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Astigmatism and Corneal Thickness in Cataract Surgery

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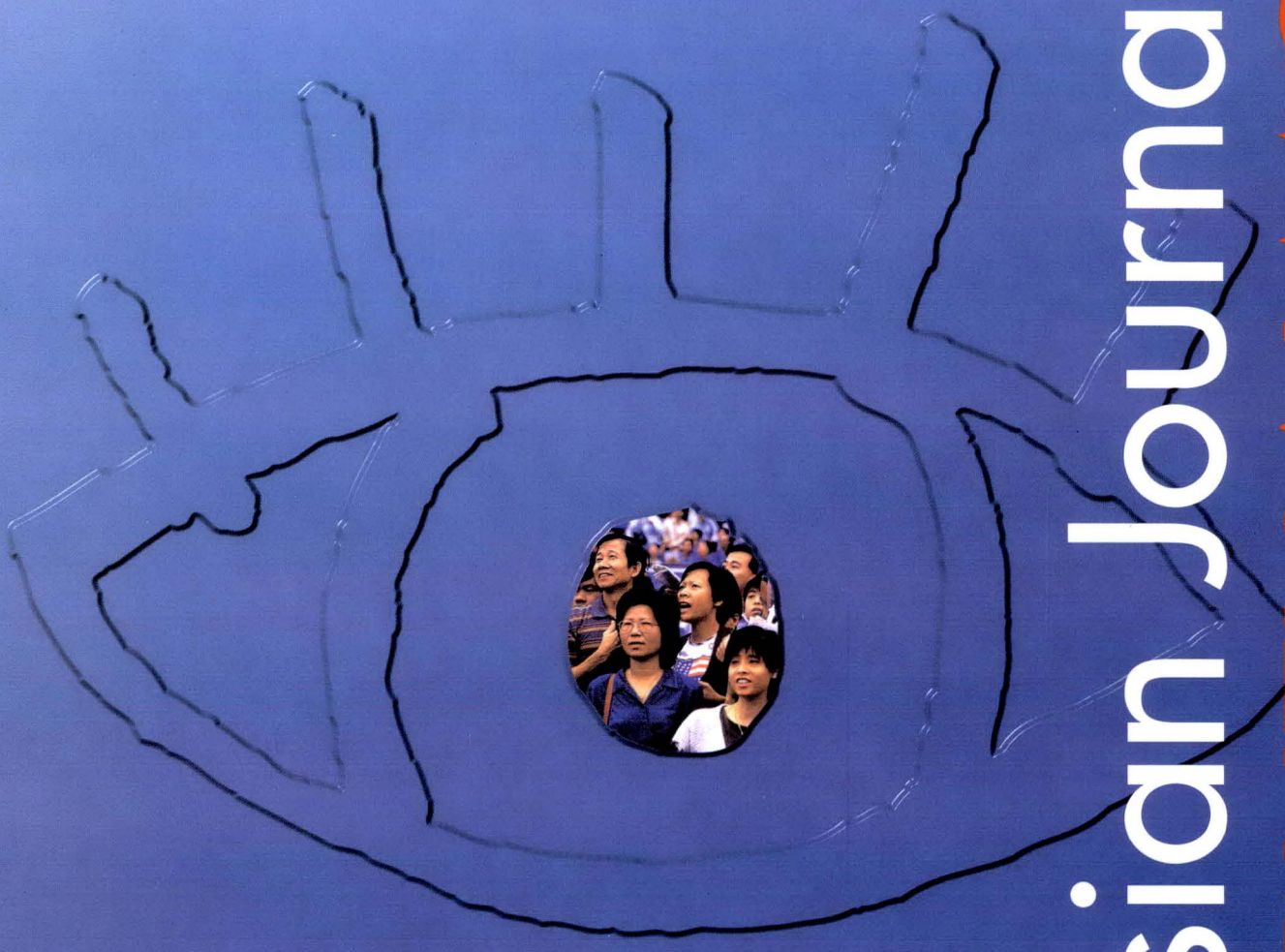

Asian Journal of OPHTHALMOLOGY

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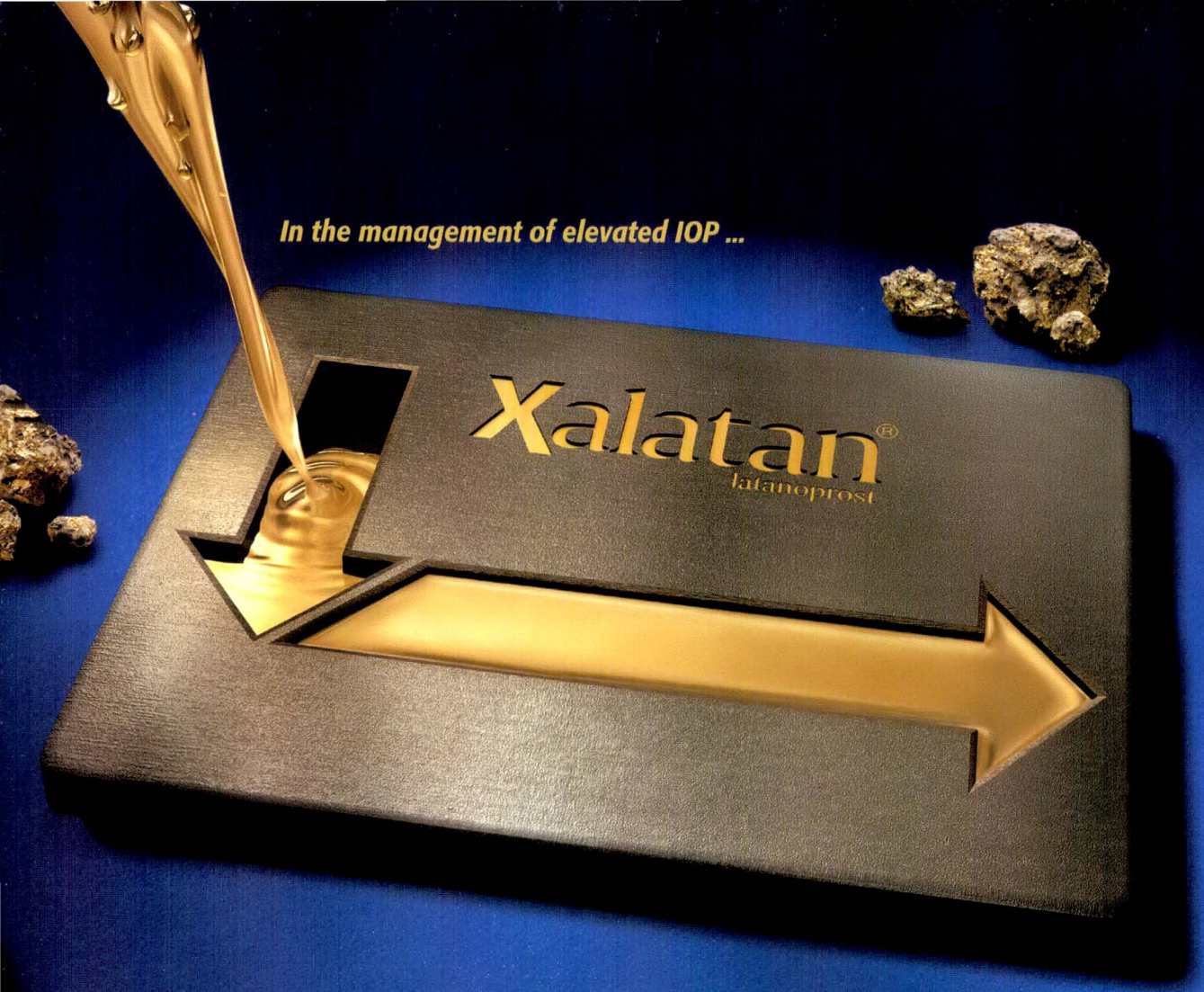

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§Available safety data include a 4-year, open-label long-term study and spontaneous reports.
‡IMS D&H™ audit from July 2000 to June 2001 (based on value share).

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Asian Journal of OPHTHALMOLOGY is a quarterly publication for the practising ophthalmologist. As new technologies and therapeutic interventions are continually being developed, ophthalmology has become a field of rapid change, particularly in the Asia-Pacific region, where disease patterns and health care delivery differ greatly from that seen in the West. Whilst the focus of Asian Journal of OPHTHALMOLOGY is on glaucoma, other topics relevant to the region will not be ignored. Input from ophthalmologists and allied clinicians is welcomed. This will determine the content and direction of Asian Journal of OPHTHALMOLOGY.

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Astigmatism and Corneal Thickness in Conventional Large Incision Versus Manual Small Incision Cataract Surgery

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Purpose: *To compare the amount of induced astigmatism following manual small incision sutureless cataract surgery and conventional large incision cataract surgery.*
Patients and Methods: *Thirty patients underwent small incision sutureless cataract surgery and 60 patients underwent conventional large incision cataract surgery, and were alternately assigned to wound closure by continuous or interrupted sutures.*
Results: *The final induced postoperative astigmatism was significantly different between the groups at 1.46 ± 0.83 D for patients undergoing manual small incision sutureless cataract surgery and 2.68 ± 1.9 D for patients having conventional large incision cataract surgery ($p < 0.004$).*
Conclusion: *Manual small incision sutureless cataract surgery is an effective, fast, and economical technique, ensuring satisfactory astigmatism-free rehabilitation for patients.*

Key Words: Astigmatism, Cataract, Cataract extraction

Asian J Ophthalmology 2002;4(4):2-6.

