Visual Field Defects in Neuro-Optometric Practice: Assessment and Management:

Steve Leslie B Optom FCOVD FACBO

6th International Congress of Behavioural Optometry 2010
Aetiology of visual field loss

- Ocular pathology: glaucoma, optic nerve,......
- Neurological conditions: MS,....
- Stroke
- Traumatic brain injury
  - One study found bilateral visual field deficits in at least 1 in 7 of severe TBI patients*

Anatomy

- Field loss usually correlates well with visual pathway localised injury
  
  - Unilateral optic nerve lesion
  - Anterior chiasm
  - Chiasm
    - Bitemporal hemianopia and hemifield slide phenomenon

ICBO 2010
Anatomy

- Optic tract
- Temporal lobe
  - 25% of postchiasmal pathology
  - Possible olfactory/gustatory hallucinations, seizures, aphasia (if dominant side involved)

ICBO 2010
Parietal lobe

- 35% of postchiasmal lesions
- Field defects may be accompanied by agraphia, ipsilateral pursuit dysfunction
- If right parietal area lesion, consider possibility of left neglect
- Macula splitting more than sparing
Occipital lobe

- 80% infarct
- Macular sparing
- Often no other neurological company
Effects on activities of daily living

- Reading: effects of right or left hemianopia
- Computer use
- Driving
- Balance issues
- Walking
- Television
- Interference with rehabilitation
Effects on rehabilitation progress and prognosis

- Visual field loss has been found to be negatively correlated with return to work in a follow up study over 15 years of Vietnam Veterans.

Severity of visual field loss (VFL) and health-related quality of life

- “Health related quality of life is diminished even in persons with relatively minor VFL”*
- VFL causes difficulty with:
  - Driving
  - Dependency
  - Mental health
  - Distance vision
  - Peripheral vision

Visual field loss affects ADL’s and rehabilitation progress

- Awareness of visual field loss may help patients to adjust behaviour and performance of ADL’s.

- Other professionals may adjust therapies within the consideration of a visual field defect; communication is imperative.
Assessment of visual fields

- History, history, history
- Bedside vs office assessment
- Objective testing
- Behaviourally assessed functional fields
- Subjective fields
Hierarchy of targets in quadrants

- Hand motion
- Finger motion
- Finger counting/matching
- Saccades to moving fingers/target (children, aphasia)
- Color brightness comparison
  - Move single target across midlines, or present 4 red dots equidistant from central fixation (detects 78% of chiasmal defects)

ICBO 2010
Marking field loss midlines

ICBO 2010
Macula sparing (striate lesion) vs splitting (3 ball technique)
Amsler grid

- Useful for subtle central and paracentral scotomas which can often cause frustrating and difficult to diagnose symptoms of:
  - Ghosting
  - Blur
  - “Double vision”
- Tangent screen
- Static vs kinetic perimetry
- Computerized functional visual field assessment
- Computerised: REACT, SDSST, SOSH, SEARCH, FASTREAD, INSPECT
Focal and Ambient visual function

- Many severe traumatic brain injuries involve the midbrain, where peripheral retinal input is integrated with proprioceptive and vestibular information.
- “the ambient visual process must let you know where you are in space and essentially where you are looking before you process information about what you are looking at” (Padula & Argyris)
Ambient disruption

- Disruption of the ambient visual process disrupts the construct and stability of space so that the Z-axis loses reference.
- The disruptions directly and indirectly cause:
  - Spatial disorientation
  - Balance and postural difficulties
  - Objects appear to move
  - Floor tilting etc
Impaired simultaneous processing

- Brain injury very frequently affects attention and simultaneous processing, making it difficult for people to:
- Visually attend and listen or talk as well
- Fixate a central perimeter target and detect and respond to a peripheral target, so perimetry is not always and accurate representation of visual field function/dysfunction
Optic atrophy can be a factor

