, Paramus, New Jersey, USA)) and was defined as the greatest linear distance along the smallest hole aperture (fig 1).

All cases underwent phacoemulsification and intraocular lens implantation followed by 20-gauge three-port pars plana vitrectomy with induction of a posterior vitreous detachment when not already present. Indocyanine green (ICG)-assisted internal limiting membrane peeling was performed in all cases, using 0.5 ml of 0.5 mg/ml (0.05%) ICG and minimal retinal exposure time followed by fluid to air to 16% C2F6 gas exchange. All patients were instructed to maintain an upright postoperative posture during the day and to strictly avoid sleeping in a supine position. Follow-up was performed at day 1, 2 weeks and 3 months. Anatomical closure was determined at 3 months after surgery using indirect slit lamp biomicroscopy.

Statistical analysis
Snellen acuities were converted to logMAR units for analysis. LogMAR values of 2.0 and 3.0 were used for vision of counting finger and hand movement, respectively. Distribution analysis revealed postoperative vision and MLD to be non-normally distributed. In order to make prediction probabilities easier for application in a clinical setting a binary outcome variable "visual success" was defined, consistent with previous literature as postoperative VA of <0.3 logMAR (better than 6/12) at 3 months. MLD was categorised into quartiles (<350, s’350 to <400, 3=400 to <500, s=500 urn), age into decades, and preoperative VA as s0.3 to <0.6, s0.6 to <0.9 and &0.9 logMAR. Logistic regression analysis was used to determine which explanatory variables were to be included in the predictor for visual success. The multivariable model was built using a forward manual stepwise method by adding the most significant variable first. The significance level for removal from the model was p=0.1. Odds ratios (ORs) and 95% confidence intervals (CIs) were derived from this model. All p values were two-sided. Prediction models using logistic regression were evaluated by establishing a cut-off point; predicted probabilities below the cut-off point were treated as predictors of no event and predictions at or above the cut-off point were considered to be predictors of the event." A cut-off point of 0.50 was usually chosen. Using the 0.5 prediction cut-off points, we
**ABSTRACT**

**Background:** Current patterns of practice relating to primary intraocular lens (IOL) implantation in children <2 years old in the UK and Ireland are investigated. **Methods:** National postal questionnaire surveys of consultant ophthalmologists in the UK and Ireland. **Results:** 76% of 928 surveyed ophthalmologists replied. 47 (7%) of the respondents operated on children aged <2 with cataract. 41 (87%) of respondents performed primary IOL implantation, but 25% would not implant an IOL in a child under 1 year old. 88% of surgeons used limbal wounds, 80% manual capsulotomies, 98% posterior capsulotomies and 100% hydrophobic acrylic lenses. The SRK/T formula was most commonly used (70%). Exclusion criteria for primary IOL implantation varied considerably and included microphthalmos (64% of respondents), anterior and posterior segment anomalies (53%, 58%), and glaucoma (19%). **Discussion:** Primary IOL implantation in children <2 has been widely adopted in the UK and Ireland. There is concordance of practice with regards to surgical technique and choice of IOL model. However, there is some variation in eligibility criteria for primary IOLs: this may reflect a lack of consensus on which children are most likely to benefit. Thus, there is a need for systematic studies of the outcomes of primary IOL implantation in younger children.

Primary intraocular (IOL) implantation has become accepted practice for older children with cataract. While primary IOL implantation is being increasingly undertaken in children in the first 2 years of life, the long-term benefits and the factors associated with positive and negative outcomes are unclear. The British Isles Congenital Cataract Interest Group (BCCIG), a research network comprising British and Irish ophthalmic consultants, was established in 1995 in order to study the incidence, detection, causes, management and outcomes of congenital and infantile cataract. A national epidemiological study to investigate outcomes following primary IOL implantation in children <2 years old with congenital and infantile cataract is now being undertaken through the BCCIG. As a foundation for this research, we have investigated the surgical management of cataract in younger children in the UK and Ireland, with a focus on primary IOL implantation.

**METHODS**

In October 2008, 960 consultants comprising all members of the BCCIG, all consultant members of the Royal College of Ophthalmologists and Irish consultant ophthalmologists with a known interest in congenital cataract, were contacted using postal questionnaires accompanied by hand-addressed cover letters and postage-paid reply envelopes. Members of the BCCIG who did not respond to the mailing were sent reminders. We sought to discover the number of children <2 years old with congenital or infantile cataract managed over the previous year, the number undergoing surgery with and without primary IOL implantation and the details of surgical management. Respondents were asked to estimate the number of children managed over the preceding year. Exclusion criteria for primary implantation in children <2 were requested, as were preferred IOL model and IOL power calculation formulae together with details of surgical technique including lens aspiration and vitrectomy approaches and capsulotomy practices. The postoperative measurement of axial length was also investigated.

