Journal of the South East Asia Glaucoma Interest Group

Volume 6, Number 1, 2004

Asian Journal of OPHTHALMOLOGY

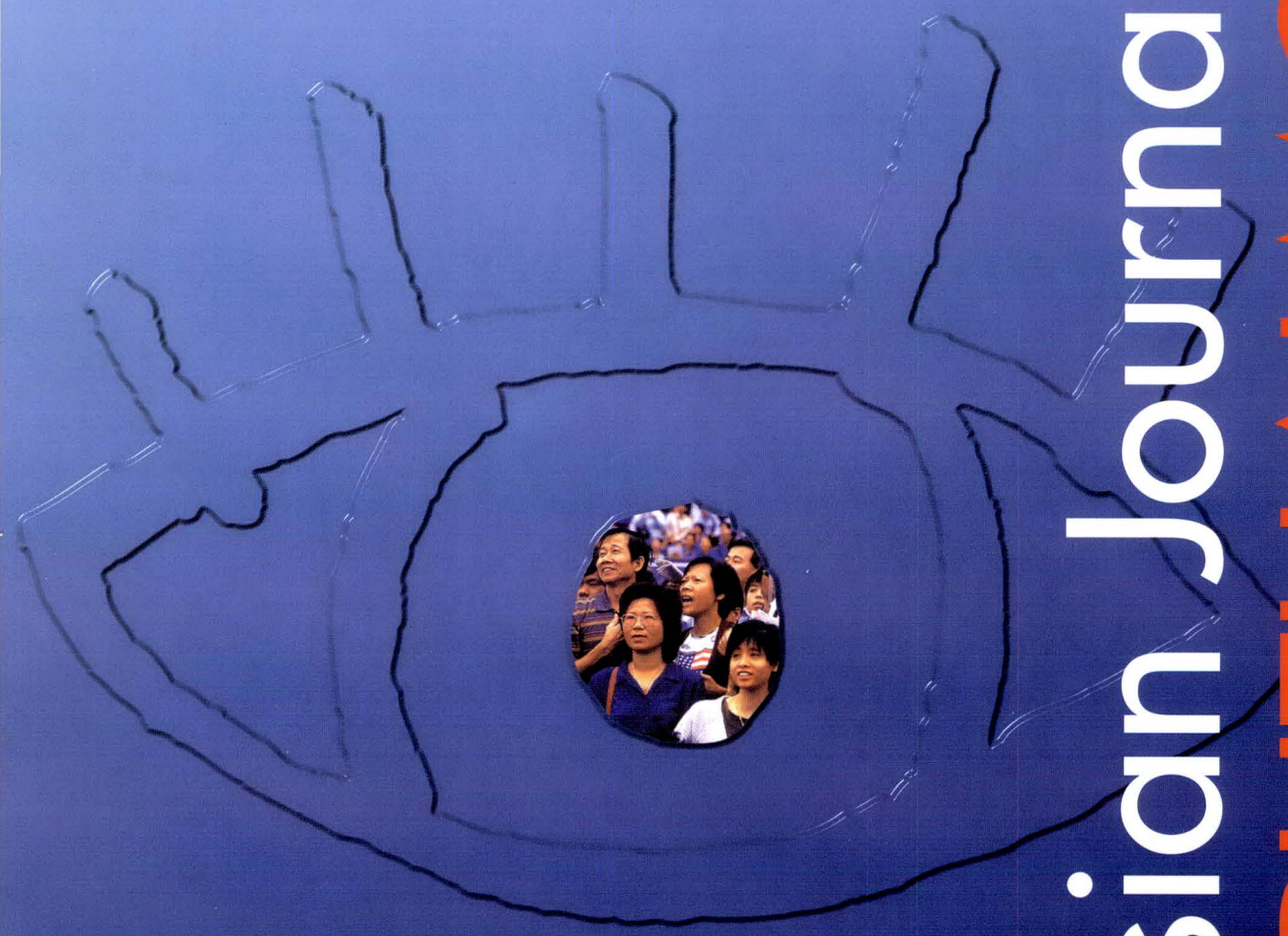
Formula for Setting Target Intraocular Pressure

Cyclosporine A or Mitomycin C for Refractory Vernal Keratoconjunctivitis

Ocular Paintball Injury

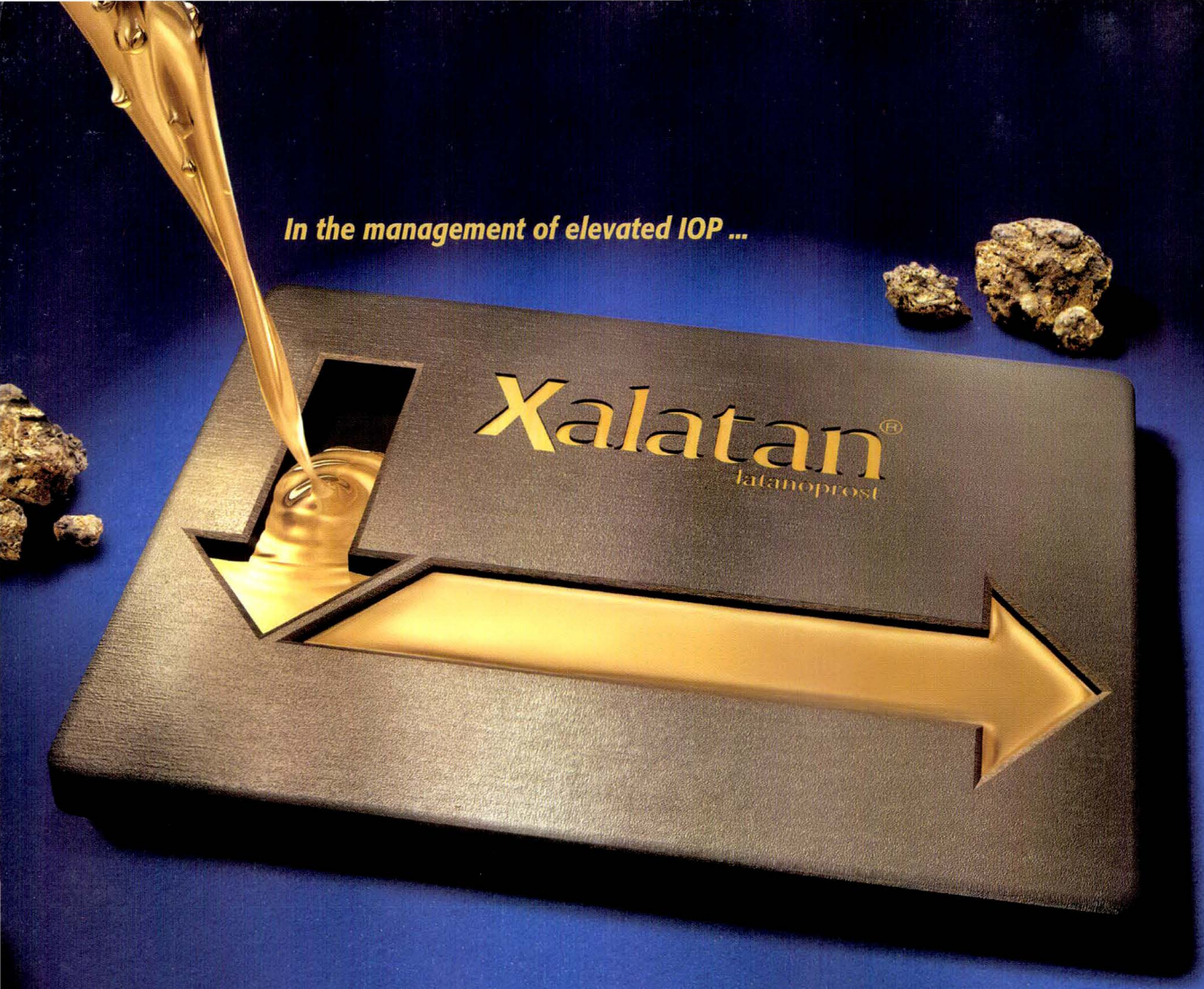
Management of Ocular Hypertension and Glaucoma

Primary Angle Closure



Scientific Communications

In the management of elevated IOP ...



A New Standard Is Taking Shape

Confident Control

- Superior IOP reduction versus[1-4]
  - timolol
  - brimonidine tartrate 0.2%
  - dorzolamide hydrochloride 2%*
  - unoprostone isopropyl 0.12%
- Consistent 24-hour IOP control[5]
- Proven long-term IOP control[†6,7]
- Benchmark that others measure against[8]
- No. 1 brand of glaucoma agent in the world[‡]

Trusted Tolerability

- Well-established ocular tolerability and systemic safety profile
- Only ophthalmic prostaglandin derivative with 4-year safety data[§7]
- Low incidence of conjunctival hyperaemia[9]

XALATAN® is indicated for the reduction of elevated intraocular pressure (IOP) in patients with open-angle glaucoma, ocular hypertension and chronic angle closure glaucoma.

XALATAN may gradually change eye colour by increasing the amount of brown pigment in the iris; this change may be permanent.

Most commonly reported side effects included eye irritation, conjunctival hyperaemia, transient punctate epithelial erosions, blepharitis, increased iris pigmentation, and eye pain.

***In a 3-month, open-label, randomised study (n=213), patients were treated with XALATAN or 2% dorzolamide hydrochloride.**
†Meta-analysis of 3 studies of 6 months (n=717) with open-labeled extensions up to 2 years (n=113).
§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).

References: 1. Hedman K, Alm A. A pooled-data analysis of three randomized, double-masked, six-month clinical studies comparing the intraocular pressure reducing effect of latanoprost and timolol. *Eur J Ophthalmol* 2000;10:95-104. **2.** Data on file. Uusitalo H, and the Finnish, German, Irish, Spanish, and UK Study Groups. A comparison of the efficacy and safety of latanoprost with brimonidine in patients with open-angle glaucoma and ocular hypertension. A randomised, observer-masked multinational study. Presented at the European Glaucoma Society (EGS); June 2000; London, England. Pharmacia & Upjohn Company, a subsidiary of Pharmacia Corporation, Kalamazoo, MI. **3.** O'Donoghue EP, the UK and Ireland Latanoprost Study Group. A comparison of latanoprost and dorzolamide in patients with glaucoma and ocular hypertension: a 3 month, randomised study. *Br J Ophthalmol.* 2000;84:579-582. **4.** Susanna R, Giampani J, Borges AS, et al. A double-masked randomised study comparing latanoprost and unoprostone in patients with primary open-angle glaucoma or ocular hypertension. Presented at: the European Glaucoma Society (EGS); June 2000; London, England. **5.** Orzalesi N, Rossetti L, Invernizzi T, et al. Effect of timolol, latanoprost, and dorzolamide on circadian IOP in glaucoma or ocular hypertension. *Invest Ophthalmol Vis Sci.* 2000;41:2566-2573. **6.** Hedman K, Alm A. Long-term effect of latanoprost on intraocular pressure. Presented at: the International Congress of Ophthalmoogy (ICO); June 1998; Amsterdam, the Netherlands. **7.** Data on file. A long-term open study of latanoprost as adjunctive therapy in glaucoma patients with uncontrolled intraocular pressure. A multicenter study in Sweden, Great Britain, The Netherlands, Belgium and Australia-extension phase. Study CTN9400PG034, March 2001. Pharmacia & Upjohn Company, a subsidiary of Pharmacia Corporation, Kalamazoo, MI. **8.** Data on file. Summary report on benchmark studies from 1999 to 2001. Pharmacia & Upjohn Company, a subsidiary of Pharmacia Corporation, Kalamazoo, MI. **9.** Data on file. Integrated summary of safety data (ISS). Pharmacia & Upjohn Company, a subsidiary of Pharmacia Corporation, Kalamazoo, MI.

Xalatan®
latanoprost

Confident Control. Trusted Tolerability.