- Raised intracranial pressure (head trauma, hydrocephalus, BIH)
- Papilloedema often undiscovered in acute care
- Anoxia (ICP, poor perfusion to optic nerve)
- Radiation optic neuropathy: focal or whole brain radiation:
  - Posterior ischaemic optic neuropathy (PION) 1-3 years post radiation
  - Painless reduction in vision
  - Can deteriorate rapidly with age due to combination of age and compromised neurons
  - Possible anterior and/or posterior optic neuropathy
Paracentral scotoma

- Frequently undiagnosed and symptoms attributed to refractive issues
- Often unhappy patients
- Commonly causes vague symptoms:
  - Blurring
  - Ghosting
  - Doubling

ICBO 2010
Quadrantanopia

- Commonly missed in assessment
- May cause unusual problems that nobody can explain eg
  - Bumping into small objects
  - Knocking over objects
  - Severe reading problems

ICBO 2010
Hemianopia

- Commonly associated with hemiplegia
- Commonly misunderstood by patients and family, they often think one eye’s vision is affected
- Orientation and mobility affected
- Head turn?
- Visual midline shift?
- Insight/poor insight?
- Good/poor compensation?

ICBO 2010
Riddoch phenomenon: Static-kinetic dissociation

- Person is aware of motion in a field “blind” to form detection
- Occipital and anterior visual pathway lesions
- Due to separate functions of parvocellular (conscious, what) and magnocellular (unconscious, motion and location) streams
- Humphrey (static) perimetry worse than Goldmann (kinetic) result
- Person often feels they can, and actually do, function better than the field defect suggests.
Effects of visual field loss on balance and movement

- Unsteady on feet or sitting:
  - postural adjustments
- Difficulty walking straight
- Visual midline shifts, head and body turns
- Confusion in busy environments
Right homonymous hemianopia

- Missing/bumping into people or objects on the right
- Driving: pedestrians, parked cars
- Severe disruption of reading
  - cannot predict the following letters or words
  - Cannot direct saccades to next word, do not finish line
  - finger or strip at end of line; rotate text to read vertically?

ICBO 2010
Left homonymous hemianopia
Left homonymous hemianopia

**Effects on ADLs**

Driving: pedestrians, cars entering from side roads

Shopping centres

Reading:

- Snellen chart: misses first letters
- Finding next line when reading
- Misread longer words:
  - finger at commencement of next line, typoscopes, strip of ribbon along left margin
Macula splitting vs macula sparing

ICBO 2010
Hemianopia can cause egocentric visual midline shifts

- Perceived visual straight ahead is shifted to the side, and/or up or down
- Resultant mismatch of visual - spatial midline with facial and body midlines
- The person will often lean to one side, forward and/or backward
- Often occurs with a hemiparesis
- Can affect:
  - Veering to one side
  - Visually guided motor skills eg reaching
  - Fatigue, stress, visual “shutdown”

ICBO 2010
Prisms for midline shift

- Yoked prisms beneficial to re-align body and vision centrally
- ‘Skewing’ of space due to field loss shifts visual mid-line away from body mid-line
- Affects posture, balance because of various head, shoulder, body turns or tilts-adaptations!

ICBO 2010
Visuospatial neglect /
Unilateral spatial inattention

- “Lack of awareness of sensory events in the contralesional side of space”.
- Behaviour as if half the spatial world (and body) does not exist.
- Most common after middle cerebral artery stroke. Typically left “neglect” from right posterior parietal cortex
- Can be associated with a left hemianopia, or isolated.
Visual neglect & walking

- Patient with left hemianopia veers to the left and exhibits head turn or eye scanning
- Patient with left neglect veers to the right, and does not show a head turn or eye scan, since the left side of the world does not exist
- Often show a visual midline shift to RIGHT
Diagnosis in practice

- Visual field loss may not have been previously diagnosed in a client
- Suggests possibly unknown pathology which requires investigation and diagnosis, together with other healthcare practitioners
- Comanagement with rehabilitation professionals to maximise performance:
  - Activities of daily living (ADL)
  - Rehabilitation progress

