Note: The following document provides information about pupil dilation for ocular examination in optometric practice. It should not be used as a substitute for statutory responsibilities and optometrists must ensure that they comply with State and Federal Laws. These guidelines do not advise on therapeutic use of mydriatics utilised in the management for iritis, amblyopia or surgery.

Summary

• Optometrists regularly perform pupil dilation to comprehensively examine the ocular fundus as part of a comprehensive eye health examination where clinically indicated.

• Tropicamide (0.5% - 1.0%) is a safe pupil dilating agent for use in primary care. Tropicamide may be augmented with phenylephrine 2.5% if maximal dilation required.

• Optometrists should familiarise themselves with the requirements of record keeping and patient pupil dilation. In particular, should a patient decline pupil dilation, records should reflect that the patient was advised that this may result in (ocular or other) pathology going undetected.

• Optometrists should discuss pupil dilation with patients, and appropriately document discussions and procedures in patient records accordingly. Patients should be warned of potential side effects of pupil dilation. These include the possibility of precipitating angle closure glaucoma, though rare, and the resultant visual blur. Driving immediately afterwards should be actively discouraged and where possible patients should be warned of this at the time of booking their appointment.

• Legal precedents overseas have recognised the lower risk of iatrogenic disease precipitated by pupil dilation versus the possibility that pathology may be missed. When performing pupil dilation, this and other considerations should inform consulting room procedures and record keeping.

• Reversal of pupil dilation is not recommended as a standard procedure following pupil dilation as this poses risks to the eye, such as secondary angle closure, that outweigh any benefit gained.

Pupil dilation

Optometrists are educated and trained to detect eye disease, if it is present, in patients they examine. A mydriatic ocular examination may be necessary to detect some eye diseases as it allows better visualisation of all structures posterior to the pupil and is necessary for examination of the peripheral ocular fundus. It is also necessary for examination techniques such as binocular indirect ophthalmoscopy and scleral indentation, and enhances retinal and vitreous examination with pre-corneal lenses such as the 78 and 90 dioptre lenses, fundus contact lenses and with direct and monocular indirect ophthalmoscopy. A dilated pupil also enhances the image quality of any diagnostic imaging performed.

The fear of precipitating angle closure glaucoma should not affect the decision to dilate to perform fundoscopy. In the context of diabetic retinopathy (DR) management, the National Health and Medical Research Council (NHMRC) states: “Pupil dilation using 0.5 to 1.0% tropicamide is safe....Two large
Australian population studies (MVIP\textsuperscript{1} and BMES\textsuperscript{2}) showed high levels of patient acceptance for pupil dilation. These and other population studies have also confirmed the safety of pupil dilation.\textsuperscript{1,2,3}

In all cases the optometrist will need to consider indications and risk factors in their decision to perform a dilated ocular fundus examination. Legal issues such as negligence (failure to dilate when indicated) and informed consent need to be considered.

**Indications for pupil dilation**

There are many clinical indications for pupil dilation and some of these are listed in Table 1 though this is not an exhaustive list.

There is no definitive list of patients that must have their pupils dilated. Signs and symptoms that may be indications for a dilated pupil examination are outlined in Table 1.

**Table 1. Common indications for pupil dilation**

<table>
<thead>
<tr>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes\textsuperscript{3}</td>
</tr>
<tr>
<td>Uveitis</td>
</tr>
<tr>
<td>Pigmented fundus lesion</td>
</tr>
<tr>
<td>Suspected or diagnosed glaucoma</td>
</tr>
<tr>
<td>Lattice degeneration and other peripheral retinal lesions</td>
</tr>
<tr>
<td>Penetrating trauma</td>
</tr>
<tr>
<td>Recent blunt trauma</td>
</tr>
<tr>
<td>Cataract</td>
</tr>
<tr>
<td>Hypertension</td>
</tr>
<tr>
<td>MD</td>
</tr>
<tr>
<td>High myopia</td>
</tr>
<tr>
<td>History of metastatic cancer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashes and floaters</td>
</tr>
<tr>
<td>New distortion</td>
</tr>
<tr>
<td>Unexplained reduction in/loss of vision or visual field</td>
</tr>
<tr>
<td>Recent blunt force trauma</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant family ocular history</td>
</tr>
<tr>
<td>Small pupils, nystagmus or unsteady fixation</td>
</tr>
<tr>
<td>Where stereoscopic viewing is essential</td>
</tr>
<tr>
<td>Systemic medications with potential ocular side effects</td>
</tr>
<tr>
<td>To obtain good imaging results</td>
</tr>
</tbody>
</table>