Further information is available upon request
Pfizer Global Pharmaceuticals -
Asia and Australia/New Zealand Region
Suite 701, 1 Pacific Place
88 Queensway, Hong Kong

Pfizer

TABLE OF CONTENTS

Review Article 2

Suggested Formula for Setting Target Intraocular Pressure
MV Aquino

Original Article 7

Comparative Clinical Trial of Topical Cyclosporine A and Mitomycin C for the Management of Refractory Vernal Keratoconjunctivitis
MN Hashemian, F Rahimi, SF Mohammadi

Case Report 13

Ocular Paintball Injury with and without Eye Protection
R Shehadeh-Masha'our, H Jabaly-Habib, H Garzozi

Conference Report 15

Management of Ocular Hypertension and Glaucoma

Primary Angle Closure 17

From the European Glaucoma Society Meeting, Florence, Italy, 30 May to 4 June 2004

Congress Calendar 20

Publisher

Scientific Communications International Limited
Suite C, 10/F, Wo On Building
10 Wo On Lane, Central
Hong Kong
Tel: (852) 2868 9171
Fax: (852) 2868 9269
E-mail: editor@scientific-com.com

Editorial Office

Pfizer Global Pharmaceuticals -
Asia and Australia/New Zealand Region
Suite 701, 1 Pacific Place
88 Queensway, Hong Kong

SEAGIG
South East Asia Glaucoma Interest Group

SEAGIG now Online

The South East Asia Glaucoma Interest Group (SEAGIG) is now online. The website can be viewed at **www.seagig.org**

The Asia Pacific Glaucoma Guidelines have now been launched by SEAGIG, with the support of the Asian-Oceanic Glaucoma Society. The Guidelines may be viewed on the SEAGIG website at **www.seagig.org/apgg.html**

Asian Journal of OPHTHALMOLOGY is the official journal of the South East Asia Glaucoma Interest Group, and 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 those 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.

ISSN 1560-2133

Suggested Formula for Setting Target Intraocular Pressure

Mario V Aquino
Department of Ophthalmology and Visual Sciences, University of the Philippines College of Medicine, Manila, The Philippines

Glaucoma is a group of ocular diseases characterised by a distinct progressive optic neuropathy. Elevated intraocular pressure is exponentially associated with an increased rate of retinal ganglion cell loss and visual field progression and is considered to be the most important risk factor for glaucoma. Several randomised controlled glaucoma trials have reinforced the importance of lowering intraocular pressure and it is currently the only factor that can be modified. The concept of a target intraocular pressure therefore provides a basis for a rational approach to the treatment of patients with glaucoma.

Key words: Glaucoma, Intraocular pressure, Optic neuropathy

Asian J Ophthalmol 2004;6(1):2-6.

Glaucoma is a group of ocular diseases characterised by a distinct progressive optic neuropathy as a result of ganglion cell loss and corresponding visual field loss.

There are many risk factors for and causes of glaucoma, but intraocular pressure (IOP) is considered to be the most important risk factor and the only factor that can be modified at the present time. Numerous clinical studies strongly suggest that lowering the IOP is beneficial for glaucoma.

Reducing the IOP is currently the only clinically proven way to stop or slow down the progression of glaucoma. All Food and Drug Administration (FDA) -approved medications for the disease are based on their ability to lower the IOP.

Elevated IOP is exponentially associated with an increased rate of retinal ganglion cell loss. Low pressure changes have very little effect on the spontaneous rate of ganglion cell loss. At higher pressures, the curve is steep, and the rate of cell loss becomes increasingly pressure-dependent. The point at which the cell loss becomes pressure-dependent could be defined as the 'threshold pressure'.[1]

Threshold pressure varies in every eye and is never fully known. It is influenced by many risk factors. The eyes were not created equal, but ophthalmologists must estimate these target pressures to establish a rational plan of therapy and set a target IOP.

Lowering the threshold pressure will reduce the rate of ganglion cell death and visual field loss. This is the 'benefit of therapy', and it justifies treatment to lower IOP in a particular patient.

The underlying pathology in all types of glaucoma is the loss of retinal ganglion cells. Reducing the rate of retinal ganglion cell loss to the normal rate of loss over time that naturally occurs during the ageing process is the fundamental goal of glaucoma therapy.

In managing patients with glaucoma, the intent is to achieve an IOP that is likely to slow or stop further retinal ganglion cell loss. This is the target pressure. Untreated glaucoma can progress to total loss of vision, although treatment slows the rate of retinal ganglion cell loss, potentially preserving functional vision throughout the patient's lifetime (Figure 1).[1]

The threshold pressure cannot be measured, and it varies for each individual patient. Figure 2 shows 2 patients with different threshold pressures.[1] The patient with the higher threshold pressure can tolerate having a higher IOP without accelerated ganglion cell loss than the patient with the lower threshold pressure. This variability in the susceptibility of different individuals to pressure-dependent ganglion cell loss is the reason why some patients have 'low-tension' glaucoma.

The susceptibility of patients to pressure-dependent ganglion cell loss is likely to vary as the disease progresses. Patients with advanced glaucoma are more likely to be susceptible to IOP-mediated optic nerve damage. Indeed, IOPs that are not considered a risk factor for damage in early glaucoma may cause progression in advanced glaucoma. For this reason, the target IOP for each patient may need to be adjusted during the course of the disease and patients with advanced glaucoma may require very low target pressures (Figure 3).[1]

In the early 1960s, Chandler said: "Eyes with advanced glaucoma require a pressure below the average while eyes with limited

Figure 1. Slowing the rate of ganglion cell loss to the age-dependent rate is the fundamental goal of glaucoma therapy.[1]

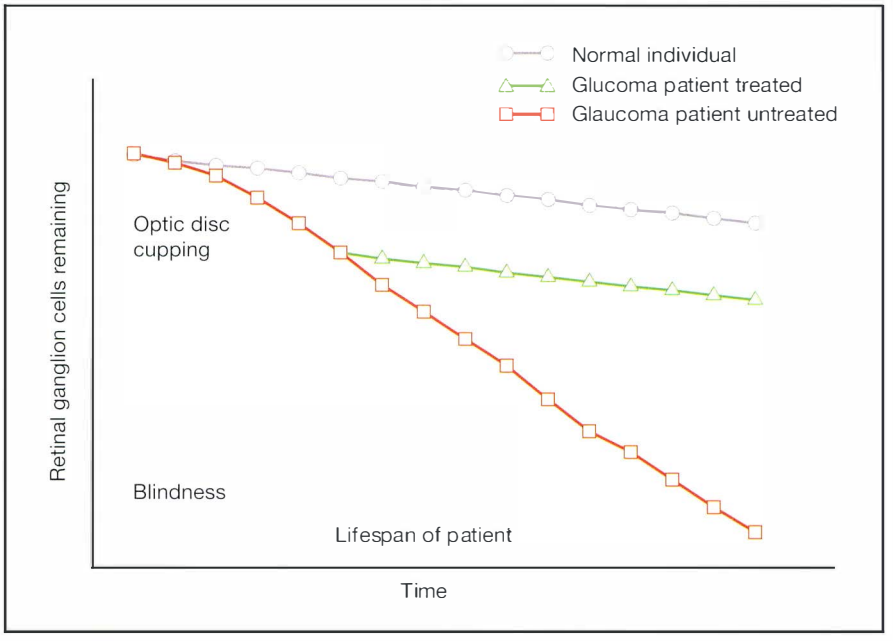


Figure 2. Individual variation in susceptibility to pressure-dependent damage.[1] No single target pressure level is approprate for all patients.

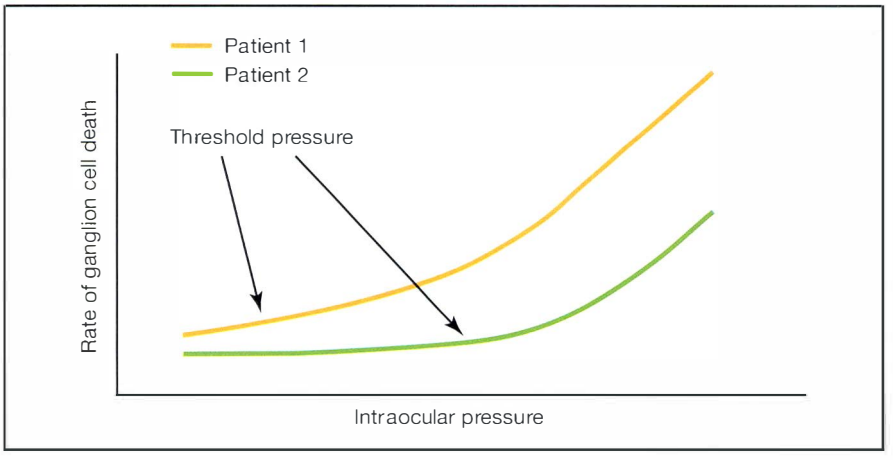
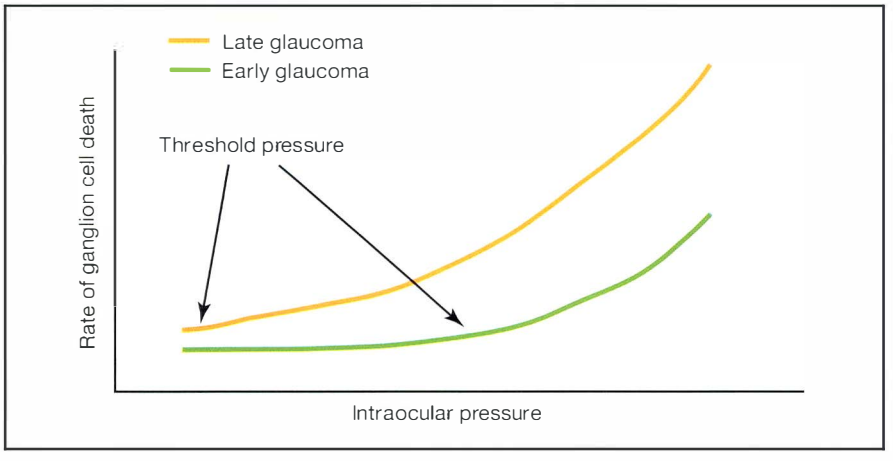


Figure 3. Change in the susceptibility to increased intraocular pressure during the course of glaucoma.[1]



cupping, confined to one pole of the disc, appear to withstand pressure better, and eyes with a normal disc appear to withstand pressure well over many years".[2]

Results from several US National Institutes of Health (US NIH) and Glaucoma Research Foundation randomised multicentre trials, namely the Ocular Hypertension Treatment Study (OHTS),[3] Collaborative Initial Glaucoma Treatment Study (CIGTS),[4] Collaborative Normal Tension Glaucoma Study (CNTGS),[5] Advanced Glaucoma Intervention Study (AGIS),[6] and Early Manifest Glaucoma Treatment Study (EMGTS),[7] have reinforced the long-held assumption that lowering the IOP benefits patients, whether the patient just has high IOP and is at risk for glaucoma, whether they are in the early or late phase of the disease, or even if they have glaucoma but have never had very high IOP.

Ocular Hypertension Treatment Study

In the OHTS, 1636 patients with ocular hypertension were randomised to observation or treatment with topical medications.[3] A minimum reduction of 20% from baseline was set as the target pressure. After 60 months of observation, the treated group achieved a 22.5% reduction in IOP, compared with a 4.0% reduction in the untreated group. After 60 months of observation, the cumulative probability of developing primary open angle glaucoma (POAG) was 4.4% in the treated group, compared with 9.5% in the observation group.

Collaborative Initial Glaucoma Treatment Study

The aim of the CIGTS was to determine whether newly diagnosed patients with POAG are better treated initially with medication or filtering surgery.[4] 307 patients

were randomised to the medication group and 300 patients to the surgery group. Very aggressive IOP lowering was a hallmark of this study. Both treatment modalities lowered the IOP — surgery lowered IOP more than medications, but they also lowered the IOP very well. For patients in the medication group, a 37% reduction of IOP from 27.0 to 17.5 mm Hg resulted in no net visual field progression, and a better quality of life than for those in the surgical group. Surgical patients had their IOPs reduced to 14 mm Hg. After a 5-year follow-up period, there was no significant difference between the 2 groups as far as progression was concerned.

Collaborative Normal-tension Glaucoma Study

The CNTGS aimed to determine whether IOP lowering is effective in reducing the progression of normal-tension glaucoma.[5] 140 patients were randomised to receive either medication or surgery to lower IOP by 30%, or no treatment. Thirty five percent of the untreated eyes and only 12% of the treated eyes progressed. This study also showed that lowering IOP is important no matter what type of glaucoma the patients have.

Advanced Glaucoma Intervention Study

The objective of the AGIS was to determine the effect of trabeculectomy or laser trabeculoplasty in patients with IOP uncontrolled by medications.[6] 780 eyes were randomised to either trabeculectomy or trabeculoplasty. If neither of these attempts worked, a reverse procedure was performed followed by a trabeculectomy. The associative analysis of data after 5 years showed that those patients who achieved the lowest IOPs consistently had the least chance of progression.