Introduction

Control of postoperative astigmatism has become an important challenge in recent years. After a seemingly well-performed cataract extraction with intraocular lens implant, high astigmatism can result, leading to patient dissatisfaction because of the delayed rehabilitation and blurred unaided vision. Large size of the incision and corneal distortion due to suture placement are the major determinants of astigmatism. Manual small incision sutureless cataract surgery (SICS) may therefore be the answer to the problems related to high astigmatism.[1]

Deturgescence of the corneal stroma is controlled by the pumping action of the endothelial layer and can be monitored by measurement of central corneal thickness (pachymetry). Loss or damage of endothelial cells leads to an increase in corneal thickness, which may ultimately induce corneal decompensation and loss of vision.[2]

The present study was undertaken to compare the amount of induced astigmatism following manual SICS and conventional large incision cataract surgery (LICS). This study also aimed to compare corneal thickness changes to gauge the difference in the magnitude of endothelial damage incurred during these 2 procedures.

Patients and Methods

This study was conducted at the Department of Ophthalmology at the BP Koirala Institute of Health Sciences in Nepal during 1 year from April 2000 to April 2001. Patients with uncomplicated age-related cataract were enrolled. Patients with coexisting glaucoma, uveitis, subluxated lens, traumatic cataract, or posterior segment pathology were excluded from the study.

This was a case series review of 30 patients who underwent SICS (group 2) who were compared with a group of 60 patients who underwent conventional LICS (group 1). Patients in group 1 were alternately assigned to wound closure by continuous or interrupted sutures. Keratometry, pachymetry and A scan biometry were done for all patients as well as the usual investigations according to the protocol for cataract surgery.

Surgical Technique

All patients were operated on using peribulbar anaesthesia. For patients in group 1, the site of incision was the superior limbus. The size of the incision, as measured by a Castroviejo scleral calliper (straight), was 8.5 mm. Envelope capsulotomy and an in-the-bag intraocular lens implantation was done for all patients. Continuous crossed 10.0 sutures were used to close the incision for 30 patients and 5 interrupted

10.0 sutures were used for the other 30 patients in this group. Patients in group 2 were operated on via a frown-shaped scleral incision, 5.5 mm in length. The centre of the frown was situated at the 11 o'clock position in the right eye and the 1 o'clock position in the left eye, 2 mm from the superior limbus, with the edges of the frown 3 mm from the limbus. A scleral tunnel was fashioned with a crescent knife. The length of the frown was measured by the Castroviejo calliper for all patients. Envelope capsulotomy was performed. The nucleus was removed by an irrigating vectis after hydrodissection, delineation, and prolapse into the anterior chamber. Viscoelastic was used to expel broken fragments of the nucleus, if present. An in-the-bag intraocular lens implantation was performed for all patients. No sutures were used to close the incision.

All procedures for patients undergoing SICS (n = 30) were performed by the same surgeon, while all LICS procedures (n = 60) were performed by 2 other surgeons, one of whom performed continuous suturing (n = 30) while the second did interrupted suturing (n = 30). Wound size was the same for all LICS operations. There was no intra-group variation in the surgical technique except for the suturing technique.

Postoperative follow-up was done at day 1, and 1, 4, and 6 weeks. At each follow-up visit, keratometry, refraction, and uncorrected visual acuity (UCVA) were performed. Pachymetry was performed at 1 and 6 weeks. The results were analysed by unpaired student *t*-test and analysis of variance (ANOVA). Astigmatism was diagnosed from the pre- and postoperative keratometry readings. Postoperative mean induced astigmatism at the end of 6 weeks was calculated by the simple subtraction method.[3,4]

Only corneal (keratometric) astigmatism was computed in this study since induced astigmatism is most frequently due to corneal scleral suturing and not tilting of the pseudophakos.[5]

Results

The male:female ratio was 2:1 (Figure 1) in both groups and most patients were aged 50 to 60 years (Figure 2). There were no statistically significant differences in the baseline variables between the 2 groups (Table 1). The mean preoperative astigmatism was 0.55 D for patients in group 1 and 0.50 D for patients in group 2.

The final induced postoperative astigmatism was 1.46 ± 0.83 D for patients in group 2 and 2.68 ± 1.9 D for patients in group 1, a highly significant difference ($p < 0.004$) [Figure 3].

The pattern of astigmatism was with-the-rule (WTR) for the majority of patients in group 1 (43; 72.2%), whereas this was only noted in 12 patients (40%) in group 2. Against-the-rule (ATR) astigmatism was

Figure 1. Male to female ratio.

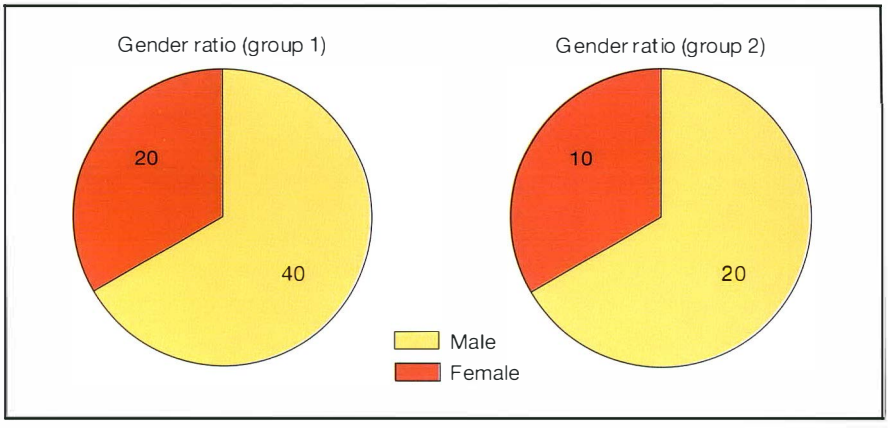


Figure 2. Patients' ages.

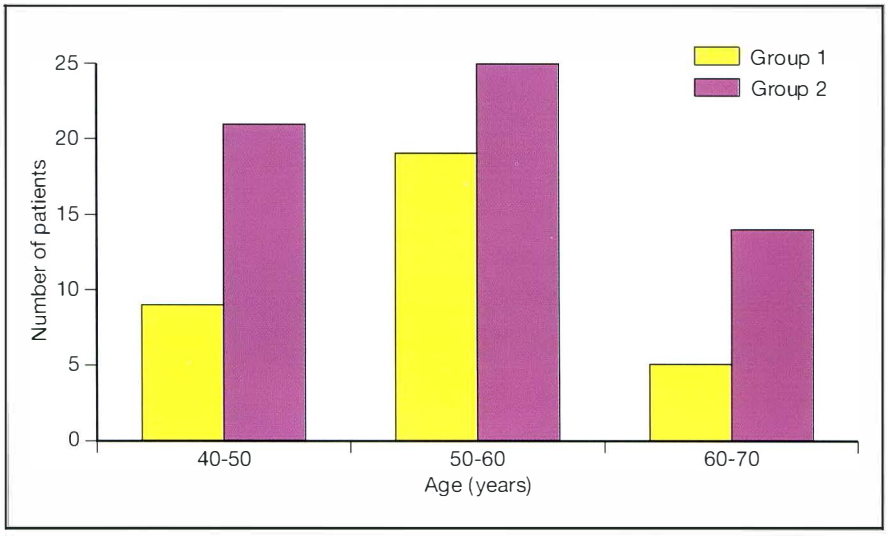
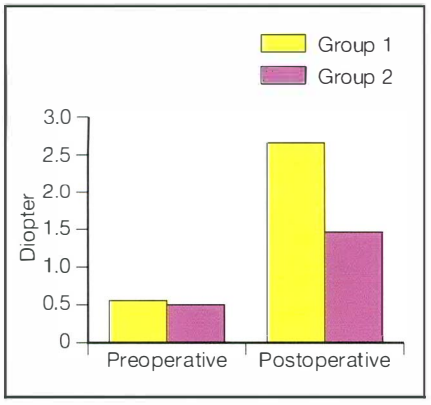


Table 1. Patients' characteristics.

Parameter	Group 1	Group 2
Mean age (years)	57.0 ± 6.6	55.0 ± 6.2
Gender ratio (M:F)	40:20 (2:1)	20:10 (2:1)
Preoperative astigmatism (D)	0.55	0.50
Preoperative pachymetry (mm)	0.52 ± 0.02	0. 54 ± 0.03

Figure 3. **Final induced postoperative astigmatism.**



noted in 12 patients (20%) in group 1 and in 12 (40%) in group 2. Six patients (20%) in group 2 were astigmatically neutral compared with 5 (7.8%) in group 1 (Figure 4).

The UCVA was 6/6 in 36.6% of patients in group 1 and 40% patients in group 2. Approximately 60% of patients in each group had UCVAs of 6/9 to 6/12, and no patients had UCVA of <6/12 (Table 2).

The average preoperative corneal thickness was 0.52 ± 0.02 mm for patients in group 1 and 0.54 ± 0.03 mm for patients in group 2. For patients in group 1, there was an increase to 0.60 ± 0.07 mm at the end of the first postoperative week, after which there was a steady decline to an average 0.54 ± 0.04 mm after 6 weeks. For patients in group 2, the increase at the end of the first week was to 0.62 ± 0.08 mm, after which the declining trend was the same as for patients in group 1, with the final corneal thickness after 6 weeks being 0.56 ± 0.06 mm (Figure 5). There was no significant difference in the increase in the corneal thickness at the end of the first week between the 2 groups. There was no significant difference in the preoperative and final postoperative corneal thickness in either group.

