Brien Holden Vision Institute

REFRACTIONS FOR PRESCHOOL CHILDREN

Examining and refracting preschool children brings a unique challenge to the clinician. Measurement of visual acuity is difficult, attention span is short and responses to subjective refraction questions are confusing and often unreliable. This chapter will detail objective refraction approaches that will allow the clinician to accurately refract preschool children.

AIM

This unit teaches you how to perform alternative retinoscopy techniques which are helpful for examining pre-school children.

LEARNING OUTCOMES

When you have worked through this unit you should be able to:

- perform cycloplegic retinoscopy (including make informed choices regarding which topical agents to use)
- perform Mohindra retinoscopy
- use the results of these alternative retinoscopy methods to prescribe appropriate spectacles for pre-school children.

USEFUL RETINOSCOPY TECHNIQUES FOR PRESCHOOL CHILDREN

Combining visual acuity (VA) measures with non-cycloplegic retinoscopy and Blur Function refraction is the most efficient non-invasive way to accurately refract most school-age children and some preschool children. However there are some children for whom you will be unable to determine an accurate refraction using these techniques.

Two techniques that are useful for preschool children are:

- Cycloplegic retinoscopy
- Mohindra retinoscopy

WHICH CHILDREN NEED CYCLOPLEGIC RETINOSCOPY?

WHICH CHILDREN NEED CYCLOPLEGIC RETINOSCOPY?	Cycloplegic retinoscopy is the most appropriate technique to use when: • VA cannot be measured (e.g. children under 2.5 years of age), or cannot be measured repeatedly or efficiently (e.g. preschoolers with less than average concentration) • a child is unable to focus on a distant target for long enough for you to perform standard retinoscopy • you are unable to successfully determine an astigmatic correction • a child has a strabismus and/or deep amblyopia • a child has unexplained vision loss Cycloplegic retinoscopy gives you the best chance of successfully refracting children in these situations.

CYCLOPLEGIC RETINOSCOPY

Cycloplegic retinoscopy is completed in two parts. Firstly, cycloplegia is achieved by using eye drops that paralyze accommodation, or at least severely impair it. Secondly, retinoscopy is performed while the person cannot accommodate.

PUTTING DROPS IN CHILDREN'S EYES	Some children are scared of having drops put in their eyes, which means that it sometimes becomes difficult. One way to make it easier is to lie the child down on her parent's lap, ask her to close both eyes tightly, then place 3 drops on the eyelashes of each eye near the nose. Once the drops are in place, take the drop bottle away and tell the child to open her eyes. The equivalent of one drop will get into each eye. A second way to minimize fear is only useful for atropine (due to its long action time). Ask a parent put the drop in while the child is asleep.
WHICH DROPS TO USE	Both cycloplegic (accommodation control) and mydriatic (pupil dilation) effects of drops can be useful in diagnosing children's eye problems. The cycloplegic effect paralyses accommodation, allowing an objective refraction to be performed. The mydriatic effect dilates the pupil, allowing good ocular fundoscopy to be performed.

CYCLOPLEGIC RETINOSCOPY (cont.)

WHICH DROPS TO USE (cont.)	The three most common drops used are: **Tropicamide (mydriacyl)** • 0.5% is the most common preparation. • Pupils dilate 20 – 30 minutes after instillation, and stay dilated for 30 minutes – 4 hours. • It is good for dilation, but gives unreliable accommodation control (the cycloplegic effect varies between people). **Cyclopentolate** • Cyclopentolate can be absorbed and cause systemic toxicity in infants, or people with known autonomic nervous system problems (e.g. Down Syndrome, spastic paralysis or brain damage). It can also cause eye complications in people with narrow anterior chamber angles, hypersensitivity to any of the ingredients and keratoconus (can result in fixed dilated pupil). • Sensible dosages will nearly always prevent complications related to age, but it is best to avoid use in other people specifically listed above: – children under 12 months of age – use 1 drop of 0.5% per eye, and separate the eyes by 30 minutes – children 1 – 2 years of age – use 1 drop of 1% per eye, and separate the eyes by 15 minutes – children over 2 years of age – use 1 drop of 1% per eye, with no time separation required. • Using one drop of local anaesthetic per eye 5 minutes before cyclopentolate improves comfort for the child and speed of drug action. • Dilation and cycloplegic effects generally take 30 to 40 minutes, and wear off over 4 to 10 hours. • Cyclopentolate has provided the same dilation and cycloplegic effect as atropine whenever they have been compared directly. **Atropine** • Atropine can be absorbed and cause the same systemic toxicity in the same people as cyclopentolate. • Sensible dosages will nearly always prevent complications related to age, but it is best to avoid use in other people specifically listed under cyclopentolate: – children under 12 months of age – use 1 drop of 0.5% per eye, separating the eyes by 30 minutes, three times daily for three days – children over 1 year of age – use 1 drop of 1% per eye, with no time separation between eyes required, three times daily for three days • Dilation and cycloplegic effects generally take an hour or so, stay profound for one to two days, but can be detectable for a week or more. • Although having a reputation for providing the “best” cycloplegia, direct comparison to cyclopentolate does not show any consistent difference.