Early Manifest Glaucoma Trial

The EMGT aimed to compare the effect of immediate treatment to lower IOP against no treatment on the progression of newly detected POAG.[7] 255 patients with POAG were randomised to observation versus laser trabeculoplasty plus betaxolol. On average, the IOP of the treated group was reduced by 25% from baseline. After 5 years of follow-up, 62% of the untreated group and only 45% in the treated group progressed. This study showed that for each mm Hg decrease in IOP, there was an associated 10% decrease in the risk of glaucoma progression.

Conclusions from the Landmark Studies

The randomised controlled glaucoma trials reinforce the importance of lowering IOP, no matter what type of glaucoma the patients have. Every millimetre of mercury drop in IOP correlates with a decrease in the progression to glaucomatous damage and visual field loss. Early and aggressive treatment that will least likely affect the patient's quality of life is the goal we strive to achieve in the management of glaucoma.

Believing that lowering the IOP is beneficial for glaucoma, a fundamental question is the degree to which the IOP should be lowered to be safe for the optic nerve. Unfortunately, there is no single IOP measurement below which glaucoma will not progress and above which glaucoma will progress — we have to make an educated guess of what pressure will match the threshold pressure. A possible answer to this question is the concept of a target pressure. This provides a basis for a more rational approach to the treatment of patients with glaucoma.

Intraocular pressure is without question the most important risk factor for glaucoma and it is the only factor that can be modified at the present time. The idea of a target pressure formula was initially proposed by Jampel at the 1995 American Academy of Ophthalmology Glaucoma Update.[8] Jampel incorporated the initial pressure to the equation relating to the extent of IOP lowering needed to attain the target pressure. His proposed target IOP formula was

Figure 4. **Target pressure range, 1999 (modified from Jampel[8]).**

$$TP = IP\ (1 - IP/100) - Z \pm 2$$

TP = Target pressure
IP = Initial pressure
Z = Functional status (disc damage/field changes)

Z-0 Glaucoma suspect (LR)
Z-1 Glaucoma suspect (HR)
Z-2 Early glaucoma
Z-3 Moderate glaucoma
Z-4 Severe glaucoma
Z-5 End-stage glaucoma

Figure 5. **Target pressure range, 2004.**

$$TP = IP\ (1 - IP/100) - Z \pm 2$$

TP = Target pressure
IP = Initial pressure
Z = Functional status (disc damage/field changes)

Z-0 Glaucoma suspect (LR)
Z-0 Glaucoma suspect (HR)
Z-1 Early glaucoma
Z-3 Moderate glaucoma
Z-5 Severe glaucoma
Z-7 End-stage glaucoma

TP = IP (1 - IP/100) where TP is the target IOP and IP is the initial pressure. Clearly, the selection of a target pressure is not merely a relation of the initial pressure and a percentage IOP lowering. An equation of target IOP must take into account the patient's history, the IOP at presentation, the degree of damage, the rate of progression, the age of the patient or life expectancy, the condition of the other eye, and other factors involved in the glaucomatous status of a patient's eye.[9]

In 1999, I modified Jampel's formula and included a Z constant and correction factor to result in a range of IOP values and the resulting formula is: TP = IP (1 - IP/100) - Z ± 2. The Z constant was incorporated to emphasise that the extent of IOP lowering is dependent on patient-related factors (Figure 4).

The value of the Z constant would vary according to the stage of the patient's glaucoma. A patient with a more advanced stage of glaucoma will necessitate a larger reduction in IOP, whereas for a patient with suspected glaucoma, a mild reduction in IOP would suffice.

A factor of ± 2 mm Hg was incorporated into the formula to take into account the diurnal IOP fluctuation. An eye with a difference of more than 4 mm Hg between its highest and lowest IOP, or a difference of more than 4 mm Hg between the left and the right eye was considered to be abnormal. The resulting target pressure range would be more clinically relevant than a single point value in enabling the clinician to tailor it to individual patients and estimate the level at which glaucoma will progress or be halted.

Influenced by the outcomes from the US NIH and Glaucoma Research Foundation studies, I again revised the formula in 2004. Lowering IOP has been shown by these recent trials to be important for the treatment of glaucoma of all types, with a decrease in IOP correlating with a decrease in the

Table 1. The 'Z' constants in the proposed target intraocular pressure formula and corresponding clinical features

Z-0 Glaucoma suspect (low risk)	
Intraocular pressure	>21 mm Hg but in the 20s
History and physical examination	No family history of glaucoma
	Central corneal thickness normal
Disc	Normal
	• Cup <0.3 C/D
	• No cup asymmetry
	• Rosy neuroretinal rim
Fields	Normal
Z-0 Glaucoma suspect (high risk)	
Intraocular pressure	High 20s with functional status as low risk
History and physical examination	Family history of glaucoma
	Pseudoexfoliation
	Krukenberg spindle
	Pigment dispersion
	Angle recession
	Iris transillumination (ruff/periphery)
	Pupillary abnormalities
	Thin central corneal thickness
	Other
Disc	Normal
	• Cup <0.3 C/D
	• No cup asymmetry
	• Rosy neuroretinal rim
Z-1 Early glaucoma	
Disc	0.3-0.5 C/D (vertically oval)
	Cup asymmetry of ≥0.2
	Rim variable but rosy
	Disc haemorrhage
Fields	Nasal step
	Paracentral scotoma
	Seidel's scotoma
	Generalised depression
	Increased short-term fluctuation
Z-3 Moderately advanced glaucoma	
Disc	0.5-0.7 C/D (vertically oval)
	Rim variable with area of pallor
	Notching (may extend to the disc margin)
	Lamellar dots (+ or -)
	Bayoneting
	Slight nasalisation of vessels
Fields	Complete arcuate scotoma (upper or lower)
Z-5 Severe glaucoma	
Disc	0.8-0.9 C/D (vertically oval)
	Rim extremely narrow and pale mostly extending to the disc margin
	Marked nasalisation of vessels
	Lamellar dots and bayoneting
Fields	Double Bjerrum scotoma
	Breaking through periphery
	Threatening fixation
Z-7 End-stage glaucoma	
Disc	Almost total cupping
	Rim completely pale
	Lamellar dots
	Bayoneting
	Extreme nasalisation of vessels
Fields	Tubular and/or temporal island

progression of glaucoma and visual field loss. The basic formula remains the same [TP = IP (1 - IP/100) - Z ± 2], but the major modification in the 2004 formula is the changes in the Z constants at each of the stages of glaucoma (Figure 5 and Table 1).

A greater reduction in IOP and a lower target IOP range are required for patients with more advanced glaucoma, those with faster rates of progression, younger patients, and those with a lower IOP when visual field damage occurred.

While the eye is continuously subjected to the effect of IOP, we measure IOP infrequently. For this reason, we do not really know how successful we have been in achieving the target pressure. Therefore, the IOP should be regularly measured 'diurnally'. The optic disc and visual field should be constantly monitored, and we should modify our target pressure as indicated by the patient's course.

References

1. Brubaker RF. Delayed functional loss in glaucoma. LII Edward Jackson Memorial Lecture. Am J Ophthalmol 1996;121: 473-483.
2. Chandler P. Long-term results in glaucoma therapy. Am J Ophthalmol 1960;49: 221-246.
3. Kass MA, Heuer DK, Higginbotham EJ, et al. 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.
4. Lichter PR, Musch DC, Gillespie BW, et al. Interim clinical outcomes in the collaborative interventional glaucoma treatment study comparing initial treatment randomized to medications or surgery. Ophthalmology 2001;108: 1943-1953.
5. Collaborative Normal-Tension Glaucoma Study Group. Risk factors for progression of visual field abnormalities in normal-tension glaucoma. Am J Ophthalmol 1998;126:498-505.
6. The AGIS Investigators. The Advanced Glaucoma Intervention Study (AGIS): The relationship between control of intraocular pressure and visual field deterioration. Am J Ophthalmol 2000;130:429-440.
7. Heijl A, Leske MC, Bengtsson B, et al. Reduction of intraocular pressure and glaucoma progression. Arch Ophthalmol 2002;120:1268-1279.
8. Jampel H. Under pressure. In: American Academy of Ophthalmology Glaucoma Update. San Francisco: American Academy of Ophthalmology; 1995.
9. European Glaucoma Society. Guidelines for glaucoma. Italy: European Glaucoma Society; 1998.

Address for Correspondence
Professor Mario V Aquino
Department of Ophthalmology and Visual Sciences
College of Medicine
University of the Philippines
Taft Avenue, Ermita
Manila, The Philippines
Tel: (632) 521 0007 (telefax) or (632) 521 8450 local 2174
E-mail: mvaquino@i-manila.com.ph

Comparative Clinical Trial of Topical Cyclosporine A and Mitomycin C for the Management of Refractory Vernal Keratoconjunctivitis

Mohammad N Hashemian, Firoozeh Rahimi, S Farzad Mohammadi
Eye Research Center, Farabi Eye Hospital, Tehran University of Medical Sciences, Tehran, Iran

Objective: *To compare the short-term efficacy and safety of topical cyclosporine A and mitomycin C in the treatment of refractory vernal keratoconjunctivitis.*
Patients and Methods: *A fellow-eye controlled trial in which topical cyclosporine A 2% and mitomycin C 0.005% were administered concurrently 4 times daily for 4 weeks, one medication to each eye of 21 patients.*
Results: *Cyclosporine A brought about significant objective improvement relative to baseline ($p = 0.012$) and more objective improvement in comparison to mitomycin C ($p = 0.046$). Cyclosporine A was associated with greater improvement in ocular comfort ($p = 0.003$). Mitomycin C was associated with 14 new cases or exacerbations (67%) of punctate keratopathy and 5 cases (24%) of hypotony. Hypotony was associated with limbal involvement, disease duration, and severity ($p < 0.05$). Six patients (29%) reported a remarkable burning sensation following application of cyclosporine A.*
Conclusions: *Topical mitomycin C, even at low doses and in the short term, does not seem to be a safe treatment for vernal keratoconjunctivitis as it can result in significant punctate keratopathy and hypotony. Short-term topical cyclosporine A is an efficacious safe adjuvant to current modalities for severe vernal keratoconjunctivitis. The long-term efficacy and safety (including tolerability of its pharmacological formulation) are areas for future research and development.*

Key words: Cyclosporine, Mitomycin, Vernal keratoconjunctivitis

Asian J Ophthalmol 2004;6(1):7-12.

Introduction

Vernal keratoconjunctivitis (VKC) is a chronic inflammatory disease of the external eye, with seasonal exacerbation and recurrence.[1,2] The disease is self-limiting in the long run,[2,3] but its severe form is debilitating and potentially sight-threatening and the associated functional disability sometimes interferes with the schooling of children.

Mast cell stabilisers have several limitations, namely lack of compliance with long-term application, delayed onset of the therapeutic response, and poor control of symptoms and signs, especially in corneal forms and severe disease.[2,4,5] Topical, supratarsal, and even systemic steroids, are quite effective in controlling the disease but at the cost of dependence and major complications such as cataract and glaucoma.[1]

Topical cyclosporine A (CSA) was reported to be effective for VKC in 1986 by BenEzra et al,[6] and several reports have replicated that result and provided further evidence of its safety.[4,7-11] Topical mitomycin C (MMC) 0.01% for 2 weeks has been shown by Akpek et al to be effective in controlling refractory VKC in a placebo-controlled double-masked randomised trial.[5] More recently, Sodhi et al found MMC to be safe and comparatively more effective than azelastine in the treatment of allergic conjunctivitis.[12] The objectives of the current study were to compare the short-term efficacy and safety of topical CSA and MMC for refractory VKC.

Patients and Methods

This study was conducted at Farabi Eye Hospital, which is a major referral centre for eye diseases in Iran. Patients with severe bilateral VKC were referred to the hospital during late July to early October 2001. Patients who had no satisfactory response to

a recent course of topical cromolyn sodium for 6 weeks and a 1-week course of intense topical betamethasone were included in the study. Inclusion criteria included a history of seasonal exacerbation and at least 2 years' history of severe symptoms. Patients with active vernal ulcerative keratitis or suspected of having ocular herpes were excluded. No patient had a history of renal, liver, or collagen vascular diseases and none was taking concurrent steroids, antihistamines, non-steroidal anti-inflammatory drugs, and/or aspirin.

The study was approved by the hospital review board. Written consent was obtained from eligible patients or their proxies. Each eye of every patient was randomly assigned to receive topical CSA 2% or MMC 0.005% 4 times daily for 4 weeks. Medications were preservative-free — CSA was dissolved in olive oil and MMC in distilled water. Any current medication was discontinued. Due to the fellow-eye design of the study a wash-out phase was not considered.