Discussion

Astigmatism prevention and control is one of the biggest challenges for a surgeon after cataract surgery. The major determinants of astigmatism are the site and size of the incision, the type of suture used, and the suturing technique. Since postoperative astigmatism is the major determinant of visual outcome, a comparative study is essential to ascertain the difference in induced astigmatism, if any, for conventional versus large incision surgery.

This study shows a statistically significant difference in the amount of induced astigmatism between the 2 types of surgery, highlighting that sutureless surgery, along with the site of incision being removed from the cornea, is highly effective for controlling postoperative astigmatism. This technique is fast and safe, allows a nucleus of any size to be extracted through the incision, and results in minimal postoperative astigmatism.[6] Previous studies of SICS have shown similar results (Table 3).[6-12] Gutierrez-Carmona evaluated astigmatism resulting from a 3.2 mm incision, with the resulting minimal astigmatism of 0.47 ± 0.22 D after 1 month and 0.22 ± 0.22 D after 3 months.[8] Other studies have shown astigmatism ranging from 0.54 ± 0.58 D to 1.58 ± 1.07 D an incision size similar to that in this study (5.5 mm).

The type of astigmatism was WTR for 75% of patients in group 1, as is expected from a steeper vertical meridian following suturing. However, there was an equal incidence of WTR and ATR astigmatism in group 2, with a fair percentage of patients who were astigmatically neutral. Masket reported large astigmatic swings up to 6 D in limbal wounds compared with scleral pocket incisions in which the net astigmatic swing was reduced to <1.5 D.[13] Few studies have performed this type of comparison of astigmatism for small and large incision cataract surgery (Table 4).[13-16] Patients in group 2 had a marginally higher percentage of UCVA of 6/6 compared with patients in group 1. No patients had vision of <6/12 in either group.

Corneal thickness is an important parameter to gauge surgical trauma and endothelial cell loss. This study reported an increase in corneal thickness at the end of the first postoperative week in both groups.

Figure 4. **Pattern of astigmatism.**

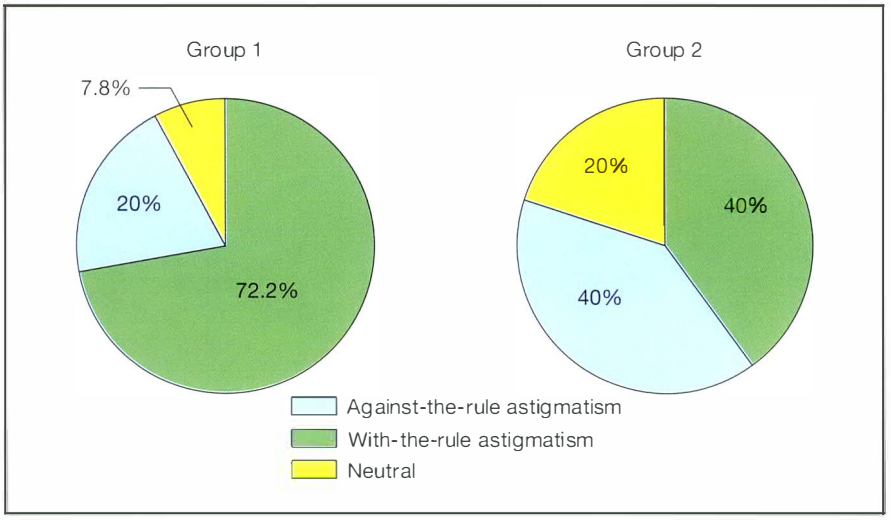


Table 2. **Uncorrected visual acuity.**

Uncorrected visual acuity at 4 weeks	Group 1 (%) [n = 60]	Group 2 (%) [n = 30]
6/6	22 (36.6)	12 (40.0)
6/9	20 (33.3)	10 (33.3)
6/12	18 (30.0)	8 (26.6)

Figure 5. **Changes in corneal thickness.**

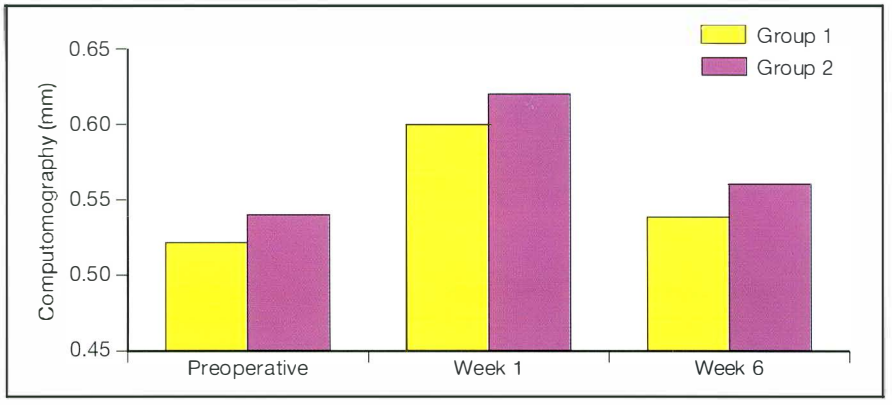


Table 3. **Studies of astigamatism following small incision cataract surgery (SICS) or large incision cataract surgery (LICS).**

Study	SICS (D)	LICS (D)
Yao et al, 1994[7]	0.92 ±0.68 (3 months)	> in SICS
Bartov et al, 1998[6]	0.54 ± 0.58 (3 months)	—
Gutierrez-Carmona, 2000[8]	0.21 ± 0.22 (3 months)	—
Luntz and Livingstone, 1977[9]	—	4. 09 (6 weeks)
Thygeson et al, 1979[10]	—	3.0 (4 weeks)
Rowan, 1978[11]	—	3. 87 (6 weeks)
Talamo et al, 1991[12]	—	1.44 (1 month)
Present study, 2001	1.46 ± 0.83 (6 weeks)	2. 68 ± 1.9 (6 weeks)

Nissen et al reported an increase to 0.68 ± 0.08 mm from 0.53 ± 0.04 mm on the first postoperative day.[17] Tragakis et al reported an increase of 16% by the third day from an initial value of 0.56 mm.[18] In the study described here, there was marginally increased corneal oedema and thickness in the first week (0.62 ± 0.08 mm) for patients in group 2 compared with those in group 1 (Figure 5). This was the result of a higher incidence of nucleus-endothelial contact during nuclear manipulation in the anterior chamber. Sharma et al have also reported a marginally higher rate of corneal endothelial decompensation following SICS.[19] Transient corneal oedema has been reported to be the most significant postoperative complication (54%) by Hepsen et al[20] and Bayramlar et al.[21] Amon et al reported a greater increase in peripheral corneal thickness than in central corneal thickness following SICS,[22] while Ventura et al reported that all patients in their series had significant postoperative corneal swelling on the first postoperative day.[2]

After 6 weeks, the corneal thickness reverted to normal preoperative values for the majority of patients, as reported by Tragakis et al.[18] Ventura et al reported restoration to preoperative values by 3 months.[2] Meanwhile, comparison of the corneal thickness changes between the groups undergoing LICS and SICS has been done for the first time in this study (Table 5).

Table 4. **Type of astigmatism.**

Studies	Initial astigmatism	Final astigmatism
Axt, 1987[14]	Initial WTR (LICS)	Followed by ATR
Masket, 1989[13]	Initial WTR (LICS)	Followed by ATR
Wishart et al, 1986[15]	Mainly WTR (LICS)	—
Catalin et al, 1998[16]	Initial WTR (LICS)	Followed by ATR
Present study, 2001	WTR (after 6 weeks): LICS 72.2%; SICS 40%	ATR (after 6 weeks): LICS 20%; SICS 40%

Abbreviations: ATR = against-the-bag; WTR = with-the-bag.

Conclusion

Manual SICS induces significantly lesser astigmatism compared with conventional LICS. Corneal thickness has a significant initial increasing trend during the first week, especially for patients undergoing SICS. However, this reverts to normal within 6 weeks for the majority of patients in both groups.

Thus, SICS is an effective, fast, and economical technique, ensuring satisfactory astigmatism-free rehabilitation for patients. This is important for developing countries such as Nepal, where possession of sophisticated and expensive instruments such as a phacoemulsification machine is not viable for most institutions.

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Table 5. **Corneal thickness following small incision cataract surgery (SICS) or large incision cataract surgery (LICS).**

Study	Preoperative corneal thickness (mm)	Postoperative corneal thickness (mm)		Type of surgery
Tragakis et al, 1997[18]	0.56	0.64 (day 3)		LICS
Nissen et al, 1991[17]	0.53 ± 0.04	0.68 ± 0.08 (day 1)		LICS
Present study, 2001	0.52 ± 0.02	Week 1	Week 6	
		0.60 ± 0.07	0.54 ± 0.04	LICS
	0.54 ± 0.03	0.62 ± 0.08	0. 56 ± 0.06	SICS

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Prechop Manual Phacofragmentation: Cataract Surgery without a Phacoemulsification Machine

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In this cataract extraction technique, the nucleus is manually split into 2 fragments by prechopper forceps and the fragments removed through a 5.5 to 6.5 mm temporal clear corneal incision. After capsulorrhexis, hydrodissection, hydrodelineation, and surface cortex aspiration, a prechopper forceps is gently passed into the centre of the nucleus core and the nucleus is fragmented into 2 pieces. Each piece is prolapsed into the anterior chamber and extracted with 0.12 corneal forceps and a Sinsky hook via a small incision. This method of cataract removal was performed for 145 consecutive patients, among whom there were 5 posterior capsule ruptures, but no serious complications occurred. Postoperative best corrected visual acuity was better than 20/40 for 80% of patients.