\textsuperscript{1} Melbourne Visual Impairment Project
\textsuperscript{2} Blue Mountains Eye Study
\textsuperscript{3} NHMRC Guidelines for Management of Diabetic Retinopathy report dilation using 0.5% to 1.0% tropicamide is safe
Contraindications to, and risk factors for, pupil dilation

Although optometrists should be aware of the potential to induce acute angle closure glaucoma from use of mydriatic drops, its incidence is rare and NHMRC Diabetic Retinopathy Guidelines state that tropicamide alone has not been reported to cause this. Concerns about the possibility of precipitating an angle-closure glaucoma attack must be weighed against the importance of detecting ocular pathology.

Despite the small risk of precipitating acute angle-closure glaucoma with tropicamide, patients should be screened for narrow anterior chamber angles. The Van Herick technique provides reasonable estimates of anterior chamber angles. Where Van Herick assessment is suggestive of risk, the angle should be first assessed with gonioscopy prior to pupil dilation.

Tonometry should be performed both prior to and after dilation; a small (3mmHg) intraocular pressure rise may occur after dilation. If a practitioner feels uncertain about a subsequent intraocular pressure increase, or if the intraocular pressure is unusually high following pupil dilation, ophthalmologic advice should be sought.

Particular clinical presentations are nonetheless considered contraindications for pupil dilation and these are listed below:

- Iris fixated IOLs (absolute contraindication)
- Narrow anterior chamber angles or known or suspected predisposition to angle closure glaucoma
- Active corneal disease or corneal epithelial erosion
- Subluxated posterior chamber IOLs or crystalline lens
- Hyphaema
- When pupil reactions need to be preserved, such as when same day referral is required in iris or head trauma or neurological anomalies
- Patients under miotic therapy for angle closure glaucoma
- Suspected penetrating ocular injury
- Known hypersensitivity to mydriatic drug

Pregnant and nursing women

Optometrists should exercise caution in dilating pupils in pregnant and breast feeding mothers. In particular this should be avoided in the first trimester. If pupils must be dilated, tropicamide is recommended.

Proceeding with pupil dilation

Once an optometrist has made a decision to recommend pupil dilation to a patient, the importance of pupil dilation should be discussed with the patient. They should be made aware that their vision will be blurred for up to 4-6 hours afterwards. It should be emphasised that they should not drive or operate heavy machinery in this time if their visual acuity is reduced. Where possible this conversation should occur prior to the appointment whether with the optometrist or their support staff. This discussion should be noted in the patient record card.

Patient permission must be obtained for pupil dilation following explanation of possible side-effects and risk factors. Optometrists are encouraged to inform patients of the small risk of inducing acute
angle-closure glaucoma (about one in 5,000). It may be beneficial to develop a ‘script’ which covers potential side effects and risks in a simple way when obtaining patient consent.