At baseline, the type of VKC, relative ocular discomfort (patients were asked "Which eye feels worse?"), intraocular pressure (IOP), and degree of keratopathy were recorded, palpebral and limbal views were photographed, and the first medications were supplied. Instructions on punctal pressure for 1 minute following application, storage of bottles in cool dark places, and exclusive use of each medication for the respective eye were provided. Bottles were opaque and identical and had 'right' or 'left' labels.

Patients were followed up weekly (3 times) by a single masked observer when the relative ocular comfort of each eye was directly questioned ("Which eye feels better?") and self-report on intolerance following administration of the medication (significant burning and/or self-discontinuation due to severe stinging) were recorded. Relative ocular comfort denoted overall relative symptomatic relief of both eyes by the 2 medications; intolerance implied the short-term effect of the topical medications in terms of an associated burning sensation following application. The cornea was checked for punctate keratopathy with fluorescent staining under cobalt light and then the IOP was measured. Medications were renewed at weekly visits (the manufacturers produced the medications under sterile hoods and supplied them weekly to ensure maintenance of sterility and activity). The need for differential usage of drops for each eye despite perceived differences in relative efficacy and tolerability by the patient was emphasised. At the fourth-week follow-up, the medications were discontinued and palpebral and limbal views were once again photographed.

Preset termination criteria were any anterior segment findings of cataract, ocular hypertension/hypotony, or any other significant adverse event.

Baseline and postinterventional palpebral and limbal photos of the eyes were compared in a paired fashion. Attention was given to reduction in the crowdedness and oedema of the papilla and reduction in limbal oedema and gelatinous hypertrophy. The right eye responses were compared with those of the left eye and relative objective improvements were determined. Observers were masked and did not know the pre-/postinterventional status of the photographs, or the respective medication groups. Based on relative ocular comfort at the baseline exam and weekly follow-ups, it was determined which eye had better overall ocular comfort.

Occurrence of new punctate keratopathy or aggravation of pre-existing keratopathy was considered as an adverse outcome (keratopathy was graded from trace to 4+; trace punctate erosions were neglected). Ocular hypotony was defined as IOP ≤7 mm Hg, IOP decrease of >6 mm Hg (relative to the baseline reading), or relative hypotony >6 mm Hg. Chi squared and student's *t* tests were used in the statistical analyses. Comparability of the severity of involvement of CSA-assigned eyes with that of the MMC-assigned eyes were checked with Wilcoxon rank test: mean baseline severities were not significantly different ($p = 0.483$).

Results

From 20 July 2001 to 10 October 2001, twenty six patients were included in the study. Twenty one patients were compliant with follow-up and medications. The mean age was 16.0 years with a standard deviation of 6.2 years. Two patients (10%) were female. The mean reported disease duration was 5 years (range, 2 to 10 years). Six of the patients (29%) were from Afghanistan — on average, they were 5.5 years olde than the Iranian patients ($p = 0.089$); otherwise, there were no significant differences in baseline and outcome measures. Nine patients (43%) had palpebral VKC, one (5%) had limbal disease, and 11 (52%) were of mixed types. Five patients (24%) had bilateral punctate keratopathy at presentation. Other findings were bilateral advanced glaucoma (1 patient), posterior sub-capsular cataracts (2 patients), pannus (7 patients), subepithelial scars (5 patients), giant papilla (3 patients), advanced keratoconus (2 patients), and pseudogerontoxon (2 patients).

As shown in Table 1, CSA-assigned eyes improved significantly in comparison with the baseline and also in comparison with their MMC-assigned fellow eyes (Figure 1).

The safety profile, including the tolerability of the medications, is presented in Table 2. Punctate keratopathy was exacerbated in 5 of 5 eyes and was induced in 9 new MMC-assigned eyes, while the contralateral CSA-assigned eyes improved in 3 of 4 patients and 3 new cases of keratopathy occurred. Occurrence or exacerbation of

Table 1. Efficacy analyses.

	Cyclosporine A-assigned eyes*	Mitomycin C-assigned eyes*	Relative improvement†	Relative ocular comfort†
Improvement over baseline	13/16‡	10/16‡	12/16‡	16/19‡
p Value	0.012	0.317	0.046	0.003

* The proportion of eyes that showed improvement was compared to the proportion of eyes that showed exacerbation or had no change and expected values of proportions were assumed to be 0.5 for Chi squared testing.
† Relative comparison was made between the proportion of cyclosporine A-assigned eyes with more improvement/better ocular comfort and proportion of cyclosporine A-assigned eyes that did not have/gain more improvement/better ocular comfort in comparison to mitomycin C-assigned fellow eyes. Expected values of proportions were assumed to be 0.5 for Chi squared testing.
‡ Relative ocular comfort was compared in 19 of 21 pairs of eyes and a complete set of photographs were available for 16 pairs.

punctate keratopathy in MMC-assigned eyes was related to the baseline severity ($p = 0.016$).

Five patients had hypotony — all were in MMC-assigned eyes, had limbal involvement (limbal or mixed forms) [$p = 0.046$], had a significantly longer duration of disease (mean duration difference, ~3 years; $p = 0.027$), and had more severe disease ($p = 0.049$). The average time of onset of hypotony was less than 3 weeks (Table 3).

Patients with hypotony and severe punctate keratopathy were excluded and conventional treatment was reinstated. In 2 of the CSA-assigned eyes, the medication was perceived to be stinging so much that the patients themselves discontinued the respective medication. For these patients, the other medication (MMC) was instituted. One patient found both medications intolerable.

Discussion

This study provides evidence for the efficacy of CSA in the treatment of severe VKC consistent with previous reports.[4,6,8,9] Additionally, it underscores the superiority of CSA over MMC in terms of improvement in palpebral and limbal photographs and ocular comfort. Th-2-mediated and immunoglobulin E/mast cell-mediated responses have been implicated in the pathogenesis of VKC[1,13-17] and these findings provide clinical evidence for the importance of the former, whose role has also been proven in immunohistochemical and impression cytology studies.[18,19] CSA is a specific inhibitor of interleukin-2 synthesis and accordingly has the potential to specifically halt the pathologic process at the beginning through inhibition of Th-2 proliferation.

MMC may non-specifically inhibit proliferation of inflammatory cells and fibroblasts causing the symptoms and signs associated with VKC. MMC 0.01% was given for 2 weeks in Akpek et al's study, in which significant improvement of MMC for refractory VKC was shown.[5] In addition, MMC

Figure 1. Sample tarsal photographs. (a and b) Application of cyclosporine A from 25 July to 30 August 2001 resulted in significant atrophy of palpebral papilla; (c and d) cyclosporine A brought about marginal improvement (determined in the masked ranking); and (e and f) the mitomycin C-assigned fellow eyes experienced exacerbation, as is evident from the associated discharge (arrows).

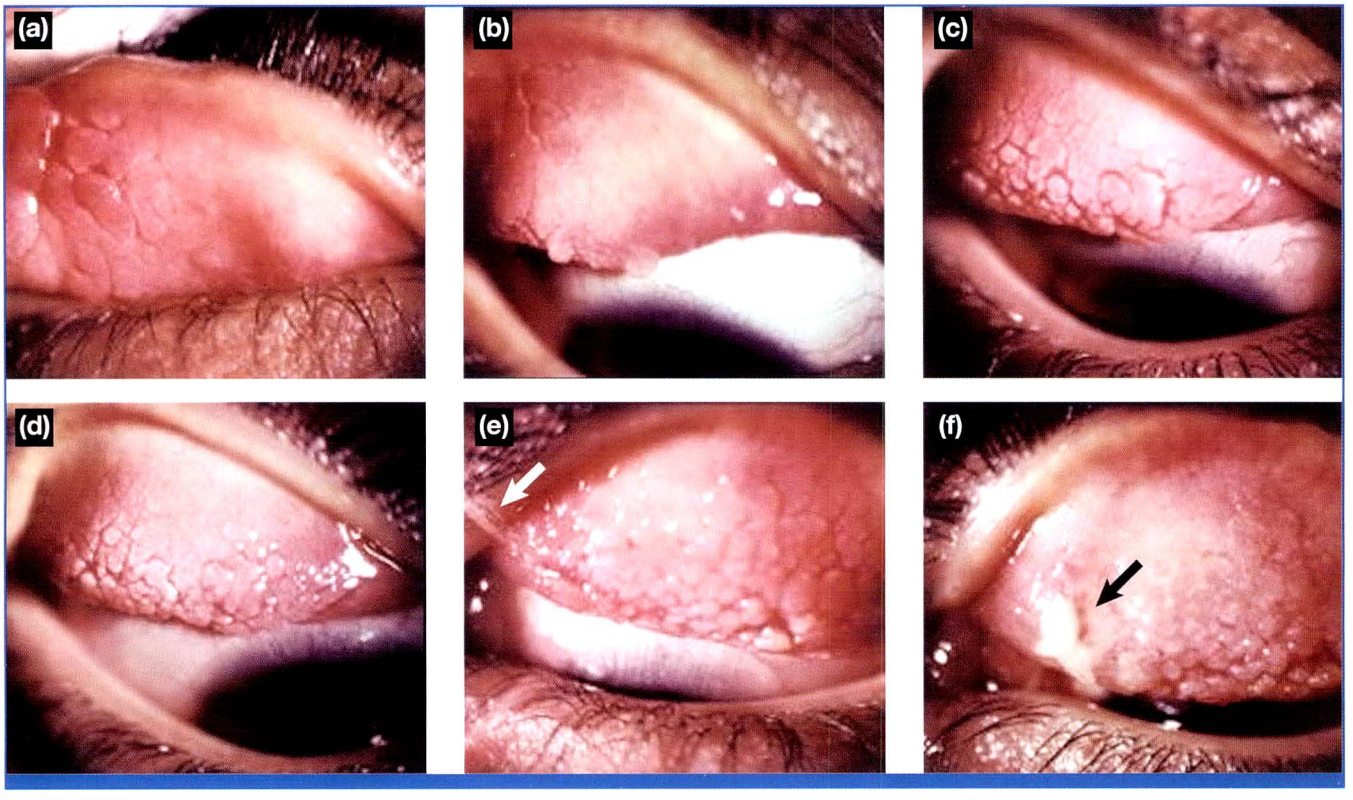


Table 2. Safety profile of cyclosporine A (CSA) and mitomycin C (MMC).*

	Punctate keratopathy		Hypotony	Self-reported intolerance
	Newly occurred or exacerbated	All eyes Baseline versus post-interventional (p Value)		
Cyclosporine A-assigned	3/19	4 vs 4/19 (1.000)	0	6
Mitomycin C-assigned	14 (67%; 95% confidence interval, 47%-87%)	5 vs 14 (0.012)	5 (24%, 95% confidence interval, 6%-42%)	1
Odds ratio	12 (MMC vs CSA)			8 (CSA vs MMC)
p Value	0.001			0.093

* Data are presented as frequency of observations and denominators are all 21 if not specifically mentioned.

Table 3. Ocular hypotony.

Patient number	Onset (weeks)*	Intraocular pressure (mm Hg)			Intraocular presure course at monthly follow-up
		Mitomycin C-assigned	Drop from baseline	Cyclosporine A-assigned fellow eye	
1	2	7	8	17	Low at month 1†
2	3	7	4	15	Normalised at month 3
3	2	5	12	13	Normalised at month 1
4	3	6	6	14	Normalised at month 2
5	4	6	6	16	Low at month 1†

* Onset refers to the time lag between the institution of topical mitomycin C to the time that hypotony was first detected.
† Lost to further follow-up.

0.002% for 3 months was given in Sodhi et al's study for the treatment of allergic conjunctivitis, in which significant therapeutic response was observed.[12] We could not replicate their work as we did not find significant improvement in MMC-assigned eyes in comparison to baseline. However, this may be explained by the lower concentration of MMC in our study in comparison to Akpek et al's study[5] (0.005% versus 0.01% for 4 weeks versus 2 weeks, respectively, although the cumulative dose was comparable), shorter duration of application of MMC, and/or the different nature of the disease in comparison to Sodhi et al's study,[12] and/or inadequate statistical power.