Key Words: Cataract extraction, Corneal incision, Phacoemulsification

Asian Journal of Ophthalmology 2002;4(4):7-9.

Introduction

Phacoemulsification prechop is a technique described by Akahoshi,[1] in which lens nucleus is divided into 4 pieces by the phacoemulsification prechopper or Akahoshi's forceps. Each fragment is then emulsified by the phacoemulsification machine.

Phacoemulsification allows the surgeon to work with small incisions but this technique requires expensive, complex equipment, which is an obstacle in many regions.[2,3] During the 1980s, manual cataract fragmentation techniques began to appear as alternatives to phacoemulsification. These small incision procedures are associated with a short learning curve and involve a relatively small financial outlay.[4]

In this article, a technique that divides the nucleus into 2 fragments prior to manual removal through the temporal clear corneal incision is described. This prechop manual phacofragmentation (prechop MPF) procedure is easy, economical, and has a good visual outcome. The procedure is performed without a phacoemulsification machine but achieves a similar outcome.

Surgical Technique

After administration of retrobulbar anaesthesia, 2 paracenteses, at the 1 and 5 o'clock positions in the left eye and the 7 and 11 o'clock positions in the right eye, are made with a 15° stab knife, followed by a temporal clear corneal incision using a 3 mm keratome. A large capsulorrhexis is performed after injection of a viscoelastic substance. Hydrodissection followed by hydrodelineation are performed until the 'golden ring' is present. Viscoelastic is then reinjected for optimal visualisation and stability of the anterior chamber. For the left eye, the Sinsky hook is passed through 1 side port and placed at the 9 o'clock position under the anterior capsule to stabilise the nucleus. The prechop forceps (Khosla Surgical Industries PVT Ltd, Mumbai, India) is inserted through the corneal wound at the 3 o'clock position and gently passed into the centre of the nucleus core. Slowly opening the forceps will easily split the nucleus split into 2 pieces. However, if the nucleus does not split, a second insertion may be made until the division of the nucleus occurs (Figure 1).

Figure 1. The Sinsky hook is passed through 1 side port of the left eye and was placed at the 9 o'clock position under the anterior capsule. The prechopper forceps are gently inserted into the nucleus core and slowly opened.

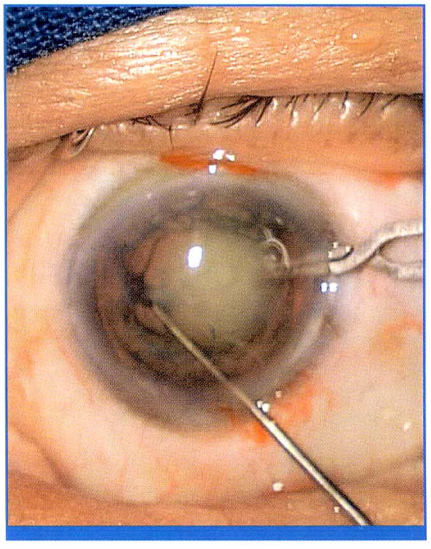


Figure 2. The nuclear fragment is prolapsed into the anterior chamber with the help of a spatula.

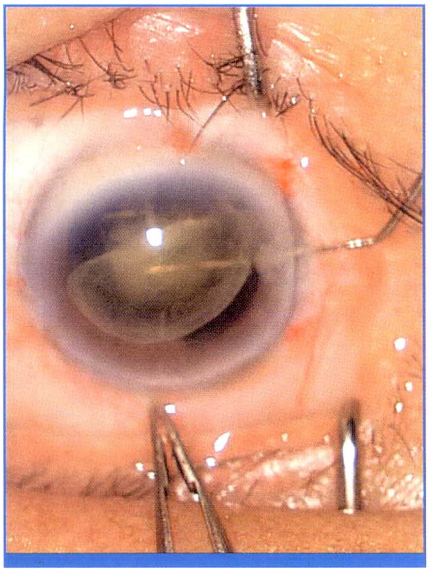
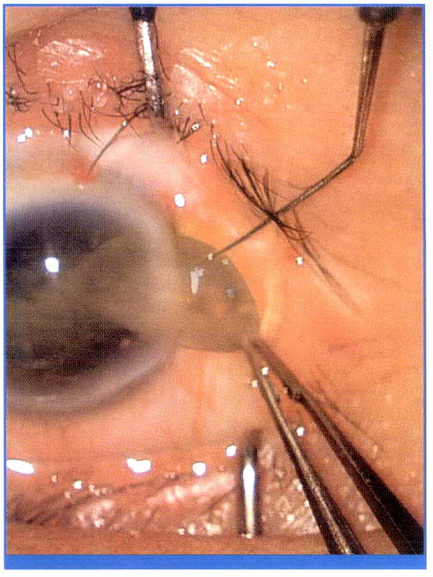


Figure 3. The nuclear fragment is removed through the corneal incision using 0.12 corneal forceps and a Sinsky hook.



The corneal incision is then enlarged to 5 to 6 mm with a 3.2 mm disposable keratome. After the viscoelastic agent is injected, the first fragment is prolapsed into the anterior chamber with the help of a spatula and is set on its end facing the internal opening of the incision (Figure 2). Gentle pressure on the posterior lip of the wound with 0.12 corneal forceps will tip the lens fragment to become engaged within the wound. A Sinsky hook is then reinserted above and towards the centre of the fragment to draw it out (Figure 3). The remaining fragment is removed using the same technique.

An anterior chamber maintainer (ACM) is now gently inserted into 1 of the side port incisions and firmly advanced until the tip is visible in the anterior chamber.[5] The epinucleus and lens cortex are flushed out by gentle pressure on the sclera posterior to the incision. The residual cortex is removed through the side port incisions by a single lumen cortex aspirator. A 5.5 mm polymethyl methacrylate posterior chamber intraocular lens (IOL) is implanted in the capsular bag and the wound is closed with one 10.0 nylon suture.

Outcomes

From April 2000 to July 2001, 145 cataract extractions were performed at Prapokklao Hospital in Thailand using this method. The average operation time was 15 to 25 minutes. Posterior capsule rupture occurred during removal of the nucleus in 2 eyes, during removal of the epinucleus in 2 eyes, and during implantation of the IOL in 1 eye. In all cases of capsule rupture, a posterior chamber IOL was implanted in the sulcus. There were no serious complications during the operation. Clear cornea was observed on the first postoperative day in 127 eyes and minimal early postoperative corneal oedema occurred in 18 eyes (12.41%), which responded well to topical steroid administration within a few days. Best corrected visual acuity (BCVA) of 20/40 or better was achieved for 121 eyes (83.45%) at the end of the first postoperative week.

Discussion

Phacoemulsification has become the surgery of choice for cataract extraction. However, this procedure requires costly instrumentation and is associated with a relatively long learning curve. Many manual small incision techniques have been developed to achieve the same benefit as those of small incision phacoemulsification, including the mininuc, sandwich, phacosection, phacotrisection, and quarters extraction techniques.[2,6-8]

In the prechop MPF technique, the nucleus is divided into 2 pieces in the capsular bag. Each piece is prolapsed in the anterior chamber and extracted through a relatively small incision, using inexpensive instrumentation. During cataract extraction, the critical step in endothelial safety is at the point of fragmentation. With this technique, fragmentation is in-the-bag, while with the sandwich and phacosection techniques, fragmentation occurs in the anterior chamber. This technique requires less anterior chamber manipulation than other techniques. Compared with the sandwich technique (38.0%)[7] and the phacotrisction technique (54.0%),[9] prechop MPF resulted in a decreased incidence of postoperative transient corneal oedema (12.4%). In addition, use of viscoelastic and progression along the learning curve can lower the incidence of endothelial-related complications. Of 18 patients with postoperative corneal oedema, 13 (72.22%) were among the first 40 patients and only 5 cases occurred among the remaining patients (27.78%). In addition, all intraoperative complications occurred among the first 40 patients.

Prechop MPF does not require expensive instrumentation, and visual recovery is as rapid as that after phacoemulsification. Since prechop MPF can be entirely manual, it is well suited to areas in which the likelihood of finding advanced instrumentation is low. However, this technique is contraindicated for patients with a large nucleus or subluxated lens. Further improvements for optimal surgery are required.

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Photodisruptive Neodymium:Yttrium-aluminum-garnet Laser in the Management of Premacular Subhyaloid Haemorrhage

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This report is of a patient with acute idiopathic premacular subhyaloid haemorrhage, which was treated successfully by subsequent Q-switched neodymium:yttrium-aluminum-garnet laser hyaloidotomy via the transcorneal route.

Key Words: Lasers, Macula lutea, Haemorrhage, Visual acuity

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Introduction

A 21-year-old, otherwise healthy, man was referred to the clinic with sudden visual loss to counting fingers at 20 cm in the right eye for 20 days' duration. There was no history of systemic or ocular disorders, trauma, or surgery. No further identifiable cause for subhyaloid haemorrhage was found upon systemic evaluation. Complete ophthalmological examination of the left eye was normal with a visual acuity of 20/20.