Record keeping

It is advised that the following details be documented on a patient’s clinical record:

- Visual acuity prior to instillation of dilating agent/s
- That informed consent was received prior to instillation of dilating agent/s including a discussion of risks and possible side-effects (advice against driving immediately after dilation owing to visual blur/disturbance)
- Time of instillation as well as the dilating agent/s and strength used
- Information on patient general health including (known) current medicines (so as to minimise risk of drug-interactions by highlighting any contraindications to dilation)
- Any patient refusal to have their pupils dilated despite optometrist recommendation including the risk to the patient that pathology may go undetected without dilation
- Gonioscopy observations (where performed)
- Pre- and post- dilation tonometry measurements

Preferred mydriatic drugs

The following list provides key points about the more commonly used dilating agents (mydriatic drugs) in optometric practice. The Australian Therapeutic Goods Administration (TGA) provides product and consumer information on the following drugs that can be viewed online: https://www.ebs.tga.gov.au/ebs/picmi/picmirepository.nsf/PICMI?OpenForm&t=&k=C&r=/

Tropicamide 0.5% and 1%

- Tropicamide is an anti-muscarinic drug that blocks the responses of the sphincter muscle of the iris and the accommodative muscle of the ciliary body (mildly) to cholinergic stimulation, producing mydriasis within 20-40 minutes of instillation and (weak) cycloplegia maximal within 30 minutes. Both effects usually last up to 6 hours.
- 0.5% produces slightly less dilation than 1% however 1% produces greater cycloplegia.
- The mechanism of action minimises the risk of pupil block.
- Hypersensitivity (allergic) to tropicamide may be displayed by some patients.
- Should be used with caution in patients with conditions characterised by tachycardia as it may accelerate heart rate.
- As with other mydriatic-cycloplegics, tropicamide can raise intraocular pressure in eyes with open-angle glaucoma. This effect is thought to be caused by a decrease in the outflow facility. This pressure elevation is usually less than 5 mmHg and can be considered insignificant in most patients, since it will subside in several hours.
- Dilation of narrow angles is generally considered to be safer with anti-muscarinic drugs such as tropicamide. Adrenergic drugs such as phenylephrine, because of their mode of action, increase the risk of pupil block.
• Because tropicamide is devoid of vasopressor effects, it is the safest mydriatic agent for use in patients with systemic hypertension, angina, or other cardiovascular disease

**Phenylephrine (Phenylephrine hydrochloride) 2.5% and 10%**

• Phenylephrine is a direct acting sympathomimetic agent. It causes mydriasis by affecting the iris dilator muscle. Maximal mydriasis occurs in 10-90 minutes with recovery after 5-7 hours. There is almost no cycloplegic effect

• 10% is contraindicated in children and the elderly because of the risk of systemic toxicity. Hypersensitivity (e.g. allergic contact blepharoconjunctivitis) is rare but may be displayed by some patients

• In most cases there is no significant difference on pupil dilation between the 2.5% and 10% concentrations

• Phenylephrine should be used with caution in the following patient groups:
  - those with cardiac disease, hypertension, aneurysms, long-standing insulin dependent diabetes mellitus and tachycardia
  - patients on monoamine oxidase inhibitors, tricyclic antidepressants and antihypertensive agents (including beta blockers)
  - patients with closed angle glaucoma (unless previously treated with iridectomy)
  - patients with a narrow angle prone to glaucoma precipitated by mydriatics

• Phenylephrine will also contract the smooth muscle of the arterioles of the conjunctiva and eyelids, causing blanching of the conjunctiva and possible lid retraction

**Cyclopentolate**

• Cyclopentolate hydrochloride is an antimuscarinic compound which produces mydriasis and cycloplegia

• Maximum effects produced within 30-60 minutes and accommodation recovers within 24 hours although in some individuals complete recovery may take several days

• Premature and small infants are especially prone to central nervous system (CNS) and cardiopulmonary side effects from systemic absorption of cyclopentolate and cyclopentolate is contraindicated in these patients

• The elderly and children with spastic paralysis or brain damage are also more susceptible to CNS effects of cyclopentolate

• Cyclopentolate recommended dosage is included in the Appendix

**Practical tips/hints**

The following practical tips may be considered to enhance the clinical effectiveness of pupil dilation.

• Prior instillation of a topical anaesthetic increases the speed of onset of both tropicamide and phenylephrine by reducing irritation caused by the medication and enhancing corneal permeability. It also prolongs the recovery time.
• Dilation of narrow angles is generally considered to be safer with anticholinergic drugs such as tropicamide. Adrenergic drugs such as phenylephrine 2.5%, because of their mode of action, increase the risk of pupil block.