Punctate keratopathy has been previously reported as an adverse effect of topical MMC.[20-23] Akpek et al also observed punctate keratopathy in their study of MMC and VKC and considered it reversible.[5] They reserved MMC for refractory cases for a short period of time. Although punctate keratopathy is itself a sign of severe VKC, our comparative data leave little doubt that MMC was the primary cause. Punctate keratopathy may be a result of stem cell toxicity and not merely due to a simple chemical insult to the corneal epithelium.[24] Therefore, in the long term it may play a role in the development of limbal stem cell deficiency, especially in severe corneal VKC in which stem cells are already under toxic effects of local mediators. Patients with VKC experience very distressing ocular discomfort and development of significant punctate keratopathy would seriously complicate their well-being.

Hypotony is a widely reported complication of MMC-augmented filtering surgery. Excessive filtration and ciliary body toxicity are the current explanations for this complication.[25,26] Several experimental studies provided fluorophotometric and morphologic evidence in support of aqueous hypoproduction and the ciliary body toxicity hypothesis.[26-30] Our study provides clinical evidence in favour of the ciliary body toxicity hypothesis, suggesting that MMC could transconjunctivally induce hypotony at very low concentrations that have previously shown no evidence of toxicities in animal models.[27] There is growing evidence that the permeability of the conjunctiva to small water-soluble molecules is 20 times that of the cornea and perilimbal conjunctiva offers an effective trans-scleral route for delivery of drugs to anterior segment structures.[31] The observation that the eyes that developed hypotony had a severe limbal form of the disease and a long-standing course further substantiates the plausibility of this hypothesis as severe chronic inflammation and congestion of the perilimbal vessels may facilitate transconjunctival ciliary body access. The long-term impact of this untoward effect is not clear but an experimental study by Mietz et al documented evidence of toxicity up to 6 months following MMC application.[28] As shown in Table 3, IOP may not normalise for several weeks. Further studies are needed to clarify the primary focus of hypotony, i.e., the ciliary epithelium,[30] the ciliary nerve,[32] and/or the trabecular meshwork.[26] Akpek et al's report did not include IOP measurements.[5]

Lack of tolerability could be a major drawback for CSA (3 patients noted that although the oily one stung, it was more effective). The irritating nature of topical CSA has been previously reported[33-35] and

is attributed to the oily base of the medication.[36] On the other hand, olive oil alters the surface permeability[37] and this may facilitate the therapeutic response. As we did not plan a routine (relative) tolerability measure in advance (we did not directly question it), intolerance to CSA might have been underestimated. The reported intolerance in our study was significantly associated with age ($p = 0.007$), with those who complained being 8 years older on average — younger participants might have had significant burning but were not able to communicate it. Development of tolerance has been reported.[35]

MMC in distilled water is unstable; weekly renewal of the medications, opaque walls of the bottles, and instruction to keep the medication in cool and dark places should largely eliminate this concern. Additionally, MMC was quite active in producing adverse effects and these findings lessened the importance of this concern in the current study. The differential nature of the bases (oily versus aqueous) should not change the implications for the current clinical practice. MMC is water-soluble and CSA is lipid soluble and the reported studies of the topical application of these 2 medications used similar formulations. Nonetheless, in interpreting the studies, formulations have to be accounted for.

Seasonality constitutes a major aspect of VKC and towards the end of the study as autumn was approaching, there should have been some degree of spontaneous remission with or without intervention. However, seasonality contribution over a period of 4 weeks should not be great, especially for patients with severe refractory disease (many of whom had perennial symptoms). In addition, although seasonality may imply some overestimation of absolute therapeutic response, it would not endanger the relative inferences about CSA and MMC.

Five of the patients were not compliant with follow-up and medications. However, compliance seemed attributable to the issue of access as 3 were living in other cities and failed to return to the first follow-up, or personal motivation, which was apparent at the first visit in 1 patient. Only one of the 5 patients was actively excluded due to intolerance to both medications. Photograph losses (5 sets) were accidental (whether baseline or postinterventional) and, although it could have affected the power of the study (especially for the MMC efficacy analysis), this should not change the other inferences.

Conclusion

Regular use of topical MMC, even at low concentrations such as 0.005% and for short periods such as 2 weeks, can cause punctate keratopathy and ocular hypotony. We would not advise use of this medication for VKC, especially for the chronic severe limbal form and for those patients with punctate keratopathy. Limbal stem cell toxicity and transconjunctival ciliary body toxicity are the likely explanations for these effects. In comparison, topical CSA 2% is efficacious and safe for the treatment of VKC in the short term and, due to the potential steroid-sparing effect, it could be a very good adjuvant and/or substitute to steroids for severe, refractory, and/or complicated VKC. Now CSA needs to be evaluated in long-term controlled studies. Intolerance to the topical CSA formulation is a significant challenge and is an area for pharmaceutical development. For the time being, patients should be informed about this stinging effect in advance and a tolerance trial for individual patients before long-term prescription seems wise.

Acknowledgements

We acknowledge Dr A Karbasian and his colleagues at Sina Darou Pharmaceutical Company who provided the medications and Dr M Mohebbi for case selection and referral. It is noteworthy that the study was the residency thesis of Dr S Farzad Mohammadi defended at Farabi Eye Hospital, 2003.

References

1. Leonardi A, Smith LM, Secchi AG. Venal keratoconjunctivitis. In: Abelson MB, editor. Allergic diseases of the eye. 1st ed. Philadelphia: WB Saunders Co; 2000:179-194.
2. Stock EL, Meisler DM. Vernal keratoconjunctivitis. In: Tasman W, Jaeger EA, editors. Duane's clinical ophthalmology. Vol 4. Philadelphia: JB Lippincott; 1998: chapter 9:1-5.
3. Schlote T, Thiel HJ, Zierhut M. Allergic disorders of the eye. In: Zierhut M, Thiel HJ, editors. Immunology of the skin and the eye. 1st ed. Bruen: Æolus Press, Science Publishers; 1999:156-158.
4. Bleik JH, Tabbara KF. Topical cyclosporine in vernal keratoconjunctivitis. Ophthalmology 1991;98:1679-1684.
5. Akpek EK, Hasiripi H, Christen WG, Kalayci D. A randomized trial of low-dose, topical mitomycin-C in the treatment of severe vernal keratoconjunctivitis. Ophthalmology 2000;107: 263-269.
6. BenEzra D, Pe'er J, Brodsky M, Cohen E. Cyclosporine eye drops for the treatment of severe vernal keratoconjunctivitis. Am J Ophthalmol 1986;101: 278-282.
7. BenEzra D, Matamoros N, Cohen E. Treatment of severe vernal keratoconjunctivitis with cyclosporine A eyedrops. Transplant Proc 1988;20 (Suppl 2): 644-649.
8. Secchi AG, Tognon MS, Leonardi A. Topical use of cyclosporine in the treatment of vernal keratoconjunctivitis. Am J Ophthalmol 1990;110:641-645.
9. Gupta V, Sahu PK. Topical cyclosporin A in the management of vernal keratoconjunctivitis. Eye 2001;15(pt 1):39-41.
10. Tomida I, Schlote T, Brauning J, Heide PE, Zierhut M. Cyclosporin A 2% eyedrops in therapy of atopic and vernal keratoconjunctivitis. Ophthalmologe 2002;99:761-767.
11. Pucci N, Novembre E, Cianferoni A, et al. Efficacy and safety of cyclosporine eyedrops in vernal keratoconjunctivitis. Ann Allergy Asthma Immunol 2002;89: 298-303.
12. Sodhi PK, Pandey RM, Ratan SK. Efficacy and safety of topical azelastine compared with topical mitomycin C in

patients with allergic conjunctivitis. Cornea 2003;22:210-213.
13. Butrus SI, Leung DY, Gellis S, Baum J, Kenyon KR, Abelson MB. Vernal conjunctivitis in the hyperimmunoglobulinemia E syndrome. Ophthalmology 1984;91: 1213-1216.
14. Bhan AK, Fujikawa LS, Foster CS. T-cell subsets and Langerhans cells in normal and diseased conjunctiva. Am J Ophthalmol 1982;94:205-212.
15. Metz DP, Bacon AS, Holgate S, Lightman SL. Phenotypic characterization of T cells infiltrating the conjunctiva in chronic allergic eye disease. J Allergy Clin Immunol 1996;98:686-696.
16. Maggi E, Biswas P, Del Prete G, et al. Accumulation of Th-2-like helper T cells in the conjunctiva of patients with vernal conjunctivitis. J Immunol 1991;146: 1169-1174.
17. Abelson MB, Leonardi AA, Smith LM, Fregona IA, George MA, Secchi AG. Histaminase activity in patients with vernal keratoconjunctivitis. Ophthalmology 1995;102:1958-1963.
18. El-Asrar AM, Tabbara KF, Geboes K, Missotten L, Desmet V. An immunohistochemical study of topical cyclosporine in vernal keratoconjunctivitis. Am J Ophthalmol 1996;121:156-161.
19. Avunduk AM, Avunduk MC, Erdol H, Kapicioglu Z, Akyol N. Cyclosporine effects on clinical findings and impression cytology specimens in severe vernal keratoconjunctivitis. Ophthalmologica 2001;215:290-293.
20. Panda A, Das GK, Tuli SW, Kumar A. Randomized trial of intraoperative mitomycin C in surgery for pterygium. Am J Ophthalmol 1998;125:59-63.
21. Chen CW, Huang HT, Bair JS, Lee CC. Trabeculectomy with simultaneous topical application of mitomycin-C in refractory glaucoma. J Ocul Pharmacol 1990;6:175-182.
22. Wilson MW, Hungerford JL, George SM, Madreperla SA. Topical mitomycin C for the treatment of conjunctival and corneal epithelial dysplasia and neoplasia. Am J Ophthalmol 1997;124: 303-311.
23. Rachmiel R, Leiba H, Levartovsky S. Results of treatment with topical mitomycin C 0.02% following excision of primary pterygium. Br J Ophthalmol 1995;79:233-236.
24. Manche EE, Afshari MA, Singh K. Delayed corneal epitheliopathy after antimetabolite-augmented trabeculectomy. J Glaucoma 1998;7:237-239.
25. Costa VP, Wilson RP, Moster MR, Sc hmidt CM, Gandham S. Hypotony maculopathy following the use of topical mitomycin C in glaucoma filtration surgery. Ophthalmic Surg 1993;24:389-394.
26. Hong SJ, Wu KY, Wang HZ, Lai YH. Toxic effects of mitomycin-C on cultured ciliary process cells and trabecular meshwork cells. J Ocul Pharmacol Ther 2001;17:331-342.
27. Hara T, Obata H, Shirato S, Araie M. The cytotoxic effect of topical mitomycin C on the ciliary body in rabbits. Nippon Ganka Gakkai Zasshi 1998;102: 88-94.
28. Mietz H, Addicks K, Bloch W, Krieglstein GK. Long-term intraocular toxic effects of topical mitomycin C in rabbits. J Glaucoma 1996;5:325-333.
29. Mietz H. The toxicology of mitomycin C on the ciliary body. Curr Opin Ophthalmol 1996;7:72-79.
30. Mietz H, Addicks K, Diestelhorst M, Krieglstein GK. Extraocular application of mitomycin C in a rabbit model: cytotoxic effects on the ciliary body and epithelium. Ophthalmic Surg 1994;25: 240-244.
31. Ocular pharmacology. In: Cibis GW, Abdel-Latif AA, Bron AJ, et al, editors. Basic and clinical science course, fundamentals and principles of ophthalmology. Section 2. San Francisco: Lifelong Education for the Ophthalmologist; 2002-2003:392.
32. Mietz H, Addicks K, Diestelhorst M, Krieglstein GK. Intraocular toxicity to ciliary nerves after extraocular application of mitomycin C in rabbits. Int Ophthalmol 1995;19:89-93.
33. Solch S, Nadler PI, Silverman MH. Safety and tolerability of two percent cyclosporine (sandimmune) ophthalmic ointment in normal volunteers. J Ocul Pharmacol 1991;7:301-312.
34. Reinhard T, Godehardt E, Pfahl HG, Sundmacher R. Local cyclosporin A in nummuli after keratoconjunctivitis epidemica. Ophthalmologe 2000;97: 764-768.
35. Laibovitz RA, Solch S, Andriano K, O'Connell M, Silverman MH. Pilot trial of cyclosporine 1% ophthalmic ointment in the treatment of keratoconjunctivitis sicca. Cornea 1993;12:315-323.
36. Versura P, Cellini M, Zucchini PG, Caramazza R, Laschi R. Ultrastructural and immunohistochemical study on the effect of topical cyclosporin A in the rabbit eye. Cornea 1989;8:81-89.
37. Benitez del Castillo JM, del Aguila C, Duran S, Hernandez J, Garcia Sanchez J. Influence of topically applied cyclosporine A in olive oil on corneal epithelium permeability. Cornea 1994; 13:136-140.