Anterior segment examination of the right eye was normal. Funduscopy of the right eye revealed a round, well circumscribed, dome-shaped haemorrhage with a convex surface overlying the posterior pole, extending between the temporal vascular arcades, consistent with a subhyaloid or subinternal limiting membrane (subILM) haemorrhage (Figure 1). Colour fundus photographs were obtained before and after the haemorrhage was treated. The size of the pretreated haemorrhage was estimated to be 5 disc diameters.

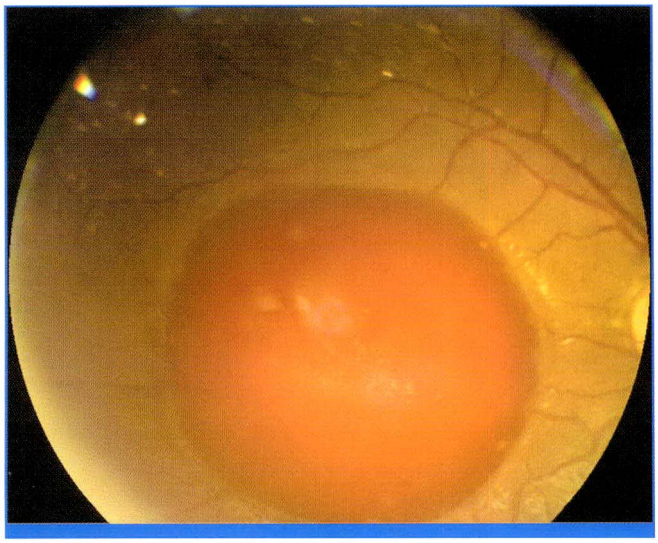
Q-switched neodymium:yttrium-aluminum-garnet (Nd:YAG) laser was performed on the posterior hyaloidotomy of the right eye over the dark, brown haemorrhage via the transcorneal route. Full pupillary dilatation was achieved with cyclopentolate 1% and phenylephrine 10%. Using simple contact anaesthesia with proparacaine, a Goldmann 3-mirror fundus contact lens was used to allow focussing of the Nd:YAG laser aiming beam. The aiming beam was precisely focussed on the surface of the posterior hyaloid membrane at the inferior edge of the subhyaloid haemorrhage to facilitate gravity-induced drainage.

The starting energy was set at a pulse power of 1.3 mJ (50 Hz burst mode, 10° cone angle, and a single pulse mode). The energy was progressively increased until a clear rupture of the target tissue was obtained. The rupture of the posterior hyaloid membrane, at a location distant from the fovea and retinal blood vessels but with a sufficient thickness of blood to protect the underlying retina, was achieved with a power of 8.7 mJ. Fifteen low-energy bursts of Nd: YAG laser were applied to perforate the anterior surface of the haemorrhage. The total energy required was 155.3 mJ.

At the end of the procedure, the haemorrhage instantaneously drained into the vitreous cavity (Figure 2), resulting in a fast visual recovery. The following day, visual acuity was 5/20, which progressively improved each day, achieving a final visual acuity of 20/20 by post-laser day 7. Fluorescein angiography, performed at post-laser day 4, did not demonstrate a source for the bleeding (Figure 3). There was fluid in the upper part of the haemorrhage and its preretinal location was confirmed by fluorescein angiography. There was neither posterior vitreous detachment nor a hole in the posterior hyaloid.

The patient was discharged home on day 10. After 15 days, the subhyaloid haemorrhage had completely cleared. The intragel haemorrhage cleared after 2 months with no further changes. The visual acuity was sustained at 20/20 during a follow-up period of 4 months. No retinal damage or rebleeding occurred due to the laser treatment, and vitrectomy was not required.

Figure 1. **Fundus photograph of the right eye showing a round, well circumscribed, dome-shaped, dark premacular subhyaloid haemorrhage centred at the fovea. The fluid level in the upper part of the haemorrhage suggests subhyaloid space location.**



Discussion

Subhyaloid haemorrhage in the premacular space may cause an acute, dramatic loss of central vision, which may persist if left untreated. Subhyaloid or subILM haemorrhage is usually caused by diabetic retinopathy,[1] hypertensive retinopathy,[2] retinal artery macroaneurysm,[2] Valsalva retinopathy,[3] Terson syndrome,[2] blood dyscrasias,[4] bacterial meningitis,[5] vitreoretinal traction of different origins, or trauma, or occurs spontaneously following partial detachment of the posterior hyaloid membrane, central retinal vein occlusion, blunt ocular trauma, laser in situ keratomileusis, macroaneurysms, presumed ocular histoplasmosis syndrome, idiopathic central serous choroidopathy, choroidal rupture, or age-related macular degeneration.

Subhyaloid haemorrhage may either improve spontaneously or may require therapeutic intervention to prevent secondary retinal degeneration. Different therapeutic approaches have been adopted for treatment of this condition, ranging from conservative treatment to prompt vitrectomy. Sung et al recommended that premacular subhyaloid or subILM haemorrhage caused by factors other than diabetic retinopathy may be conservatively managed for the first few months.[6] However, since subhyaloid haemorrhage may be associated with permanent macular changes before it spontaneously resolves and adequate treatment of the underlying cause of the haemorrhage may be delayed with potential risks for further damage to ocular structures, early intervention seems to be crucial.

O'Hanley and Canny showed that patients who did not receive vitrectomy within 4 weeks of the onset of the haemorrhage progressed to late macular traction and visual acuity no better than 6/30.[1] These authors showed that possible toxic damage to the retina occurred due to prolonged contact with haemoglobin and iron. Certainly, visual function can be almost instantly restored by pars plana vitrectomy with surgical separation of the posterior hyaloid membrane and evacuation of all blood. However, vitrectomy, although a routine procedure, is associated with numerous side effects.[7] The progression of lens nuclear sclerosis, even after uneventful vitrectomy is a well known complication, which occurs in almost all patients.[7] Intraoperative retinal breaks and postoperative proliferative vitreoretinopathy may result in retinal detachment and severe loss of visual function.[7] Tissue plasminogen activator (tPA) and perfluoropropane (C_3F_8) injection are alternative ways to clear a subhyaloid

Figure 2. **The haemorrhage instantaneously drained into the vitreous cavity at Nd:YAG laser hyaloidotomy.**

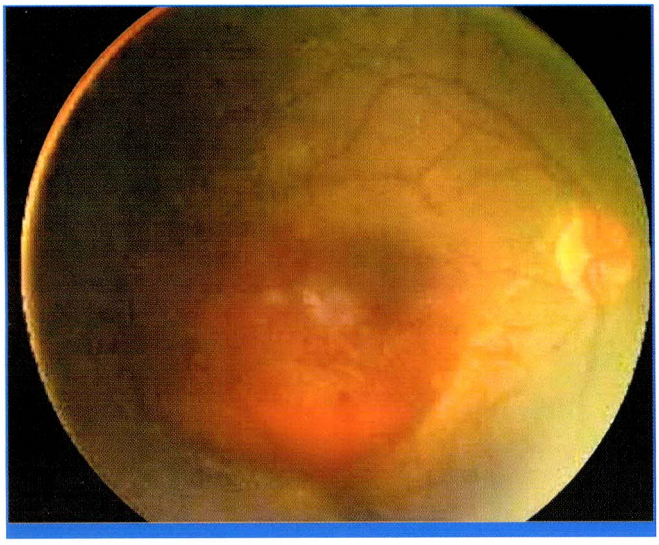
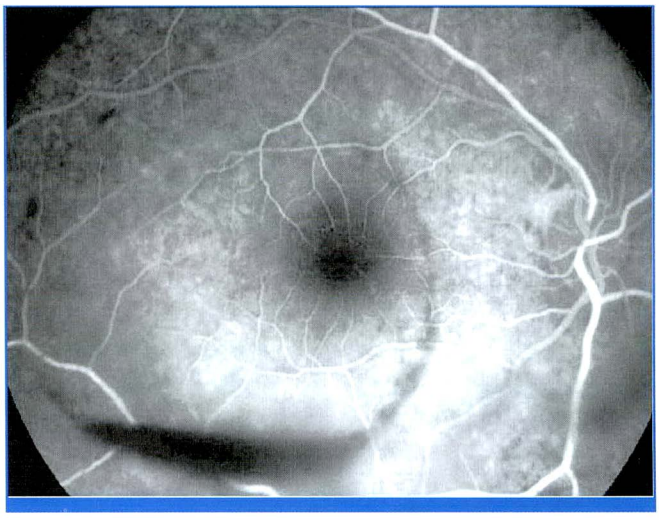


Figure 3. **Fluorescein fundus angiography at day 4 after the hyaloidotomy showing the clearance of the haemorrhage with the residual inferior rim of haemorrhage outlining the detached internal limiting membrane.**



haemorrhage, especially when the patient has media opacity or when there is a problem with contact lens application for laser therapy.[8,9] Furthermore, it has been reported that intravitreal tPA and sulphur hexafluoride (SF_6) may induce pneumatic displacement of premacular subhyaloid haemorrhages in shaken and battered baby syndrome.[10]

