



Macropsia/micropsia

Nicholas Phelps Brown describes the possible implications of an occasionally reported visual symptom. Module C13046, one general CET point, suitable for optometrists and dispensing opticians

Macropsia and micropsia are infrequently reported symptoms that can be challenging to evaluate. In macropsia the perception is of an object larger than it really is and in micropsia an object appears to be smaller. The phenomena have been known for many years.¹ The underlying causes range from trivial to life threatening.

The causes are in the categories of:

- Optical
- Accommodational
- Retinal
- Cerebral.

Cerebral causes affect both eyes equally, whereas the other causes may each affect a single eye. Accommodational causes are usually but not invariably bilateral.

Optical

Plus spectacle lenses magnify and minus lenses minify. A person will become aware of macropsia/micropsia when there has been a change in their optical status. This occurs when a hypermetrope parts with their plus spectacles and opts for contact lenses, laser sight correction, or lens implants. The person may be disappointed with their new emmetropia because of the loss of magnification and the proportional reduction in visual acuity that goes with it. Patients undergoing laser sight correction should always be warned that they may lose a line of best corrected visual acuity and that this is more likely in the hypermetrope.

When a refractive shift affects one eye or one eye more than the other, the condition is that of anisometropia and an optical correction produces magnification or minification with resultant aniseikonia. Minor degrees of aniseikonia are tolerable and compatible with binocular function, particularly if the condition has been present from childhood, but each person has a limit



Alice in Wonderland syndrome is a rare oddity in which the sufferer, usually a child, experiences themselves to be large and all external things to be small (illustration with apologies to Sir John Tenniel)

to the aniseikonia that can be tolerated. Aniseikonia is minimised by the use of a contact lens on the affected eye and eliminated by a posterior chamber lens implant.

The increase in myopia that is associated with the development of nuclear cataract is due to the increase in refractive index of the lens nucleus. The myopic shift commonly precedes visible cataract.² This requires a minus shift in the patient's spectacles with concurrent minification. The reduced image size is likely to be the reason why patients with nuclear cataract do not tolerate well the full minus adjustment in their spectacles, particularly when the cataract is unioocular.

Myopia due to an axial length increase is seen following retinal detachment surgery in which an encircling explant has been used. A spectacle correction for any surgically induced myopia produces minification.

A hypermetropic shift occurs in

phakic or pseudophakic eyes in which the retinal surgeon has filled the posterior segment with silicone oil. This relatively high refractive index material reduces the effectivity of the posterior lens contour and produces an approximately +4.5D shift. The spectacle lens correction will then cause magnification, which is likely to produce unacceptable aniseikonia.

The biggest refractive shift of all used to be seen after cataract surgery without lens implants; something that is rarely met today. Spectacle correction with a high plus lens for aphakia of about +10D produces a magnification of about 33 per cent which is not tolerated by a patient with a phakic fellow eye. A contact lens correction for aphakia produces a magnification of 7 to 10 per cent, which is usually tolerated. An anterior chamber lens implant produces about 3 per cent magnification and the posterior chamber implant no discernable magnification.

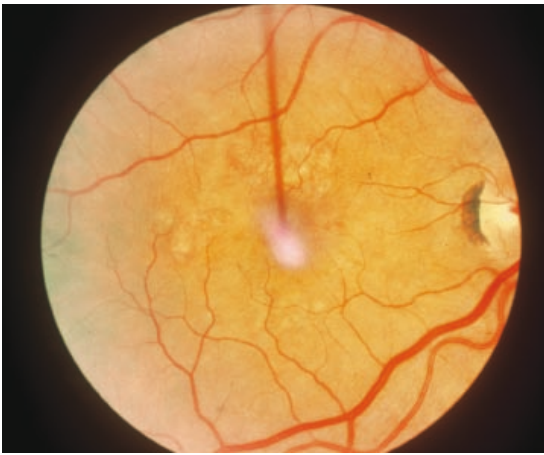


Figure 1 Cystic macular oedema (with fixation pointer)