Address for Correspondence
SF Mohammadi, MD
PO Box 14155-7146
Tehran, Iran
Tel: (98 21) 541 6134
Fax: (98 21) 541 6134
E-mail: sfmohamm@razi.tums.ac.ir

SEAGIG and EMBASE

It gives the editors great pleasure to announce that Asian Journal of OPHTHALMOLOGY has joined forces with the South East Asia Glaucoma Interest Group (SEAGIG) to become the official SEAGIG Journal. The journal will continue to publish relevant articles related to ophthalmology, while the focus will remain on glaucoma.

We are also proud to announce that Asian Journal of OPHTHALMOLOGY is now indexed in the EMBASE database. The database can be found on the Internet at www.elsevier.com/locate/esbd and there will be links to the Asian Journal of OPHTHALMOLOGY website at www.scientific-com.com/AJO

We are grateful for the support that Asian Journal of OPHTHALMOLOGY has received from our authors and readers, which has enabled both of these steps to take place. Please continue to send your contributions to the Editorial Office.

Ocular Paintball Injury with and without Eye Protection

Raneen Shehadeh-Masha'our, Haneen Jabaly-Habib, Hanna Garzozi
Ha Emek Medical Center, Afula, Israel

'Paintball' is a war game in which 2 teams use special carbon dioxide or air compressed guns to shoot gelatin or latex balls filled with paint. The balls rupture on impact marking the victim with the extruded dye. Ocular paintball injuries are increasingly being reported, probably due to the popularity and unrestricted use of this game without consideration for safety. This report presents the first 2 incidences of ocular paintball injury in Israel.

Key words: Eye, Pellet, Rupture, Trauma

Asian J Ophthalmol 2004;6(1):13-14.

Case Report 1

A 21-year-old man presented to the emergency room immediately after sustaining an ocular paintball injury to his right eye (RE) after temporarily removing his protective eyewear to clean it.

At presentation, RE best corrected visual acuity (BCVA) was hand movements, intraocular pressure was 14 mm Hg, there was a lower lid haematoma, subconjunctival haemorrhage, mild corneal oedema, hyphaema, 2 hours iridodialysis, and traumatic mydriatic pupil with reverse relative afferent pupillary defect (RAPD). The lens and posterior segment were initially obscured by hyphaema and vitreous haemorrhage (Figure 1), which was partially absorbed after 2 days to reveal a clear lens, suprachoroidal haemorrhage with suspected rupture of the choroids, and the posterior wall of the eye. Ultrasound (US) examination showed suprachoroidal haemorrhage and possible rupture of the posterior wall of the eyeball inferonasally, with an attached retina. The patient was treated conservatively with systemic and topical corticosteroids and mydriatics for 1 week.

Two months after the injury, BCVA improved to 20/400. Anterior segment examination showed the iridodialysis and the mydriatic pupil; the lens remained clear. Fundus examination showed foveal scar, nasal area of retinal pigment epithelium (RPE) hyperplasia, choroidal rupture temporal to the optic disc, and the eyeball rupture scar inferonasally (Figure 2). On electrophysiology of both eyes, the visual evoked potentials were normal and symmetric bilaterally, the pattern electroretinogram was normal for the left eye (LE) but depressed for the RE.

Case Report 2

A 19-year-old man presented to the emergency room after sustaining an ocular paintball injury to his left eye. He was injured while wearing protective goggles, when the paintball hit him laterally between the goggles and orbit.

At presentation, LE uncorrected visual acuity (UCVA) was 6/7, intraocular pressure was 12 mm Hg, and there was upper lid

Figure 1. Fundus photograph at presentation showing the posterior segment obscured by vitreous haemorrhage.

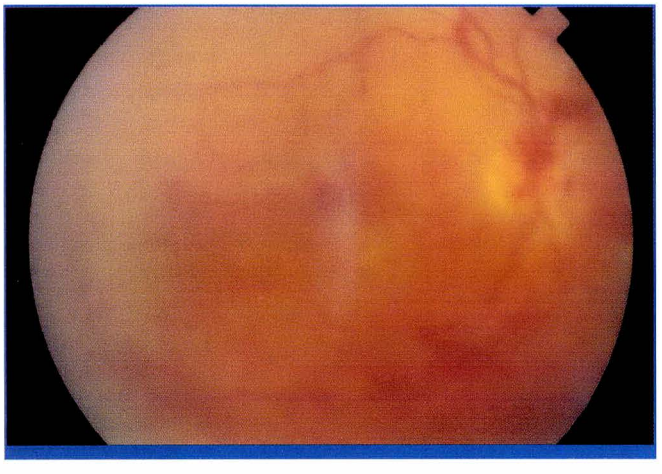
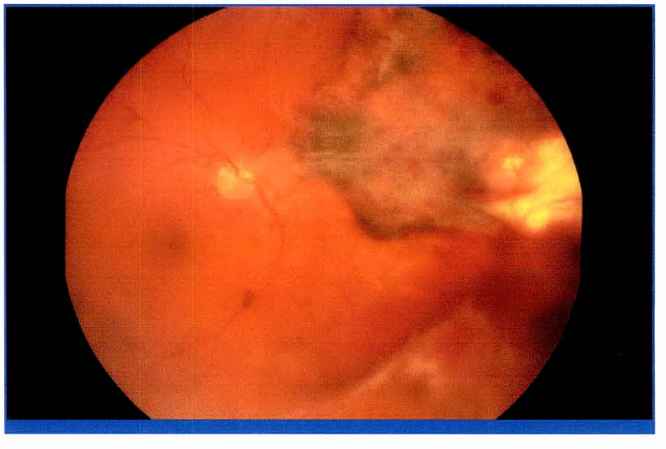


Figure 2. Panoret fundus photograph 2 months after the injury showing the nasal area of retinal pigment epithelium hyperplasia and the eyeball rupture scar inferonasally.



haematoma, subconjunctival haemorrhage temporally, microhyphaema, mildly traumatic pupil, and clear lens. Fundus examination revealed a restricted area of retinal oedema and microhaemorrhages at the temporal periphery. He was treated with topical corticosteroids. Three days later the microhyphaema resolved as well as the retinal oedema and microhaemorrhages. Gonioscopic examination revealed angle recession.

Discussion

War games with paintball pallets were first played in 1981 in New Hampshire. Since then, the sport has become increasingly popular, with millions of people participating.[1,2] The increasing popularity of this game, the availability of these weapons for informal use, and the introduction of cheap locally made paintballs with a hard plastic coating in some countries have contributed to the increase in ocular injuries.[2]

It is estimated, that proper use of eye protection may lead to the prevention of up to 90% of injuries in sports.[3] In most cases of ocular paintball injury reported in the literature,[1,2,4-6] the injuries occurred when the players were not using eye protectors or when they temporarily removed them during a game as in the first patient described in this report. However, cases have been reported in which eye protection was worn and eye injury still occurred as in the second patient. In some of these patients, the paintball entered under the mask[5,7] or 'displaced' the goggles,[5,8] while in others, the goggles were projected into the eye.[5,9,10]

None of our patients were wearing an eye protection device meeting the current American Society of Testing and Materials (ASTM) standards for paintball sports. The ASTM upgraded the goggles from simple ocular protection to full facial protection. Not only does this provide better protection to the face and ears, but also makes it less likely that ocular injury will occur while wearing such protection devices. Although eye protection devices not meeting the ASTM standards don't provide full protection, they may reduce the severity of the injuries, as was noted for patient 2 compared with patient 1.

The blunt shape, the soft texture, and the low muzzle velocity of the paintball projectiles of 80 to 130 m/second compared with an airgun of 260 m/second make the ocular injury similar to that of blunt trauma with coup-countercoup mechanisms and anterior-posterior compression of the eyeball with equatorial expansion.[4] This mechanism might explain the choroidal rupture temporal to the optic disc and the iridodialysis seen in patient 1. The small diameter of the paintball (12 to 17 mm) allows direct transmission of energy into the globe, bypassing the protective effect of the orbital rim. In addition, since the paintballs are designed to rupture on impact, there is no exit wound, and all of the energy is released at the site of impact.[4] Fortunately the released material is neutral and does not cause chemical burns.

Hyphaema and vitreous haemorrhage are the most commonly reported anterior and posterior segment paintball injuries, respectively. Other common anterior segment injuries are traumatic cataract, dislocation of the crystalline lens, angle recession, iridodialysis, and traumatic keratopathy. Regarding posterior segment injuries, commotio retina, choroidal rupture, retinal breaks, retinal dialysis, and retinal detachment also frequently occur. Macular hole and rupture of the globe are less frequently reported.[1,2,4-6]

Patient 1 was a young man without ocular protection. He had both choroidal and globe rupture, which illustrates the serious damage of these high-energy injuries with severe visual impairment. The second patient, was also a young man but who was wearing ocular protection. Although his goggles did not meet the ASTM standards, they provided some protection leading to a less severe injury. This patient was advised to continue long-term follow-up due to the angle recession and the risk of developing glaucoma in the injured eye.

Wearing adequate protective facemasks may prevent most of the above injuries. These devices should never be removed in areas of play.[1,2,4-6] Participants should be older than 18 years and instructed not to shoot towards the head and neck.[2]

References

1. Kruger LP, Acton JK. Paintball ocular injuries. S Afr Med J 1999;89:265-268.
2. Kitchens JW, Danis RP. Increasing paintball related eye trauma reported to a state eye injury registry. Inj Prev 1999;5:301-302.
3. Pashby TJ. Eye injuries in Canadian sports and recreational activities. Can J Ophthalmol 1992;27:226-229.
4. Hargrave S, Weakly D, Wilson C. Complications of ocular paintball injuries in children. J Pediatr Ophthalmol Strabismus 2000;37:338-343.
5. Fineman MS, Fischer DH, Jeffers JB, Buerger DG, Repke C. Changing trends in paintball sport-related ocular injuries. Arch Ophthalmol 2000;118:60-64.
6. Thach AB, Ward TP, Hollifield RD, et al. Ocular injuries from paintball pellets. Ophthalmology 1999;106:533-537.
7. Acheson JF, Griffiths MF, Cooling RT. Serious eye injuries due to war games. BMJ 1989;298:26.
8. Wrenn KD, White SJ. Injury potential in "paintball" combat simulation games: a report of two cases. Am J Emerg Med 1991;9:402-404.
9. Martin PL, Magolan JJ. Eye injury during "war games" despite the use of goggles. Arch Ophthalmol 1987;105:321-322.
10. Pakoulas C, Shar S, Frangoulis MA. Serious eye injuries due to war games. BMJ 1989;298:383.

Address for Correspondence
Dr Raneen Shehadeh-Masha'our
Department of Ophthalmology
Bnai Zion-Medical Center
Golomb St 47
PO Box 4940
Haifa 31048, Israel
Tel (972 4) 835 9550/4
Fax: (972 4) 835 9556
E-mail: garzozi@yahoo.com

Management of Ocular Hypertension and Glaucoma

From a sponsored symposium held by Pfizer at the European Glaucoma Society Meeting, Florence, Italy, 1 June 2004

The Glaucoma Continuum

Robert N Weinreb
Hamilton Glaucoma Centre
University of California
San Diego
La Jolla
California, USA

The glaucoma continuum ranges from a normal healthy eye through undetectable disease and detectable asymptomatic disease to functional impairment and ultimately blindness (Figure 1). Early diagnosis is essential for early treatment and prevention of loss of vision across the continuum.

Examination of the optic disc and retinal nerve fibre layer (RNFL) is essential for both diagnosis and monitoring of glaucoma. Early in glaucoma, retinal ganglion cells (RCGs) have morphologic changes such as shrinkage of the dendritic field and the cell body. A process of accelerated apoptosis is initiated. At this stage, cell function may still be normal. Within the central visual pathway, relay neurones in the lateral geniculate nucleus — the target of the RGCs — and visual cortex also undergo structural changes.

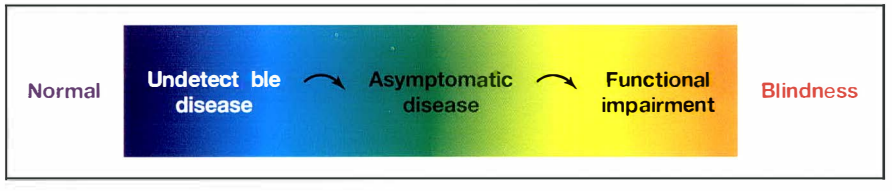
It is not until the stage of asymptomatic disease, when changes in the RNFL become apparent, that glaucoma usually can be detected.