CYCLOPLEGIC RETINOSCOPY (cont.)

WHICH DROPS TO USE (cont.)	 ***Complications*** **with cyclopentolate and atropine are rare when the precautions and sensible dosages listed above are used.** **However, it is important to know what complications are possible and how to react appropriately.** **Complications include:** • **redness and swelling around the eye** • **skin rash** • **fever** • **facial flushing** • **rapid and irregular heart beat** • **loss of coordination** • **low blood pressure** • **difficulty breathing.** **If any of these complications occur, stop using the drops and work with the emergency department of a hospital immediately.** • **In severe or life-threatening situations, intramuscular physostigmine can be used to counteract the muscarinic antagonist effect of the drops.**
TIPS FOR PERFORMING CYCLOPLEGIC REFRACTION	When the drops are in and working, there are still a few things that require care during retinoscopy: • look at the central reflex only (ignore peripheral movements) • stay on-axis (larger pupils allow you to accidentally move off-axis, but this could make it seem like there is astigmatism that does not really exist) • remember that the working distance lens is still required! – Working distance lenses are needed so that you do not have to hold your retinoscope at infinity. – Continue to work at the appropriate distance for the working distance lens you use. While it is technically possible to perform a subjective refraction on a child who is cyclopleged, it is not recommended. VA is usually reduced to 6/12 or so. Most people find it difficult to judge which lens is better, partly because of the VA reduction, and partly because of the variation in refraction across the large pupil.

CYCLOPLEGIC RETINOSCOPY (cont.)

PRESCRIBING FROM YOUR CYCLOPLEGIC RETINOSCOPY RESULT	• In an average child with ***myopia*** it is common to prescribe spectacles of the same power as your cycloplegic retinoscopy result. *For example:* If you measure a cycloplegic retinoscopy result of: R –5.00 DS L –5.00 DS Prescribe spectacles with: R –5.00 DS L –5.00 DS. • In an average child with ***hyperopia*** it is common to prescribe spectacles as: **Spectacle power = cycloplegic retinoscopy – 0.50 DS** - This is to allow for ciliary muscle and lens tone (accommodation that the child can never relax), present because an uncorrected hyperopic child has to accommodate all the time. *For example:* If you measure a cycloplegic retinoscopy result of: R +5.00 DS L +5.00 DS Prescribe spectacles with: R +4.50 DS L +4.50 DS. • In an average child with ***myopic astigmatism*** it is common to prescribe spectacles as: **Spectacle power = cycloplegic retinoscopy + plano/+0.50 DC** *For example:* If you measure a cycloplegic retinoscopy result of: R –5.00/-2.00x180 L –5.00/-2.00x180 Prescribe spectacles with: R –5.00/-1.50x180 L –5.00/-1.50x180. • In an average child with ***hyperopic astigmatism*** it is common to prescribe spectacles as: **Spectacle power = cycloplegic retinoscopy – 0.75 D/+0.50 DC** *For example:* If you measure a cycloplegic retinoscopy result of: R +5.00/-2.00x180 L +5.00/-2.00x180 Prescribe spectacles with: R +4.25/-1.50x180 L +4.25/-1.50x180.

CYCLOPLEGIC RETINOSCOPY (cont.)

PRESCRIBING FROM YOUR CYCLOPLEGIC RETINOSCOPY RESULT (cont.)

However, there are many reasons why you might vary your prescription from these rules. Reasons include:

- If there is an ***esotropia*** (the child is cross-eyed)
  → do not add –0.50 DS

Hyperopic child with esotropia:
- spectacle power = cycloplegic retinoscopy

- If there is an ***exotropia*** (the child is wall-eyed)
  → consider adding –1.00 DS or more

Child with exotropia:

- spectacle power = cycloplegic retinoscopy – 1.00 DS

particularly if the child has hyperopia, but sometimes for myopia also.

- If there is ***anisometropia*** (one eye has a different prescription to the fellow eye), you may use your clinical judgment to:
  - prescribe the whole difference
    Example: For a child with amblyopia (lazy eye)
  - decrease the difference
    Example: For an adult with acquired anisometropia

WHICH CHILDREN NEED MOHINDRA RETINOSCOPY?

WHICH CHILDREN NEED MOHINDRA RETINOSCOPY?