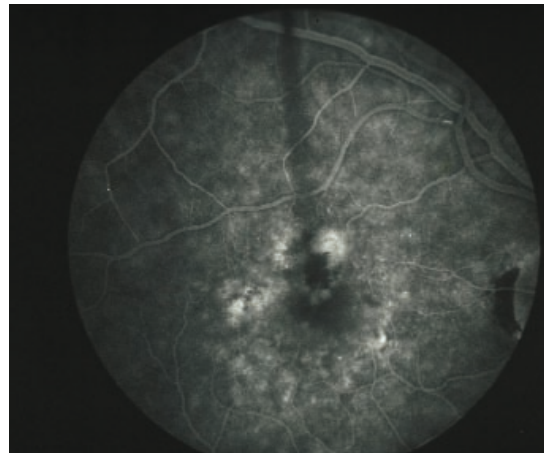


Figure 2 Fluorescein angiogram of Figure 1. This shows the cystic pattern of the oedema

Accommodational

The brain receives proprioceptive feedback in relation to the muscular effort required for accommodation, which can produce the illusion of accommodative micropsia or of macropsia.^{1,3} In weakness of accommodation, a greater effort is needed to focus a near object and therefore the object is perceived to be nearer than it actually is. The retinal image remains the same size for a familiar object at its actual distance and it therefore appears small. Accommodative micropsia is reported in persons straining to accommodate at the onset of presbyopia, but does not occur when there is complete paralysis of accommodation.

When the accommodation is greater than that needed to focus a near object, it is described as accommodation excess. A state of inappropriate maximal accommodation is described as spasm of accommodation.

In accommodation excess and in spasm of accommodation a reduced effort or no effort is required by the person to focus a near object. The near object is therefore judged to be a larger object at a distance and the person is affected by macropsia.

Accommodation excess may be primary and functional in nature or organic and secondary to pathology.⁴ The functional cases occur in young persons who may be suffering from pressure at school and may have neurotic or hysterical personalities. It is more likely to occur in children with uncorrected refractive errors. The symptoms are blurred distance vision, macropsia and headache. A refraction without mydriatic is likely to show a variable degree of myopia, which can result in the child's condition being aggravated by the prescription of minus lenses. The management involves a mydriatic refraction and spectacles given with a full plus refractive correction. An



Figure 3 Choroidal melanoma lifting the macula

anticholinergic eye drop such as tropicamide may be used for a period of time to relax the ciliary muscle. The child's circumstance should not be overlooked and psychological help may be needed.

The causes of organic spasm of accommodation are ocular or neurological. The ocular causes include uveitis and scleritis affecting the ciliary body and in traumatic myopia a myopic shift occurs with ciliary body swelling or spasm resulting from blunt trauma. Ciliary spasm may also be induced by an adverse reaction to a number of drugs including sulphonamides and thiazides, such as acetazolamide.

The neurological causes include irritative lesions of the brain stem affecting the third nerve nucleus as may occur in encephalitis. Spasm of accommodation affecting one eye can occur with an Adie pupil in the tonic phase in association with miosis. Spasm of accommodation may also occur as a component of cyclic oculomotor spasm, a rare and recurring condition, which affects the pupil and extraocular muscles of one eye supplied by the third nerve.

Retinal

If the retinal elements become spread apart, the image of an object falls onto fewer elements and is perceived as smaller. Conversely if the elements become crowded together the image of an object falls onto more elements and is perceived as larger.⁵ Micropsia and macropsia are only experienced when the macular region is affected.

Retinal oedema and fluid beneath the neuroepithelium stretches the retina causing micropsia (Figures 1 and 2). This occurs in cystic maculopathy, central serous retinopathy, and in acute-onset 'wet' age-related macular degeneration. Other causes are choroidal tumours (Figure 3) and a retinal detachment just beginning to lift the macula. Micropsia is also reported in retinal re-attachment following successful surgery. Choroiditis can cause macropsia or micropsia.⁶ The retina is commonly stretched unevenly, causing distortion (metamorphopsia), which is easily detected with the Amsler chart. The visual acuity is commonly reduced by the retinal dysfunction due to the condition causing the micropsia, but it is also reduced geometrically in proportion to the minification.