It appears that, in young glaucoma and ocular hypertension patients, progressive RNFL injury often precedes the development of functional visual field loss. As many as 85% of patients with ocular hypertension have RNFL injury at the time they develop glaucomatous visual field loss and 60% of patients have RNFL injury up to 5 years before visual function damage becomes apparent. While standard automated perimetry remains the most widely used functional test for diagnosing glaucoma, there are several important limitations, including the long follow-up period and the number of examinations required to confirm the endpoint and detect meaningful changes. Standard automated perimetry has poor sensitivity and poor reproducibility.

By the time a visual field defect is present, as many as 50% of the RGCs may be lost. This has implications for the current staging for glaucoma, in that what is now considered to be early glaucoma may in reality be moderate to advanced disease.

Currently, many clinicians only diagnose glaucoma when there is a visual field defect and a corresponding change in the optic disc. Alternative definitions that may be more sensitive and specific could be a corresponding structural or structural-functional abnormality such as a disc abnormality with a corresponding RNFL defect; a disc or RNFL abnormality with a corresponding functional defect; or a progressive structural or functional change such as a progressive change in disc, RNFL, or visual field. A number of new tests have emerged that have great promise for the diagnosis of glaucoma. Therefore, the future looks bright for detecting glaucoma at an early stage, enabling treatment of progression at an earlier stage. Several clinical studies have now confirmed that treatment by lowering intraocular pressure has benefits across the glaucoma continuum.

Figure 1. **The glaucoma continuum.**



In Summary

Examination of the optic disc and RNFL is essential for both diagnosis and monitoring. Earlier diagnosis allows for earlier treatment. Treatment prevents loss of vision across the continuum.

Comprehensive Intraocular Pressure Management

Mitch Menage
Leeds General Infirmary
Leeds, UK

The goals of glaucoma treatment are to maintain the patients' quality of life by preventing or delaying visual disability, and also by minimising the side effects, inconvenience, and cost of treatment. The endpoints of treatment include the optic disc, visual field, and intraocular pressure (IOP), as well as quality of life.

It is clear that comprehensive IOP management with effective IOP control, maximum reduction, minimal fluctuation, long-term efficacy, and persistency prevents or delays disability. The side effects,

inconvenience, and cost of treatment are minimised by safety and compliance, tolerability, low potential for systemic side effects, and convenient dosing.

The therapeutic implications of restaging glaucoma are manifold. Restaging glaucoma adds impetus to the need for medical therapy as patients begin treatment earlier, are asymptomatic for longer, and will be treated for longer.

Treatment effectiveness encompasses a number of separate issues, including both efficacy and effectiveness (Table 1). The effectiveness of a medication for glaucoma and ocular hypertension includes IOP-lowering effect, tolerability, long-term compliance, and persistence. Measures to improve effectiveness include greater IOP-lowering effects with no change in tolerability and safety, or greater safety and tolerability with an equal pressure lowering effect.

Several large randomised controlled trials have recently confirmed that IOP reduction is an evidence-based treatment for glaucoma. Some of the conclusions drawn from these trials include the following: IOP reduction is of benefit at various stages of glaucoma or ocular hypertension; lower IOP means better protection against visual field loss; a larger initial IOP-lowering effect has a favourable influence on progression in later years; and IOP-lowering treatment may not be of benefit to every patient. Clinically, it is advisable to aim for a 30% reduction in IOP for mild to moderate glaucoma, while a target pressure of 15 to 18 mm Hg may be required for advanced glaucoma.

Prostaglandins have a 25% to 30% IOP-lowering effect, followed by β-blockers, α_2-agonists, and pilocarpine with a 20% to 25% reduction, while carbonic anhydrase inhibitors have a 15% to 25% reduction.

Compliance is important to ensure constant daily IOP control. Approximately 10% of glaucomatous visual field loss is due to poor compliance. Successful compliance depends on patients using the right medication, at the right time, in the prescribed amounts, and in the proper way.

Factors that affect compliance include safety and tolerability, lack of visual symptoms, forgetfulness, inconvenience, difficulty in application, cost, and patients' understanding of the preventative nature of the treatment. Ocular and topical side effects are most important for compliance as they are easily noticed by patients and linked to their medications. The degree of IOP fluctuation has been correlated with risk of disease progression. Indeed, a large diurnal IOP fluctuation has been associated with a 5-fold increased risk of progression. Both latanoprost and timolol have been shown to reduce the nocturnal fluctuation in IOP compared with baseline.

β-Blockers have been shown to result in a general tolerance in the form of a long-term drift, resulting in a gradual rise in IOP. A meta-analysis of 3 studies has found no such tolerance to latanoprost, which maintained the pressure reduction over a period of 2 years. In addition, there are robust 5-year safety data for latanoprost, while, despite the long-term clinical experience with β-blockers, there are no long-term safety data available.

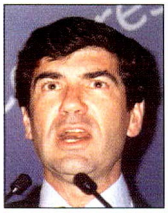
In Summary

Ophthalmologists are beginning to broaden their definition of efficacy beyond IOP lowering percentages. This broader concept is important for the clinical debate on restaging glaucoma. In the future, patients will be treated earlier, they will be healthier, and will require medication for longer. The criteria for optimal IOP lowering include long-term efficacy with optimal IOP lowering and minimal fluctuation, avoidance of ocular and systemic side effects, and simplification of the dosing schedule to support compliance and persistency.

Table 1. Concept of effectiveness.

- Efficacy and effectiveness are 2 distinct terms
- Efficacy relates to the pharmacodynamic property of a drug to favourably change a clinical parameter
- Effectiveness relates to a drug's overall ability to improve outcomes in clinical practice
- Efficacy is a prerequisite of effectiveness, but is only a component of this comprehensive measure

The Importance of Persistency



Roberto Carassa
San Raffaele Hospital
Milan
Italy

As knowledge of the natural history of glaucoma increases and earlier detection of visual field loss becomes possible, glaucoma will need to be restaged. More patients are being treated at an earlier stage and a younger age. This means that maintaining quality of life has become an important goal for the treatment of glaucoma. Therefore, the goal of glaucoma treatment should be "the preservation of visual function adequate to the individual needs with minimal or no side effects, for the expected lifetime of the patient, without any disruption of his/her normal activities, at a sustainable cost". There is a broad spectrum of treatment for glaucoma, and much is now known about the mechanisms of drug treatment. However, much of these data come from controlled clinical trials conducted among selected groups of patients, which may not mimic clinical practice. Health outcomes trials tend to be population-based and are therefore more representative of clinical practice. These trials provide a better understanding of the therapeutic value of a treatment approach.

Patient persistence is a key measure of health outcomes trials and represents the measure of time a patient persists with continuous therapy. Persistence can therefore be

a good measure of real-world clinical effectiveness since it incorporates both physician perception of the effectiveness of a treatment and patient perception of the need for therapy, efficiency, tolerability, convenience, and value. Persistency is usually measured by drug discontinuation and change rates, which may be either patient- or physician-initiated. The 2 issues of compliance and persistency are important measures of therapeutic success in clinical practice. However, compliance as a measure is associated with bias and it is difficult to monitor exactly. Persistency is easier to measure and may be considered a surrogate marker for compliance and tolerability. A 2-year retrospective European cohort study showed that newly diagnosed patients with glaucoma showed better persistence with initial therapy with latanoprost than with β-blockers. The mean time for initial therapy with latanoprost was 22 months compared with 11 months for β-blockers ($p < 0.0001$; Table 1). It is now known that 50% of patients given initial β-blocker therapy require a change in drug within 2 years. This may be related to the issue of long-term drift with this drug category. A managed care administrative claims data study from the USA found that patients persisted with latanoprost for longer than with timolol, brimonidine, betaxolol, and dorzolamide ($p < 0.001$; Table 2). Overall, almost 40% of patients discontinued the initial drug within 21 months.

A French naturalistic prospective study of second-line therapy found that patients persisted for longer with latanoprost (84.4%) than with β-blockers (68.9%) [$p < 0.01$]. Similarly, combination therapy with latanoprost (79.8%) showed better persistence than combination therapy without latanoprost (44.0%) [$p < 0.001$].

Table 1. Persistence with latanoprost and β-blockers as first-line treatment.

	Latanoprost	β-Blocker
No change	73%	29%
Change x 1	18%	31%
Change x 2	4%	24%
Change >2	4%	14%

Table 2. Persistence with antiglaucoma medications.

Medication	Relative risk
Latanoprost	1.00
Timolol	1.77
Brimonidine	1.87
Betaxolol	2.14
Dorzolamide	1.71

In Summary

Glaucoma is a chronic asymptomatic disease, for which treatment compliance and persistence are necessary. Studies have demonstrated the need to improve compliance and persistence with medical therapies, as improving these will improve outcomes. While the search for new effective therapies must continue, efforts focused on decreasing medication discontinuation may have a greater overall impact on health than the discovery of any single new agent.

Primary Angle Closure

From the European Glaucoma Society Meeting, Florence, Italy, 30 May to 4 June 2004

Primary Angle Closure

P Foster
University College London
Moorfields Eye Hospital
London, UK

Primary angle closure (PAC) occurs more frequently among East Asian people than among Europeans. Importantly, this disease is usually asymptomatic among this group of patients, with only 30% to 40% presenting with symptoms. By extrapolating data from Mongolia and Singapore to China, it is estimated that approximately 4.5 million Chinese people have PAC with glaucomatous optic neuropathy. Approximately 3.5 million have primary open angle glaucoma and 1.4 million have secondary glaucoma. Primary angle closure glaucoma (PACG) is the greatest cause of bilateral glaucoma blindness among Chinese people.

The current symptomatic classification for glaucoma may now be inappropriate for identifying people at greatest risk for visual loss and for extrapolating a prognosis. With this in mind, a revised classification scheme for staging angle closure has been proposed according to current knowledge about the natural history of the disease. This progression is thought to start with an anatomically narrow drainage angle (angle closure suspect), proceeding to established angle closure in which appositional or synechial closure of the angle occurs in the presence of raised intraocular pressure (IOP). This stage places people at risk for angle closure with glaucomatous optic neuropathy.

Shaffer's grade is commonly used to quantify angle width as an index of risk of angle closure. The validity of this scheme in Asian people has, until recently, been uncertain. Using data from Singapore and Mongolia to ascertain the relationship between the angle width and risk for closure, it was found that the rate of peripheral anterior synechiae (PAS) is 1.0% to 1.5% with 30° to 40° angles, but this increases to 8% to 12% for a 20° angle and 17% to 33% for a 10° angle. There is a clear 'dose-response' relationship for risk of angle-closure and angle width in Asians. Anterior chamber depth is thought

to be a risk factor for angle closure, although this is still being investigated. A study of Singaporean and Mongolian eyes found that Singaporean people have a higher rate of angle closure with a deeper anterior chamber (Figure 1). However, at approximately 2 mm anterior chamber depth, Mongolian people tend to develop a much greater rate of angle closure. Thus, it would appear that the risk associated with anterior chamber depth differs between populations.

Classification according to the mechanism of glaucoma has been proposed (Table 1). Plateau iris is thought to be due to anterior rotation of the ciliary body causing contact between the back surface of the iris and the anterior surface of the ciliary body causing peripheral angulation. However, this may be different for Chinese eyes, in which there may be a pronounced peripheral angulation but no contact between the ciliary body and the back surface of the iris. Indeed, the ciliary body may be posteriorly rotated. When considering the risk of closure for eyes with angulated iris configurations, the height of the plateau is important, in that the higher the plateau is in relation to the ciliary body, the greater the risk for significant closure. The trabecular meshwork is involved in angle closure, and may be damaged in asymptomatic and symptomatic disease. In acute angle closure, the trabecular meshwork may be damaged. However, in asymptomatic 'chronic' angle closure, there may be even more gross alteration of the architecture of the trabecular meshwork, with pigment clumping and fused trabecular beams, and damage may be evident away from areas of PAS. While PAS are an indication that the angle has been damaged, PAS are not necessarily present in conjunction with damage to the trabecular meshwork.