If cycloplegic retinoscopy cannot be performed (for example, if you do not have access to appropriate eye drops, or if the child is at high risk of, or has had complications from, the available eye drops) then Mohindra retinoscopy can be a useful substitute in these situations:

- VA cannot be measured (e.g. children under 2.5 years of age), or cannot be measured repeatedly or efficiently (e.g. preschoolers with less than average concentration)
- a child is unable to focus on a distant target for long enough for you to perform standard retinoscopy
- you are unable to successfully determine an astigmatic correction
- a child has a strabismus and/or deep amblyopia
- a child has unexplained vision loss

Mohindra retinoscopy gives you an opportunity to successfully refract children in this situation, but does not allow good ocular fundoscopy (because the pupils are not dilated). If there is unexplained vision loss, you may still need to refer the child to a children's eye specialist to establish the cause of the vision loss.

MOHINDRA RETINOSCOPY

MOHINDRA RETINOSCOPY THEORY	Mohindra retinoscopy is based on the assumption that everyone has the same ***dark focus***. Dark focus is the point that eyes focus to when there is no visual stimulus (for example, in a dark room). This is usually not zero dioptres or optical infinity. The average person has a dark focus (or "tonic accommodation") of 0.75 DS. Putting a patch on the eye you are not examining removes any visual stimulus from that eye and so helps accommodation relax to the dark focus. Turning on the room lights between measurements not only helps you see what you are doing, but also prevents the child from dark adapting (getting used to the darkness). Less dark adaptation means less visual stimuli will be seen, which helps to keep accommodation at the dark focus.
MOHINDRA RETINOSCOPY METHOD	• Place a patch on the child's left eye. • Hold a 1.25 D trial lens in your left hand, and your retinoscope in your right hand. • Close the door, switch off all room lights and charts – make the room as dark as possible. • Now scope the child's right eye through the trial lens using a working distance of 50 cm. • When you know which way the reflex is moving, turn on the room lights. • Change lenses in + or – directions as you would for standard retinoscopy, and repeat the procedure of turning off room lights and scoping. When the reflex movement is neutralised, your Mohindra retinoscopy result is: • the power of the lens in your hand – 1.25 DS *Example:* If reflex movement is neutralized with: –2.00/–1.00x180 trial lenses your Mohindra retinoscopy result is: –3.25/–1.00x180. The adjustment of –1.25 D is the difference between your 2.00 D working distance (holding the retinoscope at 50 cm from the child's eye) and the 0.75 D dark focus. • Repeat for the left eye with the patch moved to the child's right eye.
PRESCRIBING FROM YOUR MOHINDRA RETINOSCOPY RESULT	You can prescribe your Mohindra retinoscopy result without changing it. However, you must remember that the accuracy of Mohindra retinoscopy depends on two assumptions: 1) that you have created conditions that make the child's accommodation system go to its dark focus 2) that the child you are examining has the average dark focus (+0.75 D). If one or both assumptions are wrong, Mohindra retinoscopy will be inaccurate.

SUMMARY: REFRACTIONS FOR PRESCHOOL CHILDREN

WHICH CHILDREN WILL NEED CYCLOPLEGIC RETINOSCOPY?

- When VA cannot be measured, or is reduced for an unexplained reason, or a child cannot concentrate during non-cycloplegic retinoscopy, or you cannot accurately measure astigmatism, you should refract using cycloplegic retinoscopy.

CYCLOPLEGIC RETINOSCOPY

- Tropicamide, cyclopentolate and atropine all have uses in achieving cycloplegia. Complications from cyclopentolate and atropine can nearly always be avoided by knowing which people are most likely to have complications (and avoiding use when possible) and using appropriate dosages for different age groups.
- When a child is cyclopleged, make sure you stay on axis, look at the central reflex only, and remember that the working distance lens is still required.
- Prescribe your cycloplegic retinoscopy result for most myopes, but slightly less than the full result for most hyperopes and astigmats.

WHICH CHILDREN WILL NEED MOHINDRA RETINOSCOPY?

- If cycloplegic retinoscopy is indicated, but cannot be completed (e.g. appropriate drops not available or cause unacceptable complications), then Mohindra retinoscopy may be useful in determining refraction.

MOHINDRA RETINOSCOPY

- Technique based on the assumption that everyone has the same dark focus (0.75D), and the assumption that you can create conditions in which a child will relax accommodation to their dark focus.
- Patch one eye, remove all visual stimuli from the child by turning off all room lights and charts, and shutting the door. Perform retinoscopy on the unpatched eye. Your Mohindra result is the lens that neutralizes the movement minus 1.25 DS.

TEST YOURSELF QUESTIONS

1. When would you choose to perform cycloplegic retinoscopy rather than a Blur Function refraction?

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2. Which drops (drug and dosage) would you use to cycloplege an 18 month old child?

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_____

3. a) What prescription would you give to a child with amblyopia whose cycloplegic retinoscopy result was R −9.25/−3.00x180, L −5.75/−2.50x180?

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b) Would your answer change if this finding was for an older adult without amblyopia?

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4. If a +4.50D lens neutralizes movement during Mohindra retinoscopy, what is the Mohindra retinoscopy result for that eye?

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NOTES