**RESULTS**

Thirty-two of the 960 distributed questionnaires were returned as undeliverable. Of the remaining 928 contacted consultants, 709 (76%) replied to the survey. Replies were received between October 2008 and January 2009. Of the 709 respondents, 47 (7%) stated that they operated on children <2 years old, estimating that over the preceding year they had operated on a total of 301 children. Six (13%) of the 47 surgeons did not perform primary IOL implantation in any child <2. The 41 surgeons who did perform primary IOL implantation estimated that in the preceding year they had operated on 268 children (116 with unilateral, 152 with bilateral cataract), undertaking primary IOL implantation in 65% (table 1).

**Exclusion criteria**

Exclusion criteria for primary IOL implantation in children <2 were provided by 36 of the 41 respondents. Six (17%) surgeons did not mention any ocular anomaly among their stated exclusion criteria. Twenty-three (64%) described specific anomalies which would prevent them from...
ABSTRACT

Aim: To compare the long-term intraocular pressure (IOP) outcomes of Ahmed Glaucoma Valve (AGV) implantation to trabeculectomy with mitomycin C (MMC) in open-angle glaucoma (OAG).

Methods: 78 OAG patients who underwent AGV implantation were matched with respect to age, preoperative IOP and preoperative medications. However, when success was defined according to criteria B, eyes undergoing trabeculectomy with MMC had a higher rate of success (p = 0.024).

Conclusions: Trabeculectomy with MMC has a significantly higher 5-year cumulative probability of success compared with AGV implants when greater reduction IOP is necessary.

It is estimated that by 2010, 60 million people worldwide will suffer from some type of glaucoma. Open-angle glaucoma (OAG) accounts for 74% of these cases. In OAG, the intraocular pressure (IOP) is frequently controlled with medications. However, when medications and lasers fail to control IOP, surgical management is necessary. Two surgical treatments with the longest success records are trabeculectomy with mitomycin C (MMC) and glaucoma drainage devices (GDD). Prior studies have reported 40-90% success rate with trabeculectomy in OAC. However, the majority of the studies with GDD include patients with neovascular, uveitic, developmental and mixed glaucoma (referred to as refractory, intractable or complicated glaucoma). Furthermore, there are fewer studies comparing the two surgical modalities, and only one of them is in patients with OAC. Currently, there is an ongoing prospective study comparing the 350 mm² Baerveldt glaucoma implant to trabeculectomy with MMC in patients with OAG and chronic angle-closure glaucoma (CACG). The treatment outcomes in the Tube Versus Trabeculectomy study reported a higher 1-year success rate in patients with the Baerveldt compared with trabeculectomy with MMC. One study comparing Ahmed Glaucoma Valve (AGV) implant with trabeculectomy with MMC in patients with primary OAG, secondary OAG and primary angle-closure glaucoma (PACG) reported no difference between the two groups with follow-up times of 6-13 months. Another study, by the same group, also reported no difference between the two groups at 31 months in patients with primary OAG and FACG. There is only one prior study comparing cataract extraction combined with Molteno implant or trabeculectomy in patients with OAG. Molteno and coauthors also reported no difference between the two groups at 8 years. As far as we are aware, there is currently no data comparing ACV with trabeculectomy with MMC in patients with OAG beyond 3 years.

The purpose for this study is to compare the long-term surgical success of ACV implantation with trabeculectomy in OAG.

PATIENTS AND METHODS

This is a retrospective case-controlled study of patients with OAC, which includes primary open-angle (POAG), pseudoexfoliation glaucoma (PXG) and pigmentary dispersion glaucoma (PDG), who underwent ACV implantation (New World Medical, Rancho Cucamonga, California) or trabeculectomy with MMC at the Jules Stein Eye Institute, University of California, Los Angeles with a minimum of 3 years' follow-up time. The surgery was performed by three experienced surgeons (JC, ALC or SKL) from 1994 to 2004. One hundred and eighty-eight eyes from 186 patients followed at the Jules Stein Eye Institute from 1994 to 2007 were identified. OAG eyes that had ACV implantation were matched with respect to age, gender, race, self-reported history of hypertension and diabetes, best-corrected visual acuity (BCVA), mean intraocular pressure (IOP), and all study procedures adhered to the recommendations of the Declaration of Helsinki.