Cerebral causes

Primary image formation occurs in the striate cortex at the occipital pole of the brain and the interpretation of this image depends upon the function of the association areas of the pre-striate and also of the parietal and temporal regions of the brain. The pre-striate cortex is associated with form recognition,⁷ motion perception⁸ and colour recognition.⁹ Further forward in the brain the parietal and temporal areas are associated with visuospatial perception.¹⁰ Temporal lobe dysfunction can cause macropsia or micropsia.¹¹

Temporal lobe dysfunction with ▶



macropsia may occur without evident pathology in the aura of migraine and in partial temporal lobe epilepsy. The aura of migraine takes on many forms of sensory disturbance and is not necessarily followed by a headache. When it involves micropsia this can cause much distress to the sufferer when first experienced. Partial temporal lobe epilepsy is an epilepsy without seizures or loss of consciousness. The sufferer is affected by altered awareness or by sensory disturbance including visual disturbance. Temporal lobe disturbance with micropsia also occurs in response to toxic brain states including that due to hallucinogenic drugs, such as dextromethorphan, LSD, magic mushrooms, cannabis, opiates (such as morphine) and heroin. Micropsia may be persistent after ceasing long-term cocaine use.¹²

Pathological cerebral causes of micropsia/macropsia include temporal lobe tumours, brain injury, cerebral infarcts, multiple sclerosis and Epstein-Barr virus infection (infectious mononucleosis) which occasionally causes encephalitis.¹³ Micropsia may be the presenting sign of this infection.¹⁴

Alice in Wonderland syndrome¹⁵ is a rare oddity in which the sufferer, usually a child, experiences themselves to be large and all external things to be small, and occasionally vice versa. In the famous story by Lewis Carroll, Alice experienced this phenomenon after eating cake and drinking a magic potion. Perhaps the author was familiar with hallucinogenic substances? However, Alice in Wonderland syndrome can be primary without hallucinogenic substances being implicated. It can also be secondary to cerebral viral infection.¹³

Psychological disturbance is implicated as a cause of functional micropsia/macropsia.¹⁶ Micropsia may be a component of a dissociative disorder, a condition in which the person separates certain thoughts or memories from normal consciousness. In this condition there may be a breakdown of memory, or of awareness of identity and the person may also have disordered perception with micropsia.¹⁷ The psychoanalytical explanation of micropsia is that the person is trying to distance themselves from an environment fraught with conflict.¹⁸

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MULTIPLE-CHOICE QUESTIONS – take part at opticianonline.net

1 Which of the following is not a cause of perceived image size change?

- A Accommodation fluctuation
- B Refractive change
- C Peripheral retinal elevation
- D Macular oedema

2 Which of the following is true regarding optical macro/micropsia?

- A A hyperope experiences micropsia when moving from spectacles to contact lenses
- B A hyperope experiences macropsia when moving from spectacles to contact lenses
- C A hypermetrope undergoing refractive surgery may experience macropsia
- D A myope undergoing lens implantation may experience micropsia

3 Which of the following binocular corrections will result in the least aniseikonia?

- A Spectacles
- B Contact lenses
- C Corneal refractive surgery
- D Intraocular lens implantation

4 Which of the following would not cause a decrease in axial length?

- A Central serous retinopathy
- B Posterior staphyloma
- C Choroidal neovascular AMD
- D Retinal detachment with macula off

5 Which of the following may result in persistent micropsia?

- A Cannabis
- B LSD
- C Cocaine
- D Magic mushrooms

6 Dysfunction of which lobe results in macropsia/micropsia?

- A Parietal
- B Occipital
- C Temporal
- D Frontal

Successful participation in this module counts as one credit towards the GOC CET scheme administered by Vantage and one towards the Association of Optometrists Ireland's scheme. The deadline for responses is February 18 2010



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