Nd:YAG laser photodisruption of the posterior hyaloid membrane has been reported to achieve distribution of the haemorrhage in the vitreous, which resulted in accelerated clearing and visual improvement.[11] Within the first 3 to 4 days after occurrence of a premacular subhyaloid haemorrhage, the posterior vitreous boundary layer may be lacerated by argon laser coagulation in such a way that the blood floats into the vitreous body, where it is absorbed within a few weeks. Older premacular haemorrhages under an intact vitreous boundary layer, typically green-white in colour, should be treated by more invasive vitreo-surgical procedures.[12] Tassignon et al recommended Nd:YAG laser for treatment of premacular haemorrhages without underlying proliferative disease and where the volume of the blood does not greatly exceed 12 µL.[13] Spontaneous resorption of subhyaloid or subILM haemorrhage caused by Valsalva retinopathy usually occurs without sequelae.[3] Berrocal et al showed that patients without subretinal neovascular membranes had a better visual improvement rate.[14] YAG laser was previously reported to be useful for lysis of organised vitreous membranes near the optical axis of the eye.[15] The advantages of Nd:YAG laser over vitrectomy are the ambulatory and painless nature of the procedure, without stimulating proliferative vitroretinopathy. In addition, the use of Nd:YAG laser will not inadvertently affect the outcome of a later vitrectomy.[16] Complications included macular holes and retinal detachment from a retinal break in a patient with myopia.[17] For patients with cataract or media opacity, effective and precise laser delivery could be difficult.[11]

This case demonstrates the effective treatment of a dense central subhyaloidal haemorrhage using Nd:YAG laser. No side effects were attributed to the procedure, in contrast to the potential risks of vitrectomy. Since the haemorrhage may cause permanent macular changes before it resolves, Nd:YAG laser hyaloidotomy, being a safe and effective procedure, achieving rapid resolution of premacular subhyaloid haemorrhage with restoration of binocular vision and preventing the need for vitreoretinal surgery, is a viable treatment alternative for eyes with recent bleeding in selected patients. The risks and benefits of Nd:YAG laser treatment as a routine procedure should be evaluated in a randomised trial and compared with those of deferral of treatment or primary vitrectomy.

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Recurrent Vitreous Haemorrhage in a Patient with Waardenburg Syndrome

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Waardenburg syndrome is an inherited disorder named after Petrus Johannes Waardenburg, a Dutch ophthalmologist who was the first to notice that people with 2 different coloured eyes frequently had hearing problems. Some of the well known eye characteristics associated with the syndrome include dystopia canthorum, white eyelashes, heterochromia irides, and albinotic fundi. The patient described here also has recurrent vitreous haemorrhage, an unusual presenting ocular feature in a patient with Waardenburg syndrome.

Key Words: Vitreous hemorrhage, Waardenburg syndrome

Asian Journal of Ophthalmology 2002;4(4):13-14.

Introduction

Waardenburg syndrome was described in 1951 by the Dutch ophthalmologist Petrus Johannes Waardenburg, who noted the autosomal-dominant inheritance pattern of heterochromia irides and dystopia canthorum (lateral displacement of the inner canthi), white forelock, and sensorineural hearing loss.[1]

In addition to these primary features, there may also be cleft lip and/or cleft palate and enlargement of the colon. However, these are less common than the primary features. This report presents a patient with Waardenburg syndrome who also had recurrent vitreous haemorrhage believed to be secondary to Eales disease, an ocular condition that is not usually associated with this syndrome.

Case Report

A 36-year-old Chinese man was referred to Selayang Hospital (a tertiary referral centre for vitreoretinal disorders) from Alor Star Hospital, Malaysia, in June 2000 with a history of recurrent vitreous haemorrhage in his left eye. He had undergone a vitrectomy in his left eye in 1999 and was able to see 6/24 with pinhole after surgery. Investigations for various causes of recurrent vitreous haemorrhage were performed, but all blood and imaging investigations were unremarkable. Fundus fluorescein angiogram was planned, but the patient had a rebleed in the left eye in May 2000 and was referred to Selayang Hospital. The vision in his right eye had been poor since 1997.

At ocular examination at Selayang Hospital, the vision in his right eye was recorded as "no perception of light" and the left eye was "counting fingers at 1 foot". The right eye had corneal vascularisation with prominent iris vessels and a dense cataract. There was no view of the retina. The intraocular pressure in the right eye was 6 mm Hg. Ultrasound examination of the fundus of the left eye showed a dense vitreous haemorrhage with a flat retina.

The patient was scheduled for left vitrectomy to clear the vitreous haemorrhage in July 2000. Intraoperative findings revealed that the vitreous haemorrhage was secondary to peripheral neovascularisation. Endolaser and cryotherapy were performed. The retina was flat intraoperatively and postoperatively. He was discharged from hospital 2 days later.

From discharge from Selayang Hospital until May 2001 , the patient had 3 more documented recurrent vitreous haemorrhages. Anterior chamber washout was done at Alor Star Hospital in September 2000 and an additional 2800 shots of panretinal photocoagulation were given over time.

The patient was again referred to Selayang Hospital in February 2002. He had rebled in the left eye in January 2002. Vision in the left eye was "hand movement". He had developed a rubeosis irides and there was a hyphaema in the anterior chamber. There was no view of the fundus. The right eye was phthsical.

In February 2002, lens aspiration was performed with anterior chamber washout and vitreous washout. New vessels were seen for almost 360° at the vitreous base. Membrane peeling was done for an epiretinal membrane in the macular region and endolaser was performed for 360°.

The patient was discharged to Alor Star Hospital after 2 days. The vision in his left eye was "hand movement". There were 3+ cells in the anterior chamber with fibrin at the pupillary region. The intraocular pressure was 10 mm Hg and there was a poor view of the fundus due to a small

Figure 1. **Profile of patient with Waardenburg syndrome with white forelock, dystopia canthorum, heterochromia irides, and broad nasal bridge.**

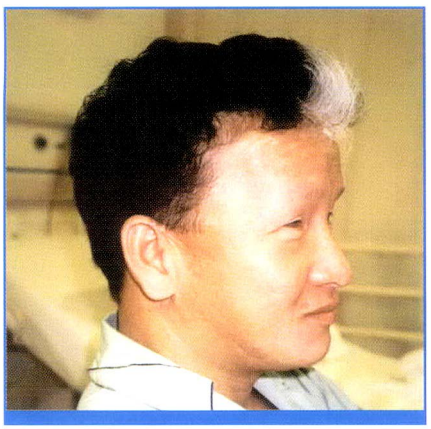
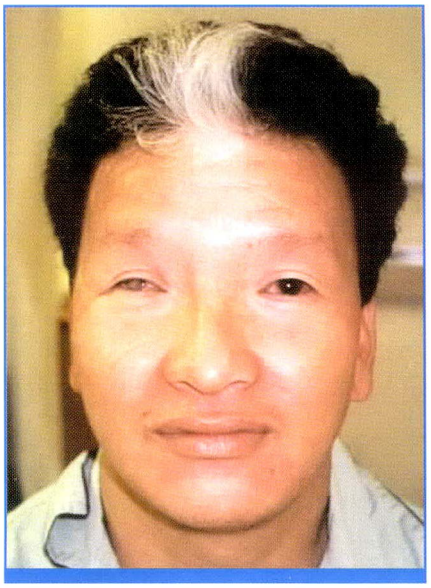


Figure 2. **Full face of patient with Waardenburg syndrome with white forelock, dystopia canthorum, heterochromia irides , and broad nasal bridge.**



pupil. Apart from having recurrent vitreous haemorrhage, this patient was noted to have a white forelock, which was also present in several other members of his family. This patient did not have hearing difficulties, but he did have dystopia canthorum, a broad nasal bridge, and heterochromia irides, features found in patients with Waardenburg syndrome (Figures 1 and 2).

Discussion

Waardenburg syndrome is an inherited disorder, characterised by varying degrees of hearing loss and changes in the skin and hair pigmentation. Commonly observed characteristics include heterochromia, white forelock or premature grey hair, wide spaces between the inner corners of the eyes, and hearing loss ranging from moderate to profound. Individuals with Waardenburg syndrome may have some or all of the traits of the syndrome. Some of the well known eye characteristics associated with the syndrome include dystopia canthorum, white eyelashes, heterochromia irides, and albinotic fundi. Apart from having Waardenburg syndrome (white forelock, dystopia canthorum, broad nasal bridge, and heterochromia irides), the patient described here also had recurrent vitreous haemorrhage, presumed to be secondary to Eales disease after other causes of recurrent vitreous haemorrhage had been ruled out.

Eales disease is an idiopathic obliterative vasculopathy that usually involves the peripheral retina of young adults. It is a diagnosis of exclusion and is believed to be a primary non-inflammatory disorder of the walls of the peripheral vessels, namely the shunt vessels. This often leads to vascular occlusions, peripheral neovascularization, and vitreous haemorrhage.[2] Bilateral involvement is evident in 80% to 90% of patients and this patient's phthsical right eye was possibly affected by the same pathophysiological condition. Peripheral non-perfusion is an atypical feature of Eales disease. Neovascularisation of the disc or neovascularisation elsewhere in the retina is observed in up to 80% of patients with Eales disease. Neovascularisation of the vitreous base was seen in this patient and is believed to be the source of the vitreous haemorrhage. Epiretinal membranes, with or without macular oedema, can compromise visual acuity in a patient with Eales disease. This patient had an epiretinal membrane that was removed during the second vitrectomy at Selayang Hospital.