Data collection

Preoperative data collected were age at the time of the surgery, gender, race, self-reported history of hypertension and diabetes, best-corrected visual acuity (BCVA), mean intraocular pressure (IOP), etc.
ABSTRACT

Aim: This study was performed to independently assess the turnover rates of aqueous and lipid layers of the tear film.

Methods: Two fluorescent dyes, fluorescein sodium and 5-dodecanoylaminofluorescein (DAF), which is a free-fatty-acid conjugate of fluorescein, were applied to the right eye of 12 healthy volunteers. Fluorescent intensity of the precorneal tear film was measured at the central cornea every minute for 10 min for fluorescein sodium, and every 5 min for 50 min for DAF. The turnover rate was calculated by plotting fluorescent intensity against time in a semilog plot and expressed as %/min.

Results: Turnover rates of fluorescein sodium

The precorneal tear film has traditionally been described as consisting of an outer lipid layer, a middle aqueous layer and an inner mucus layer. Although this remains valid, some modifications have been proposed. In the current model of the tear film, the aqueous-mucin layer is covered by two thin layers of lipids. Polar lipids such as phospholipids lie adjacent to the aqueous-mucin layer, and non-polar lipids such as cholesterol and wax ester are present at the tear-air interface. In addition, tears contain proteins that possess lipid-binding properties, such as tear lipocalin. Although lipids in tears are primarily located in the tear-film lipid layer, some lipids are presumably bound by lipocalin in the aqueous layer. Tear lipocalin is thought to have an important role in stabilising the tear-film lipid layer by transferring lipids to it from the aqueous layer.

Despite comprising a very small proportion of the overall tear-film thickness, the lipid layer is important for retarding evaporation and maintaining tear-film stability. Where the lipid layer is absent or where the integrity of the lipid layer is compromised, the evaporation rate of tears increases, accompanied by tear-film instability. To assess the lipid layer of tears, several techniques have been developed, including observation of lipid layer characteristics by interferometric methods, quantitative measurement of meibomian lipid on the lid margin by meibometry and measurement of evaporation from the ocular surface. Of these, observation of lipid layer characteristics by interferometric methods has been well established. In various pathological conditions, such as meibomian gland dysfunction, the appearance of the lipid layer can change. Lipid layer thickness, measured by interferometry, has been reported to correlate with tear-film evaporation, tear-film breakup time, and clinical symptoms. We have previously reported that the concentration of lipocalin in tears with meibomian gland dysfunction was significantly lower than in normal controls. Thus, lipids in tears, both in the lipid layer and in the aqueous layer held by lipocalin, are important when considering the pathophysiology of evaporative dry eye. Until now, however, there has been no information about the flow rate of tear-film lipid layer.

Aqueous tear flow is determined by several aspects of tear dynamics including tear production, tear volume, tear evaporation and tear outflow. Tear flow can be assessed by introducing a dye or radioactive substance into the conjunctival sac and measuring the decay in concentration over a certain period. Since the report of Mishima et al., fluorophotometric measurement using fluorescein sodium as a tracer has been the gold standard to quantify tear flow. The elimination rate of fluorescein sodium essentially represents the bulk aqueous flow because the dye is hydrophilic; however, the turnover of a certain tear component may not parallel the bulk aqueous flow. For example, we recently reported differences between the bulk aqueous flow of hyaluronic acid and the turnover of hyaluronic acid, suggesting that hyaluronic acid remains on the ocular surface independent of the bulk aqueous flow. Accordingly, we hypothesised that the flow rate of the tear lipid layer might be different from that of aqueous tear layer.

In this study, we tested this hypothesis using fluorescein and a free-fatty-acid conjugate of fluorescein. Fluorescein was used to assess the aqueous flow, and the conjugated dye was used as a tracer to determine the How rate of the tear lipid layer.

METHODS Fluorescent dye and fluorophotometer

5-Dodecanoylaminofluorescein (DAF; Molecular Probes, Eugene, Oregon) is a lipophilic and water-insoluble free-tatty-acid conjugate of fluorescein. This dye has the longest-wavelength absorption maximum at 495 nm, and an emission spectrum that peaks at 518 nm. A DAF emulsion (50 mg/ml) was prepared in sterile 0.067 M phosphate-buffered saline (PBS), pH 7.4, with 1% Tween 80.
Comparison of Outcomes of Lamellar Keratoplasty and Penetrating Keratoplasty in Keratoconus

DAPHNE C. Y. HAN, JODHBR1 S. MEHTA, YONG M1NG POR, HLA MYINT HTOON, AND DONALD T. H. TAN

• PURPOSE: To compare outcomes after penetrating keratoplasty (PK) and two techniques of deep anterior lamellar keratoplasty (DALK) in patients with keratoconus.