ICBO 2010
Functional rehabilitation and prognosis

- Communication with client, carers and other rehabilitation professionals
- Reports of potential impact on rehabilitation therapies
- Optometric management:
  - Vision therapy
  - Use of optical aids
  - Compensatory strategies
Benefits of rehabilitation for field defects

- Increased safety, decreased risk of secondary injury
- Improved function in ADL’s
- Reading
- Walking, shopping
- Driving
- Occupational demands
- Home ADL’s
- Improved overall and specific rehabilitation progress

ICBO 2010
Field awareness prism systems

- Gottlieb Visual Field Awareness system
- Peli prisms
- Fresnel prism
Gottlieb Visual Field Awareness system

- Looking into the prism brings the lost field into view
- One study showed average expansion of 13.25 degrees
- Training is strongly recommended

Reference

- Treatment of hemianopsia and “neglect” – a case report on the vision rehabilitation process utilising the Visual Field Awareness System. Gottlieb et al

Peli split plastic prisms above and below primary gaze

- Place images from field loss onto existing field monocularly
- Superior & inferior ghost images in periphery act as cues, leading head and eye movement
- Fresnel trials initially
- 8x22 mm 40D segments
- Can expand effective field by up to 20 degrees

Fresnel Prisms

- For mobility – spot or hemi prism on edge of “lost” field with scanning training to look, detect, move. Increases awareness on “blind” side to find objects again to move safely through space.
Advantages and disadvantages of Fresnel prisms

- Light, great for instant trial
- Easily applied and removed
- Cosmetically acceptable
- Increasing prism power causes blur
- Colour and reflection issues
- Monocular use causes diplopia with scanning

ICBO 2010
1:  N, 69

- Probable focal ischaemia following heart operation
- Bangs into people on right side, uses cane to keep people away
- Visual fields R homonymous hemianopsia with macula sparing; sloping margins are an advantage in adapting to prism
- Treatment R temporal Fresnel spotting prism

ICBO 2010
Spotting prism (Gottlieb, Peli)

- Gottlieb suggests 18 pd base out disc just temporal to right limbus on right spectacle lens; used as spotting prism to look into by slight right gaze, locate objects, then turn head to right and move prism out of way
- Trialled 20 then 25 pd Fresnel 10c piece size
Results

- Walks confidently in shopping centre
- Drives motorised “gofer”
- Notices diplopic vision is dominated by real vision
- Discarded white stick
- Scanning automatically
- Uses for scanning, not viewing
2: B age 40

- R intracerebral haemorrhage involving temporal, frontal and parietal areas, craniotomy and craniectomy, secondary myocardial infarction, seizures
- Hypertension primary
- Left hemiplegia and hemianopia
- Wheelchair
- Referral: impaired visual spatial sense and midline
• Confrontation: left homonymous hemianopia
• Midline: 2 cms shift to left, head turn
• Trials: 5 PD bases left shifts midline to right
• 4 pd bases left straightens head and posture, optimal midline, improves awareness of objects on left side
Progress

- Not bumping into things as much, more aware of left side
- Can pick up left side of page better
- More function of left side
- Saccades less random with quick refixation through localisation
Yoked prisms for Visual Midline Shift, & sighting prism for field loss

- When there is a combination of an homonymous hemianopia and a visual midline shift (hemi, nerve palsy, monocular VA issues)
- May combine:
  - Lateral yoked prism to normalise visual midline
  - Optical aids for increased field awareness
Progress

- (-) diplopia
- Uses glasses to remind of left side
- Trials show 15 pd Base out left eye temporal area improves awareness and saccades to left
- Reading fluently and easily to next lines
Summary

- Visual field loss is not a life sentence in relation to ADLs
- Careful assessment by all means possible of visual fields
- Understand practical effects of loss on ADL and rehabilitation
- Use lenses, prisms (yoked and spot) to improve awareness and functioning
- Learn through experience with your patients