While it remains to be proven whether there is any possible link between these 2 conditions, it is interesting to note that patients with Eales disease may have associated vestibuloauditory dysfunction,[3] as do patients with Waardenburg syndrome. This patient is interesting as his main ocular problem was not due to the typical clinical features described in Waardenburg syndrome but to recurrent vitreous haemorrhage presumed to be secondary to Eales disease. This may be the first reported case of recurrent vitreous haemorrhage in a patient with Waardenburg syndrome.

Acknowledgements

Thank you to Dr Mariam and Dr Haslina, who were involved in the management of this patient.

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Glaucoma: Global and Southeast Asian Perspectives

From the Southeast Asian Glaucoma Interest Group (SEAGIG) Meeting, Manila, The Philippines, 26-28 September 2002

Medical Therapy for Postiridectomy Residual Angle Closure Glaucoma

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Medical treatment with latanoprost is a practical strategy for the treatment of postiridectomy angle closure glaucoma, as shown by Wang et al in a study comparing latanoprost 0.005% and timolol 0.5% for this indication. Sixty eight patients with postiridectomy angle closure glaucoma received latanoprost once at night (study group) and timolol twice daily (control group). Intraocular pressure (IOP) was measured before treatment and 3 days, 1, 2, and 4 weeks, and 2, 3, and 6 months after treatment.

The pretreatment IOP was not significantly different between the 2 groups. However, 3 days after treatment, the IOP reduction in each group was significantly different — 25.8% reduction in the group receiving latanoprost and 17.36 reduction in the group receiving timolol ($p < 0.001$). This difference was retained with repeated measurements, with the IOP being consistently lower for patients receiving latanoprost throughout the follow-up period. At each follow-up visit, the IOP was significantly reduced from pretreatment levels for both groups.

These researchers concluded that medical treatment is effective for the treatment of postiridectomy angle closure glaucoma, and that latanoprost is more effective than timolol for this indication.

Relationship Between Peripheral Anterior Synechiae and Visual Field Defect in Primary Angle Closure Glaucoma

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This study was performed by Kim et al to investigate the relationship between the circumferential extent of peripheral anterior synechiae (PAS) and the severity of visual field defects in primary angle closure glaucoma (PACG). Seventy three eyes of 64 patients with PACG and visual acuity of >20/70 were evaluated. The visual field defects were classified as none (grade 0), minimal (grade 1), moderate (grade 2), and severe (grade 3). The extent of PAS between 0° and 360° of the angle circumference was also measured in each eye. Correlations between the 2 variables in conjunction with and without other variables were analysed in eyes with and without acute attacks.

Spearman's correlation coefficient between the severity of visual field defects and the extent of PAS was 0.348 ($p = 0.003$). Spearman's correlation coefficient between the severity of visual field defects and the extent of PAS in eyes with PACG without acute attacks was 0.377 ($p = 0.012$). In eyes with acute attacks of PACG, Spearman's correlation coefficient was 0.338 ($p = 0.079$).

These results show a statistically significant correlation between the extent of PAS and the severity of visual field damage in general for patients with PACG, and particularly for patients with no history of acute attacks. Therefore, the extent of PAS seems to reflect the severity of PACG, especially in chronic disease.

Intraocular Pressure and Visual Field Loss in Asian Glaucomas

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In this study by Gazzard et al, the relationship between visual field loss and pretreatment intraocular pressure (IOP) in primary angle closure glaucoma (PACG) and primary open angle glaucoma (POAG) were compared. Forty three patients with PACG and 31 with POAG were enrolled in a prospective randomised controlled trial of trabeculectomy and perioperative 5-fluorouracil. Visual field testing and intraocular pressure measurements were done prior to treatment.

The correlation between pretreatment IOP and the severity of visual field loss was stronger for patients with PACG. This may be consistent with the hypothesis of a greater IOP dependence for optic nerve damage for patients with PACG than for those with POAG. Conversely, there may be a greater importance of other non-pressure dependent mechanisms in POAG compared with PACG.

Patterns of Non-compliance to Anti-glaucoma Medications

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Non-compliance to antiglaucoma medications is an important cause of visual loss in patients with glaucoma. The latest diagnostic techniques and treatment advances are of no benefit if compliance with treatment is poor. A study was performed at the Hospital Universiti Kebangsaan Malaysia to determine the incidence and patterns of non-compliance to glaucoma medications.

100 patients with glaucoma attending the glaucoma clinic at the hospital were randomly selected and interviewed using a compliance questionnaire. Three indicators of compliance were used:

- proper drug administration technique
- proper timing and spacing of medications
- frequency of missed medications.

Only 20% of the patients interviewed used their medications at the proper time and spacing, while 32% used proper administration techniques and 52% missed medications 5 or more times in a month. There was a statistically significant association between compliance and the frequency of the medications used, although factors such as gender, age, ethnicity, and educational level had no association.

Dr Rahman concluded that the incidence of non-compliance is alarmingly high, despite education given to patients regarding the disease and its treatment at the time of diagnosis. More effort is needed to create awareness of the disease and the importance of compliance with medications to prevent glaucoma progression and blindness.

The Ocular Hypertension Treatment Study

Primary open angle glaucoma (POAG) is one of the leading causes of blindness worldwide. People with elevated intraocular pressure (IOP; ocular hypertension) are at increased risk for developing POAG. However, a substantial proportion of optic nerve fibre may be lost before glaucomatous visual field defects can be detected. There is, therefore, a need for early detection and treatment. The Ocular Hypertension Treatment Study (OHTS) was designed to evaluate the safety and efficacy of topical ocular hypotensive medication in delaying or preventing the onset of POAG in individuals with elevated IOP.

Patients and Methods

Eligibility criteria included age from 40 to 80 years, IOP between 24 mm Hg and 32 mm Hg in 1 eye and between 21 mm Hg and 32 mm Hg in the other eye, gonioscopically open angles, 2 normal visual field tests per eye, and normal optic discs. In this multicentre study, patients were randomised to either a medication group or an observation group.

Patients randomised to receive medication began treatment to achieve a target pressure of 24 mm Hg or less and a minimum 20% reduction in IOP from the average of the qualifying IOP and from IOP at baseline. Topical medication was changed or added to until these goals were met or the patients were receiving maximum tolerated therapy. The primary outcome was POAG in one or both eyes.

The medications given included prostaglandins, β-adrenergic antagonists, topical carbonic anhydrase inhibitors, α_2-adrenergic agonists, parasympathomimetic agents, and epinephrine/dipivefrin.

Results

1636 patients were enrolled in the study between February 1994 and October 1996. Patients were randomised to receive topical ocular hypotensive medication (n = 817) or observation (n = 819) and 702 and 706 patients, respectively, completed the trial.

The baseline and follow-up IOPs for patients in the medication and observation groups are shown in Table 1. The IOP goal was met in both eyes at 87% of the follow-up visits by the medication participants and in 1 eye at 7% of visits.

At 60 months, 2 or more topical ocular hypotensive medications were prescribed for 39.7% of patients receiving medication and 3 or more medications were prescribed for 9.3%. Thirty six of the patients (4.4%) in the medication group developed POAG compared with 89 patients (10.9%) in the observation only group (Table 2). During the course of the study, the cumulative probability of developing POAG was significantly lower for patients in the medication group compared with the observation group (hazard ratio, 0.40; 95% confidence interval [CI], 0.27-0.59; $p < 0.0001$). A treatment benefit was observed for reproducible visual field abnormality attributed to POAG (hazard ratio, 0.45; 95% CI, 0.27-0.76; $p = 0.002$) and for reproducible optic disc deterioration attributed to POAG (hazard ratio, 0.36; 95% CI, 0.23-0.56; $p < 0.0001$).

Discussion

This study has shown that topical ocular hypotensive medication is effective for reducing the incidence of glaucomatous visual field loss and/or optic nerve deterioration for patients with elevated IOPs between 24 mm Hg and 32 mm Hg. This is the largest randomised study of the safety and efficacy of ocular hypotensive medication for delaying or preventing the onset of POAG in individuals with ocular hypertension. After 5 years, the cumulative probability of developing POAG was 4.4% for patients taking medication and 9.5% for those in the observation group.

Interestingly, approximately 55% of the initial POAG endpoints involved optic disc deterioration in the absence of visual field abnormalities. With longer follow-up, it may be possible to ascertain how many of the patients with optic disc deterioration go on to develop visual field loss.

Table 1. Intraocular pressure (IOP) at baseline and follow up for patients with ocular hypertension receiving medication or observation

	Medication group (n = 817)	Observation group (n = 819)
IOP at baseline (mm Hg)	24.9 ± 2.6	24.9 ± 2.7
IOP average for follow-up visits (mm Hg)	19.3 ± 2.2	23.9 ± 2.9
IOP reduction from baseline (%)	-22.5 ± 9.9	-4.0 ± 11.6

Table 2. First primary open angle glaucoma endpoint for each participant.

	Medication group (n = 817)	Observation group (n = 819)
Visual field	15	29
Optic disc	18	51
Visual field and optic disc	3	9

This trial also demonstrated that moderate IOP reductions could be attained and maintained for a median follow-up of 6 years. During the course of the trial, 87% of patients receiving medication achieved the target IOP reduction in both eyes, and an additional 7% did so in 1 eye.

In terms of safety of the medications, there was no evidence of excess risk in the medication group for patient-reported symptoms according to the Glaucoma Symptom Scale or SF-36. There was no evidence of excess risk in the medication group for the overall number of new medical conditions, worsening of pre-existing conditions, admissions to hospital, or mortality. Patients in the medication group had a similar mean visual acuity to those in the observation group throughout the study.

