Many clinicians are reticent about dilating due to a misinformed belief that there is a sizable risk of causing acute angle-closure glaucoma. The traditional optometric teaching is that mydriatics lead to a bunching of the iris within the angle and in eyes with a physiological crowded angle this blocks access to the trabecular meshwork. Of course, this is not the usual mechanism underlying acute angle-closure glaucoma, which is characterised by pupil block and iris bombe in a small eye with a shallow anterior chamber. Pupil block is not possible when the iris is fully dilated because it does not rest against the crystalline lens. What is described in traditional optometric teaching is the mechanism of angle-closure seen in the rare condition plateau iris, which is characterised by a relatively deep anterior chamber, and an iris with a relatively flat contour but a steep insertion because the peripheral iris is held up by large or anteriorly positioned ciliary processes.

Mydriasis is not infrequently associated with a transient rise in intraocular pressure, but this does not indicate acute angle-closure glaucoma or an ophthalmic emergency. The pressure may rise owing to partial obscuration of the trabecular meshwork by the bunched-up iris, or by reduced ciliary body tone that lessens the pull on the scleral spur. Both of these will reverse in a few hours. The level of pressure rise varies between individuals, and it has been reported that a significant elevation is more common in patients with glaucoma.

Mydriatics can theoretically lead to an attack of angle-closure glaucoma in an anatomically predisposed eye, but the timing of any attack is likely to be several hours after patients have left the optometrist’s practice. This is because acute angle-closure glaucoma is precipitated by relatively heavy contact between the iris and the crystalline lens, and this contact is maximal when the pupil is mid-dilated, a point rapidly passed as the pupil enlarges but experienced for longer as the pupil slowly returns to its habitual size.

Epidemiologic studies indicate just how low the risk of pupil dilation inducing acute angle-closure glaucoma is. In the Rotterdam study, use of mydriatic eye drops in 6,750 Caucasian people aged 55 and over resulted in angle-closure in only two (0.03 per cent) individuals. No cases of angle-closure cases were found in the Baltimore Eye Survey where 4,870 people underwent pupil dilation, although subjects identified as having a shallow anterior chamber configuration were excluded. Routine pupil dilation of 3,654 people in the Blue Mountains Eye Study also did not result in any cases of angle-closure. A systematic review reported that out of an estimated 600,000 individuals who received mydriatic eye drops, 33 (0.006 per cent) developed acute angle-closure glaucoma, giving an estimated risk of one in 20,000. The same review found that in almost 4,000 people whose pupils were dilated using tropicamide, none developed acute glaucoma as a result of the dilatation. Exact numbers differ on the study owing to the very small numbers, but the consistent finding is that the number is very low. For my mind, the clincher comes from our litigation-averse colleagues in the US, where routine dilation is the established norm by optometrists, owing to legal precedents that recognised the lower risk of iatrogenic disease versus the flip-side of missing pathology.

Pupil dilation is essential for comprehensive ophthalmic examination.
**Mydriatics and driving**

Most patients admit to a subjective perception of visual disturbance following dilation, and about half feel that pupil dilation affects their ability to drive a car, with increased glare sensitivity being the most commonly cited reason. Objective evidence on this important topic was provided by an excellent study that tested visual function with clinical tests and also assessed driving performance on a closed-off rural road circuit. The results demonstrated a statistically significant reduction in clinical tests of visual function (visual acuity, contrast sensitivity and glare recovery), but these were of only a small level and would not disqualify a person from driving on legal grounds. However, of more importance, some visual tasks when driving were impaired to a worrisome level, in particular the ability to detect and respond to contrast hazards (t×2.2m sheets of 80mm thick grey foam rubber) and successfully drive around them. When interpreting these results the authors of the study suggest that troublesome hazards might include potholes, highway debris, speed bumps, and perhaps even pedestrians or vehicles. They also note that driving competence is more likely to be problematic when driving in poor visibility conditions, such as rain or fog, where the contrast of all roadway objects is reduced, and also night-time driving.

On the basis of this study there is evidence to support the common-sense advice to recommended that patients exercise caution or preferably do not drive for 4-6 hours following pupil dilation, regardless of legality to drive. Interestingly, in the study there was no correlation between changes in clinical tests and real world driving performance.

**Choice of mydriatic**

For diagnostic purposes when cycloplegia is not wanted, the drug of choice for most optometrists is tropicamide 0.5 per cent. This gives adequate dilation in most patients for most purposes. Phenylephrine is not suitable for use in isolation because it does not abolish the light reflex.

When maximal dilation is required for viewing the peripheral retina it may be marginally helpful to use the 1 per cent concentration or two drops of 0.5 per cent, but more effect is had by using phenylephrine 2.5 per cent as a second drug. The addition of phenylephrine is more helpful than additional tropicamide (or even potent cycloplegic drugs) because the first dose of tropicamide nearly completely prevents the iris sphincter muscle from contracting, and so much greater gains are to be had by targeting the untapped potential of augmenting the iris dilator muscle. The use of two drugs is particularly useful for diabetics in whom poor dilation with tropicamide is not uncommon, and whose sympathetically denervated small pupils are often supersensitive to sympathomimetics.