• Instillation of one drop of 2.5% phenylephrine followed (5 minutes later) by one drop of tropicamide 0.5% or 1.0% is likely to give a greater dilation than either drug used alone – maximising effect on both the iris sphincter muscle and the iris dilator muscle. This can be useful for patients whose pupils are difficult to dilate including patients with diabetes. Consideration should be given to presence of significant cardiovascular disease which would contraindicate use of phenylephrine.

• Angle-closure glaucoma precipitated through dilation with tropicamide is most likely to occur within an hour of initial instillation. If intraocular pressure has not risen significantly in the first hour, the probability of angle closure occurring is extremely low, the patient may be warned of symptoms of an acute angle closure attack and allowed to leave the practice following the procedure with instructions of what actions to take if symptoms occur (ocular pain, nausea, red eye, reduced vision).

• It is not recommended that optometrists attempt to reverse pupillary dilation with pilocarpine owing to the increased risks of angle closure glaucoma, headaches, or retinal tears in high myopes.

The Optometry Board of Australia (OBA) Scheduled Medicines Advisory Committee (SMAC) guidelines include a pathway for the management of acute angle closure glaucoma and these can be viewed on the OBA website [http://www.optometryboard.gov.au/Policies-Codes-Guidelines.aspx](http://www.optometryboard.gov.au/Policies-Codes-Guidelines.aspx)
Appendix

Recommended drug regimens for routine dilation of pupils

Simple eyelid closure AND digital occlusion of the tear duct for at least two minutes after eye drop instillation reduces systemic absorption of any topical drug by up to two-thirds. Thereby, the safety margin of any instilled medication can be expanded significantly.

In systemic disease and with concomitant drug therapies tropicamide 0.5%-1% remains the mydriatic of choice as phenylephrine is frequently contraindicated.

<table>
<thead>
<tr>
<th>Clinical situation (patient)</th>
<th>Dosage / regimen – what can be used and how</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults (&gt; 12 years)</td>
<td>Tropicamide 0.5% and 1.0% 1-2 drops in both eyes (OU)</td>
</tr>
<tr>
<td></td>
<td>Phenylephrine 2.5% one drop OU</td>
</tr>
<tr>
<td></td>
<td>Cyclopentolate 1 drop of 0.5% or 1% OU</td>
</tr>
<tr>
<td>Children</td>
<td>Tropicamide 0.5%-1% 1-2 drops OU</td>
</tr>
<tr>
<td></td>
<td>Cyclopentolate 3 months-12 years 1 drop of 0.5% solution OU</td>
</tr>
<tr>
<td></td>
<td>Cyclopentolate &gt;12 years 1 drop of 0.5% or 1% OU</td>
</tr>
<tr>
<td></td>
<td>Phenylephrine 2.5% - not 10% - one drop OU</td>
</tr>
<tr>
<td>Neonates (newborns) &amp; infants</td>
<td>Cyclopentolate &lt;3 months not recommended</td>
</tr>
<tr>
<td></td>
<td>Cyclopentolate over 3 months of age 1 drop of 0.5% solution</td>
</tr>
<tr>
<td></td>
<td>Tropicamide 0.5%-1.0% 1 drop OU</td>
</tr>
<tr>
<td></td>
<td>Phenylephrine 2.5% 1 drop OU</td>
</tr>
<tr>
<td>Pregnancy/breast feeding mothers</td>
<td>Exercise caution and avoid dilating in the first trimester.</td>
</tr>
<tr>
<td></td>
<td>If essential, tropicamide is recommended.</td>
</tr>
</tbody>
</table>

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4 Goldberg I. Drugs for glaucoma. *Aust Prescr* 2002;25:142-6
References


10. Johnson, M. Ophthalmic drugs Part 3 — Mydriatic drugs – which ones to use when and how they work Optician 24-08-2012


20. Product Information: Cyclopentolate eye drops