Overall, the decision to recommend medical treatment for patients with ocular hypertension should take several factors into consideration, including the following:

- the low overall incidence of POAG in individuals with ocular hypertension
- the burden of long-term treatment
- the individual's risk of developing POAG
- the individual's likelihood of being helped by medication
- the individual's health status and life expectancy.

Baseline factors that predict which patients in the Ocular Hypertension Treatment Study developed POAG have been published,[1] and may be useful for clinicians caring for patients with ocular hypertension.

Conclusion

For years, there has been doubt about whether lowering IOP is useful in POAG. This study provides clear proof of the benefit of lowering IOP and, when these results are taken together with results of other studies, there is now strong evidence that lowering IOP preserves vision in POAG.

Reference

1. Gordon MO, Beiser JA, Brandt JD, et al. The Ocular Hypertension Treatment Study: baseline factors that predict the onset of primary open-angle glaucoma. Arch Ophthalmol 2002;120:714-720.

This article was summarised from: Kass MA, Heuer DK, Higginbotham EJ, et al, for the Ocular Hypertension Treatment Study Group. The Ocular Hypertension Treatment Study: a randomized trial determines that topical ocular hypotensive medication delays or prevents the onset of primary open-angle glaucoma. Arch Ophthalmol 2002;120:701-713.

Abstracts of Asian research published in the international literature

Planning Low Vision Services in India

A population-based, cross-sectional study was performed to assess the prevalence and causes of low vision in a population in southern India for planning low vision services. 10,293 people of all ages from 94 clusters representative of the population of the Indian state of Andhra Pradesh were enrolled. The participants underwent a detailed eye examination, including measurement of visual acuity with logarithm of the minimum angle of resolution charts, refraction, slit-lamp biomicroscopy, applanation tonometry, gonioscopy, and stereoscopic dilated fundus evaluation. Automated threshold visual fields and slit-lamp and fundus photography were done when indicated using predefined criteria.

The main outcome measure was low vision, defined as permanent visual impairment that was not correctable with refractive error correction or surgical intervention. Participants with best-corrected distance visual acuity <6/18 to perception of light or central visual field <10° because of an untreatable cause in both eyes were considered to have low vision.

Low vision was present in 144 participants — an age-, gender-, and urban-rural distribution-adjusted prevalence of 1.05%. The most frequent causes of low vision included retinal diseases (35.2%), amblyopia (25.7%), optic atrophy (14.3%), glaucoma (11.4%), and corneal diseases (8.6%). Multivariate analysis showed that the prevalence of low vision was significantly higher with increasing age, and there was a trend for higher prevalence with decreasing socioeconomic status. Extrapolating these data to the estimated 1014 million population of India in the year 2000, 10.6 million (95% confidence interval, 8.4-12.8) people would have low vision. These data imply that there is a significant burden of low vision in this population, suggesting a need for low vision services.

Dandona R, Dandona L, Srinivas M, et al. Planning low vision services in India: a population-based perspective. Ophthalmology 2002;109:1871-1878.

Prevalence of Blindness and Low Vision in Malaysia

A national eye survey was conducted to determine the prevalence of blindness and low vision and their major causes among the Malaysian population. A stratified 2-stage cluster sampling design was used to randomly select primary and secondary sampling units. Interviews, visual acuity tests, and eye examinations for all individuals in the selected households were performed. Estimates were weighted by factors adjusting for selection probability, non-response, and sampling coverage.

The overall response rate was 69%. The age-adjusted prevalence of bilateral blindness and low vision was 0.29% and 2.44%, respectively. Women had a higher age-adjusted prevalence of low vision compared with men. There were no significant differences in the prevalence of bilateral low vision and blindness among the 4 ethnic groups, and urban and rural residents. Cataract was the leading cause of blindness (39%) followed by retinal diseases (24%). Uncorrected refractive errors (48%) and cataract (36%) were the major causes of low vision.

Malaysia has blindness and visual impairment rates that are comparable with other countries in Southeast Asia. However, cataract and uncorrected refractive errors, although readily treatable, are still the leading causes of blindness, suggesting the need for an evaluation on accessibility and availability of eye care services and barriers to eye care utilisation in the country.

Zainal M, Ismail SM, Ropilah AR, et al. Prevalence of blindness and low vision in Malaysian population: results from the National Eye Survey 1996. Br J Ophthalmol 2002;86:951-856.

Knowledge of Blinding Eye Diseases among a Chinese population

Patients' knowledge and participation in their care are important for the prevention of blindness from common eye diseases such as cataract, glaucoma, and age-related macular degeneration (AMD). The aim of this study was to measure knowledge of these conditions in the Hong Kong Chinese population. People aged 40 years or older living in the Shatin district of Hong Kong were randomly selected as part of a larger study of causes of adult visual loss. The participants received eye examinations in which the primary cause of visual disability was recorded. The respondents were asked by trained interviewers in a standardised fashion about their knowledge of cataract, glaucoma, and AMD.

Of the 2538 eyes examined, 7.0% had visual acuity less than 6/18. Approximately 70% of the visual disability for people aged 60 years or older was caused by cataract, AMD, or glaucoma. Awareness of cataract was high, in that more than 90% of respondents had heard of the condition. However, only 22.9% of particpiants could correctly describe cataract symptoms, and these percentages were lower for glaucoma (10.2%) and AMD (<1%).

This selection of the Hong Kong Chinese population had limited knowledge of common eye diseases. Educational programmes to enhance public awareness may be needed to improve the effectiveness of health promotion and thus prevent unnecessary blindness.

Lau JT, Lee V, Fan D, et al. Knowledge about cataract, glaucoma, and age related macular degeneration in the Hong Kong Chinese population. Br J Ophthalmol 2002;86:1080-1084.

CONGRESS CALENDAR

NOVEMBER

14-16

Australasian Society of Cataract and Refractive Surgeons 2002 Congress
Canberra, Australia
Contact: Jenny Boden
Tel: (61 3) 5977 0240
Fax: (61 3) 5977 0260

17-21

34th Annual Scientific Congress of the Royal Australia & New Zealand College of Ophthalmologists
Canberra, Australia
Contact: Congress Organizer, 34th Annual Scientific Congress of the Royal Australia & New Zealand College of Ophthalmologists, Canberra, Australia
Tel: (61 2) 9690 1001

29-1 December

Australasian Ophthalmic and Visual Science Meeting
Sydney, NSW, Australia
Contact: Anne Snape
E-mail: asnape@ranzco.edu

DECEMBER

6-7

Ophthalmology: Back to Basics and Beyond
Toronto, ON, Canada
Contact: Continuing Education, Faculty of Medicine, Universtiy of Toronto, 500 University Avenue, Suite 650, Toronto, Ontario, M5G 1V7
Tel: (1 416) 978 2719
Fax: (1 416) 971 2200
E-mail: ce.med@utoronto.ca

12-15

12th Iranian National Congress of Ophthalmology
Tehran, Iran
Contact: Hassan Hashemi, Center Of Razi Symposium, Iran Medical University,Tehran
Tel: (98 21) 694 2404
Fax: (98 21) 694 2404
E-mail: hhashemi@noorvision.com/eyeorg@irimc.org
Website: www.Iranophthal.com

JANUARY 2003

30- 2 February

Current Concepts In Ophthalmology
Dorado, CA, USA
Contact: Johns Hopkins University School of Medicine, Office of CME, Ophthalmology
Tel: (1 410) 955 2959
Fax: (1 410) 955 0807
E-mail: cmenet@jhmi.edu

FEBRUARY 2003

6-7

2nd International Congress on Glaucoma Surgery
Luxor, Egypt
Contact: Mrs C Jeannin
Tel: (41 21) 626 8224
Fax: (41 21) 626 8246
E-mail: kmansouri@glaucoma-eg.com

6-9

1st SERI-ARVO Meeting on Research in Vision and Ophthalmology
Singapore
Contact: Ms Karen Chee, Event Manager, Singapore Eye Research Institute
Tel: (65) 6322 8311
Fax: (65) 6323 1903
E-mail: seri_arvo@snec.com.sg

7-8

Bascom Palmer Eye Institute Mid-Winter Glaucoma Symposium
Miami, FL, USA
Contact: Nancy Fernandez
Tel: 1-305-326-6110
Fax: 1-305-326-6417
E-mail: nfernandez@med.miami.edu

7-9

7th ESCRS Winter Refractive Surgery Meeting
Rome, Italy
Contact: ESCRS, Temple House, Temple Road, Blackrock, Co. Dublin, Ireland
Tel: (35 31) 209 1100
Fax: (35 31) 209 1112
E-mail: escrs@agenda-comm.ie

MARCH 2003

6-9

2003 Annual Meeting of the American Glaucoma Society
San Francisco, CA, USA
Contact: American Glaucoma Society
Tel: (1 415) 561 8587
Fax: (1 415) 561 8531
E-mail: ags@aao.org

19-23

4th International Glaucoma Symposium
Barcelona, Spain
Contact: Kenes International, Global Congress Organizers and Association Management Services, P.O.Box 1726, CH-1211 Geneva 1, Switzerland
Tel: (41 22) 908 0488
Fax: (41 22) 732 2850
E-mail: glaucoma@kenes.com
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Reference: 1. Mester U, Anterist N, Dillinger P. Improvement of topical and visual quality by an aspheric intraocular lens [abstract]. Presented at: DGII Heidelberg; February 2002; Heidelberg, Germany. Abstract.

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