• DESIGN: Retrospective cohort study.

• METHODS: One hundred and twenty-five corneal transplantations comprising 100 PK and 25 DALK procedures for keratoconus at the Singapore National Eye Centre from April 1992 through December 2006 were included. DALK was performed with the modified Anwar technique (descemetic or DALKa group) in 14 eyes and manual lamellar keratoplasty (predescemetic or DALKm group) was performed in 11 eyes.

• RESULTS: At 12 months, the DALKa and PK groups achieved a logarithm of the minimum angle of resolution mean best spectacle-corrected visual acuity (BSCVA) of 0.15 and 0.27, respectively (P = .26), whereas the mean BSCVA of the DALKm group was 0.41 compared with the PK group (P = .12). Significance level was achieved between the DALKa and DALKm groups (P = .013). There was no significant difference in the mean spherical equivalent (P = .72) and astigmatism (P = .88) between the PK and DALK groups. The DALK group had a significantly lower incidence of complications compared with PK cases, including allograft rejection and glaucoma. Graft survival rate of both the PK and DALKa groups was 100%, whereas that of the DALKm group was 73% at 3 years after surgery (P = .000 between PK and DALKm groups).

• CONCLUSIONS: Visual acuity outcomes of the DALKa technique are comparable with those of PK for keratoconus, whereas DALK surgery results in fewer postoperative complications than PK. DALKa is emerging as a preferred choice among the lamellar techniques for better optical outcome. Further studies are required to provide long-term analysis of these results. (Am J Ophthalmol 2009;148:744-751. © 2009 by Elsevier Inc. All rights reserved.)

See accompanying Editorial on page 629.

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From the Singapore National Eye Centre (D.C.Y.H., J.S.M., Y.M.P., D.T.H.T.); the Singapore Eye Research Institute, Singapore (J.S.M., H.M.H., D.T.H.T.); and the Department of Ophthalmology (D.T.H.T.), Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Republic of Singapore.

Inquiries to Donald T. H. Tan, Singapore National Eye Centre, 11 Third Hospital Avenue, Singapore 168751, Republic of Singapore; e-mail: snecdt@pacific.net.sg

Comparison of Outcomes of Lamellar Keratoplasty and Penetrating Keratoplasty in Keratoconus

Penetrating keratoplasty (PK), the full-thickness replacement of a diseased cornea with allograft donor cornea, has been a well-accepted surgical treatment for keratoconus over the past few decades. However, it can be complicated by allograft endothelial rejection, which will lead to concomitant endothelial cell loss with subsequent risk of graft failure. Deep anterior lamellar keratoplasty (DALK), which involves replacing the anterior part of a diseased cornea while retaining the healthy deeper tissue, has the advantage of reducing the risks of graft rejection and intraocular complications. It is, however, more technically demanding and may result in suboptimal visual outcomes because of interface and refractive irregularities.

Over the past few decades, several techniques of anterior lamellar keratoplasty (ALK) have been described. These include the earlier predescemetic procedures in which some stromal tissue and Descemet membrane (DM) are left behind, such as in the manual forms of DALK in which manual lamellar surgical dissections were performed. A recent innovation of predescemetic DALK is automated lamellar therapeutic keratoplasty, which uses microkeratome instrumentation to perform lamellar dissection. Most recently, descemetic lamellar keratoplasty procedures have been described in which total stromal removal is attempted, leaving only the DM and endothelium behind, which includes the Anwar big-bubble technique.

This study aimed to compare the optical results of PK and two subgroups of ALK in patients with keratoconus, that is, predescemetic and descemetic techniques. In our population, keratoconus is the fourth most common indication for corneal grafting after pseudophakic and aphakic bullous keratopathy, postinfectious scarring, and regrafts. Because keratoconus represents low-risk keratoplasty and patients usually are young and free of other ocular pathologic features, they provide an ideal cohort to study success and visual outcomes between lamellar keratoplasty and PK.

METHODS

A COMPARATIVE COHORT STUDY WAS PERFORMED IN WHICH clinical data were retrieved from computerized database of the prospective Singapore Corneal Transplant Study. A total of 168 keratoconus patients underwent