While the risk of precipitating acute angle-closure glaucoma with tropicamide is close to zero, it is considered best practice to screen patients for an occludable anterior chamber angle. This can conveniently be done using the Van Herick technique that uses an optic section placed near the limbus with the observation system straight ahead and the light source at 60 degrees. The angle is considered at risk of closure when the width of the dark anterior chamber is less than a quarter of the width of the cornea. If this is observed the risk of inducing an attack of angle-closure is still trivial, but when dilation is not urgent it should be deferred until after the angle has been assessed with gonioscopy. If an optometrist is not confident with this technique the patient should be referred to a clinician who is to enable a decision to be made on the need for an iridotomy to lessen the potential for developing angle-closure glaucoma in the future.

Pupil dilation can increase, and sometime decrease, intraocular pressure. To better appraise the habitual eye pressure, tonometry should be performed prior to dilation.

The notion has been advanced that prior use of a local anaesthetic eyedrop shortens the time to dilate and increases the degree of dilation by virtue of its toxic effect on the corneal epithelium aiding drug penetration. This has not been supported in the literature, but if anaesthetic is to be used for contact tonometry then it is sensible to use this before, so as to prevent stinging on instillation of the mydriatic.

**Post-dilation checks**

After dilation it is best practice to re-check the intraocular pressure. If it has elevated it is unlikely to be the result of angle closure, but instead a consequence of reduced access to the trabecular meshwork and less pull on this tissue by the ciliary body. Advice of what to do in these circumstances is largely based on opinion, rather than good evidence. It is my personal opinion that a pressure rise of 5mmHg or less can be ignored. A person with a greater rise in pressure, especially when the level of pressure exceeds 25mmHg, should have their pressure re-measured every hour until it starts to decline. If it increases by more that 10mmHg or exceeds 35mmHg the local eye casualty should be telephoned for advice. A miotic should not routinely be instilled. A marked rise in pressure following dilation is more common in patients with glaucoma due to an already...
compromised trabecular meshwork, and pigment dispersion syndrome or pseudoexfoliation syndrome following the use of 10 per cent phenylephrine due to its promotion of pigment liberation.

Reversal of dilation
Owing to the inconvenience and activity restriction that results from pupil dilation it would be nice to have an ‘antidote’ that quickly reverses any mydriasis. In the UK the only candidate is the miotic pilocarpine. However, owing to its effects on the ciliary muscle, pilocarpine is associated with forward movement of the crystalline lens and heavier iridolenticular contact that greatly increases the risk of angle-closure glaucoma. This complication may be augmented by a lengthening of the time the pupil is at a mid-dilated size where iridolenticular contact is maximal. Moreover, the spasm of the ciliary body caused by pilocarpine is associated with headaches and may lead to retinal tears in high myopes.

In the 1990s an alternative α-blocking miotic named dapiprazole was marketed to reverse pupillary dilation in the US. Initial studies involving this drug were very promising, and unlike pilocarpine there was no associated reduction in anterior chamber depth that eliminated the risks of pupillary block, angle-closure glaucoma and retinal detachment. However, in clinical practice the drug was much slower than early reports, taking as long as two hours in some cases to return pupils to pre-dilation status. More troublesome was that patients did not like the side-effects of stinging and conjunctival hyperaemia, and clinicians did not like its dosing schedule that disrupted patient flow (four drops per eye, followed five minutes later by an additional two drops) and its high cost and short shelf life.

Dapiprazole was originally marketed as NuRev-Eyes (and dubbed Red-Eyes by departments at Bristol Eye Hospital, and the Glaucoma and Accident & Emergency departments at Vantage and one towards the Association of Optometrists Ireland’s scheme. The deadline for responses is September 27, 2012.

MULITPLE-CHOICE QUESTIONS - take part at opticianonline.net

1. What is the approximate risk of dilation triggering angle-closure glaucoma?
A One in 100
B One in 1,000
C One in 2,000
D One in 5,000

2. What should you do if the IOP goes up by 3mmHg after dilation?
A Send the patient to A&E
B Instil pilocarpine and send patient to A&E
C Send patient home with information leaflet
D Monitor IOPs at least hourly

3. What should you do if the patient wants to drive home?
A Inform them it is not recommended because vision is impaired
B Inform them that they are not legal to drive
C Tell them to wear sunglasses
D Telephone the police

4. What type of drug is dapiprazole?
A Beta-blocker
B Sympathomimetic
C Alpha blocker
D Anti-muscarinic

5. Which of the following options is appropriate if a post-dilation rise of IOP of 7mmHg is measured?
A Instil a myotic
B Monitor IOPs at least hourly
C Refer to casualty
D Do nothing – the rise is insignificant

6. Which of the following statements about pilocarpine is false?
A It should be used to reverse dilation if post-dilation pressure rises by more than 10mmHg
B It causes the crystalline lens to move forward
C It may lead to further pressure increase
D It is a parasympathomimetic

Summary
Pupil dilation is essential for comprehensive ophthalmic examination. Tropicamide 0.5 per cent is a safe agent for use in primary care, and when necessary can be augmented with phenylephrine 2.5 per cent. While patients should certainly be warned to seek medical attention if the symptoms of acute angle-closure glaucoma occur (red, painful eye and nausea), both the patient and optometrist should rest assured that this possibility is extremely slight and is invariably outweighed by the risks of not dilating.

References

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