Table 1. **Ritch's classification of glaucoma by mechanism.**

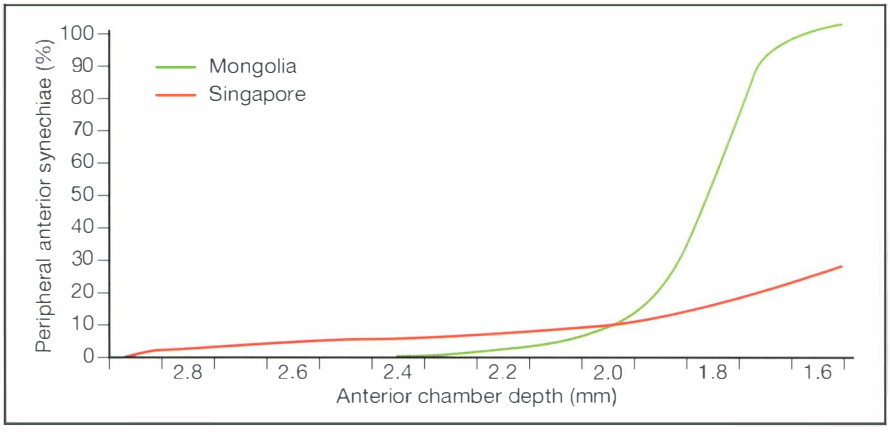
Pupil block
Plateau (anterior, non-pupil block)
Lens-induced
Causes behind the lens
Subclassification
• B-type — closure starts at the base of the angle
• S-type — first point of contact at Schwalbe's line

The risk for progression from angle closure suspect to angle closure is thought to be 10% to 40% per decade, while that for progression from angle closure to angle closure glaucoma is 28% in 5 years. Meanwhile, the pattern of visual field loss for angle closure glaucoma is similar to that for POAG.

In Summary

Angle closure is a leading cause of glaucoma blindness worldwide. Symptomatic classification does not provide a clear understanding of the mechanisms or prognosis of glaucoma. Classification should identify both the stage of the disease and the mechanism of angle closure. The risk factors for the disease are similar in different populations, but the way the risk factors exert their effect differ.

Figure 1. **Anterior chamber depth and angle closure between different populations.**



Anterior Chamber Angles in Chinese People

Gus Gazzard
Glaucoma Research Unit
Moorfields Eye Hospital
London, UK

There are important biometric risk factors for primary angle closure (PAC) and primary angle closure glaucoma (PACG) and age-related changes further predispose to these conditions. These include anterior chamber depth, thickening of the lens, and changes in lens position. Studies have shown the presence of narrower angles in people of increasing age.

Dr Gazzard described a study performed to investigate age and gender variations in ultrasound biomicroscopy (UBM) characteristics and to compare measurement techniques in 268 untreated Chinese Singaporean people drawn from the population-based Tanjong Pagar study. The mean age of the participants was 65.1 years. The methods used were UBM, optical pachymetry, gonioscopy, and Scheimpflug photography.

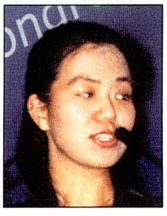
Anterior chamber depth was found to decrease with age. All the angle measurements correlated well with anterior chamber depth. UBM found that the temporal quadrant was widest. Narrower angles were found in women than in men. The inferior angle showed the greatest narrowing with increasing age, and the temporal and nasal quadrants showed similar trends. All age-related changes were more significant in women than men.

Scheimpflug photography also showed that women had narrower angles than men and narrower angles were noted with increasing age. UBM and gonioscopy correlated well, but Scheimpflug photography and gonioscopy were less well correlated, as were Scheimpflug photography and UBM.

In Summary

This study confirms that there is greater angle narrowing in older people, women have greater angle narrowing, and there is a strong correlation with central anterior chamber depth. UBM correlated better with gonioscopy than with Scheimpflug photography.

Prophylactic Laser Iridotomy in Hong Kong



Pian Yip
Tuen Mun Hospital
Hong Kong

Primary angle closure glaucoma (PACG) is relatively rare among Europeans and North Americans, but it is the leading cause of glaucoma blindness in East Asia. Among the East Asian ethnic groups, Chinese people have the highest incidence of symptomatic angle closure, with a rate of 15.5 cases per 100,000 population per year. In Hong Kong, where more than 90% of the population is Chinese, glaucoma is the leading cause of registered permanent blindness (23%). The fellow eyes of patients with acute primary angle closure (APAC) are at particular risk for developing the condition, since ocular dimensions are highly correlated between the 2 eyes. The risk for developing angle closure glaucoma if left untreated is 51% to 60%.

A retrospective non-comparative study was performed to evaluate the long-term outcomes of fellow eyes of consecutive patients with APAC after prophylactic laser iridotomy in Hong Kong Chinese people. Forty two eyes were recruited to receive sequential Argon-Nd:YAG laser peripheral iridotomy. The mean follow-up period was 67 months (range, 60 to 80 months).

All patients were successfully treated with laser iridotomy, with no recurrence throughout the follow-up period. Iridotomies remained patent throughout the follow-up period, and no major complications attributable to the procedure were noted. However, 1 eye (2.4%) had appositional angle closure despite having a patent iridotomy and was subsequently treated with argon laser iridoplasty. No further APAC attacks were sustained throughout the follow-up period.

In Summary

Laser iridotomy is effective in the long term for preventing acute angle closure in the fellow eyes of patients with APAC, even for Chinese eyes that are known to have a high incidence of symptomatic angle closure.

Argon Laser Peripheral Iridoplasty for Acute Phacomorphic Angle Closure

Jonathan Chan
The Chinese University of Hong Kong
Hong Kong

Acute phacomorphic angle closure, also known as 'phacomorphic glaucoma', is angle closure associated with an acutely swollen mature cataract, leading to a sudden and severe elevation of intraocular pressure (IOP).

The conventional treatment consists of immediate lowering of IOP with combined topical and systemic medications, followed by early cataract extraction. However, there are serious risks associated with systemic IOP-lowering medications.

The principle of argon laser peripheral iridoplasty (ALPI) is that laser burns applied to the anterior surface of the peripheral iris stimulate contraction with flattening of the peripheral iris, thereby mechanically widening the angle. This treatment has been shown to be at least as effective as systemic medications for treatment of acute primary angle closure. A pilot study was performed to determine the efficacy and safety of ALPI without systemic IOP-lowering medications as initial treatment for acute phacomorphic angle closure. This was a prospective interventional case series of 10 consecutive patients. The diagnosis was made clinically. The interventions used were immediate application of topical atropine, timolol, and prednisolone acetate, followed by immediate ALPI. Systemic IOP-lowering medication was given only if the IOP remained ≥40 mm Hg 2 hours after ALPI.

Following remission of the acute attack, all patients underwent ophthalmic B-scan ultrasound and early cataract extraction via phacoemulsification or extracapsular cataract extraction with posterior chamber intraocular lens implantation.

The mean preoperative baseline IOP was 56.1 ± 12.5 mm Hg, which decreased to 13.6 ± 4.2 mm Hg 24 hours after ALPI (Table 2). Systemic acetazolomide was required for 1 patient 2 hours after ALPI. No serious complications were encountered. The best-corrected visual acuity (BCVA) remained unchanged in most patients prior to cataract extraction. Subsequently, all patients had uncomplicated cataract extraction within 4 days of ALPI.

At the last follow-up visit (mean, 8.1 ± 8.6 months), all patients had BCVA of ≥6/120 and 6 patients had BCVA of ≥6/30. All patients had an IOP <21 mm Hg.

Table 2. Mean pre- and postoperative intraocular pressure.

Time	Intraocular pressure (mm Hg)
Baseline	56.1 ± 12.5
15 minutes	45.3 ± 14.5
30 minutes	37.6 ± 7.5
60 minutes	34.2 ± 9.7
120 minutes	25.5 ± 8.7
24 hours	13.6 ± 4.2

In Summary

This pilot study shows that immediate ALPI appears to be a safe and effective first-line treatment for acute phacomorphic angle closure, and reduces the need for systemic IOP-lowering medications.

CONGRESS CALENDAR

SEPTEMBER

9

Glaucoma Surgery
Toronto, Canada
Contact: Continuing Education, 500 University Ave, Ste 650, Toronto, ON-M5G 1V7
Tel: (416) 978 2719/(1 888) 512 8173
Fax: (416) 971 2200
E-mail: ce.med@utoronto.ca

18-22

XXII Congress of the European Society of Cataract & Refractive Surgeons
Paris, France
Contact: European Society of Cataract & Refractive Surgeons
Tel: (35 312) 091 100
Fax: (35 312) 091 112
E-mail: escrs@agenda-comm.ie

OCTOBER

22

AUSCRS 2004: The Australasian Society of Cataract and Refractive Surgeons
Broome, Australia
Contact: Jenny Boden
Tel: (61 0359) 770 240
Fax: (61 0359) 770 260
E-mail: eye@satlink.com.au

23-26

Joint Meeting of the American Academy of Ophthalmology and the European Society of Ophthalmology (SOE)
New Orleans, LA, USA
Contact: American Academy of Ophthalmology, PO Box 7424, San Francisco, CA 94120-7424
Tel: (1 415) 561 8500
Fax: (1 415) 561 8533
E-mail: meetings@aao.org

NOVEMBER

5-8

10th Congress of the Asian-Pacific Association for Laser Medicine and Surgery and 14th International YAG laser Symposium & 2004 Shanghai International Conference on Laser Medicine and Surgery
Shanghai, China
Contact: Prof Jing Zhu
Tel: (86 2) 163 740 606
Fax: (86 2) 163 740 606
E-mail: lasercenter@163.com

16-19

Annual Meeting of the American Academy of Ophthalmology
New Orleans, LA, USA
Contact: American Academy of Ophthalmology
Tel: (1 415) 561 8500
Fax: (1 415) 561 8533

DECEMBER

9-13

American Academy of Ophthalmology Annual Meeting
Tampa, FL, USA
Contact: Helen Viksnins
Tel: (1 301) 984 1441
Fax: (1 301) 984 4737
E-mail: aaoptom@aol.com

MARCH 2005

16-19

Moorfields Bicentenary Scientific Meeting
London, UK
Contact: Communications Office, Moorfields Eye Hospital, City Road, London EC1V 2PD
Tel: (44 [0]20) 7566 2628
E-mail: info@moorfields.nhs.uk

18-21

XXV Pan-American Congress of Ophthalmology
Santiago de Chile, Chile
Contact: Teresa Bradshaw
Tel: (817) 275 7553
Fax: (817) 275 3961
E-mail: paao@paao.org

30-3 April

25th Annual Meeting of the American Society for Laser Medicine and Surgery
Lake Buena Vista, FL, USA
Contact: Richard O Gregory
Tel: (1 715) 845 9283
Fax: (1 715) 848 2983
E-mail: information@aslms.org

APRIL 2005

16-20

2005 Annual Symposium and Congress of the American Society of Cataract and Refractive Surgery
Washington, DC, USA
Contact: ASCRS-ASOA, 4000 Legato Road, Suite 850, Fairfax, Virginia 22033
Tel: (1 703) 591 2220
Fax: (1 703) 591 0614
E-mail: ascrs@ascrs.org / asoa@asoa.org

SEPTEMBER 2005

25-29

15th SOE Congress Societas Ophthalmologica Europeae
103rd DOG Congress German Society of Ophthalmology
Berlin, Germany
Contact: Porstmann Kongresse GmbH, Alte Jakobstr 77, 10179 Berlin, Germany
Tel: (49 [0]30) 284 4990
Fax.: (49 [0]30) 2844 9911
E-mail: soe2005@porstmann-kongresse.de

Sharper Contrast

Makes the Difference

TECNIS, with visual acuity comparable to the SI40 lens, significantly improves contrast sensitivity in low light[1]

TECNIS™ – the first foldable IOL designed to enhance contrast sensitivity for improved functional vision

Please call a Pharmacia Corporation sales representative for more information about TECNIS

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.

NEW TECNIS™ foldable lenses WITH Z-SHA… OPTIC TECHNOLOGY

A Sharp Contrast in Functional Vision.

Pfizer

Pfizer Global Pharmaceuticals - Asia and Australia/New Zealand Region
Suite 701, 1 Pacific Place, 88 Queensway, Hong Kong

IJ0028287 0207

Now in combination therapy
for the control of elevated IOP...

A single connection
for powerful control

A Powerful Source of Control and Convenience

Once Daily

NEW Xalacom™

latanoprost/timolol maleate

XALACOM is indicated for the reduction of elevated intraocular pressure (IOP) in patients with open-angle glaucoma and ocular hypertension who are insufficiently responsive to topical beta-blockers.

Please refer to product insert for full prescribing information

Pfizer

Pfizer Global Pharmaceuticals - Asia and Australia/New Zealand Region
Suite 701, 1 Pacific Place, 88 Queensway, Hong Kong