Automated Perimetry: Practical Issues

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Automated Perimetry: Practical Issues

• Key issues:
  — Perimetry request
  — Choice of test
  — Test environment
  — Preparing the patient
  — Interpreting the printout
Automated Perimetry Practical Issues

- Highly subjective test
- For accurate results
- Patient
- Perimetrist

Perimetry Request
Perimetry Request

Purpose

- Glaucoma
  - Central field (30-2, 24-2, Macula, 10-2)

- Neurological
  - Central AND peripheral field (60-2)

Examination

- Ophthalmic
- Neurological

Examination

Ophthalmic

- Visual Acuity
  - increase target size

- Refraction (manifest)
  - field test not possible < a critical level (≈6/60)
  - calculate near add BY MACHINE
  - in high errors \( \rightarrow \) lens rim artifact

Neurological
Examination

Ophthalmic

Neurologic

Consciousness
- level, awareness & concentration

Motor
- involuntary movements, power, tone

Sensory
- pain, paraesthesia

Reflexes
- delayed

Choice of Test
Choice of Test

Lesion
- Glaucoma
  - Early
    - Central 30-2
  - Advanced
    - Central 24-2
    - Central 10-2

Patient general condition
- Extremes of age
- Attention deficit & short attention span
- Difficult positioning
  - Short test

Test Environment
Test room parameters

Illumination
- dark room
- no door opening (in or out) during the test

Quietness
- No noise in the room or from neighboring environment
- No cell phones allowed (patient & perimetrist)

Preparing the Patient
Preparing the patient

Pupil size

Pupils < 3mm should be dilated pharmacologically

Patch the non tested eye

Start by testing the better eye first

Patch the other eye with the PATCH SUPPLIED BY THE MANUFACTURER (DO NOT USE GAUZE PATCH & ADHESIVE TAPE)

Interpreting the Results
Automated Perimetry: Practical Issues

- Automated perimetry printout:
  - Patient demographics (name, date of birth, date of test)
  - Laterality (right/left)
  - Test protocol (area tested, strategy)
  - Test conditions (background illumination, stimulus size, test duration)
  - Reliability indices (false positive, false negative, fixation losses)
  - Gaze monitoring data
  - Plots (retinal threshold, age matched thresholds, focal defects plot)
  - Statistical data (global indices, glaucoma hemifield test, Bebe® curve, visual field index)
Interpreting the Results

• Check demographic data (ensure that it is your patient’s field test) →
  – Name: full name, as much as possible
  – Date of birth:
    • Identification
    • Machine database for age matching
Interpreting the Results

• Check test protocol →
  – Central, peripheral, macula
  – Area tested (degree) (expected location of defect)
  – Comparison with previous & future tests
Interpreting the Results

- Check test conditions → (*standard*, *modified*)
  - Background illumination (*white on white, blue on yellow*)
  - Target size (*larger target → poorer vision or worse field*)
  - Fixation (*central target, diamond → central scotoma*)
  - Test speed (*slow patient → slow test → reliable test, slow patient → normal speed → unreliable test*)
  - Fixation monitoring (*blind spot monitoring, pupil tracker*)
Interpreting the Results

• Check test duration (*must match the patient’s general & ocular condition → indication of reliability, i.e. slow patient or poor vision or field → longer test*)
Interpreting the Results

• Check test reliability →
  – Test duration
  – Pupil tracing
  – Reliability indices →
    • Fixation losses < 15% \(\text{(confounder: wrong determination of blind spot from the start, high false positives)}\)
    • False positives < 30% \(\text{(confounder: excessive involuntary movements \(\text{[e.g. tremors]}\) \(\rightarrow\) unnecessary responses)}\)
    • False negatives < 30% \(\text{(confounder: slow patient in a normal test speed, large blind spot due to large optic nerve or peripapillary atrophy or papilloedema)}\)
  – Perimetrist comment

Reliability Indices

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Interpreting the Results

• Check plots

  – Type

    • Numbers plots (absolute, age matched, diffuse reduction of sensitivity)
    • Grey scales (probability plots, illustrative to patient)
Interpreting the Results

• Check plots ➔
  – Description ➔
    • Every plot is divided into quadrants by a cross, centered on FIXATION (superotemporal, superonasal, inferotemporal, inferonasal)
    • The cross is marked into circles of $10^\circ$ on each arm
    • The physiological blind spot lies between the $10^\circ$ and $20^\circ$ marks (at $15^\circ$ and $1.5^\circ$ below macula, hence, does not appear in the central $10^\circ$ program) & has a size of about $5.5^\circ$ horizontal by $7.5^\circ$ vertical
Automated Perimetry: Practical Issues

- Automated perimetry printout:
  - Grey scale representation →
    - A white mark → an area of normal retinal sensitivity
    - A grey mark → an area of diminished retinal sensitivity (scotoma)
    - Scotoma may be relative (lighter grey) or absolute (denser black)
    - An absolute scotoma may have at its edge a relative scotoma (darker black, then grey, then white)
  - The SHAPE of the scotoma is approximated to the classic Goldmann plot
Interpreting the Results

• Check plots ➔
  – Plots types ➔
    • Actual retinal sensitivity plot (raw data): *(numerical/grey scale)*
      – Provides the actual sensitivity thresholds of the different retinal areas, regardless of age, gender, or generalized reduction of sensitivity

Interpreting the Results

• Check plots ➔
  – Plots types ➔
    • Actual retinal sensitivity plot (raw data): *(numerical/grey scale)*
      – Is useful for ➔
        » Confirming **laterality** at a glimpse *(position of the blind spot & fixation)*
        » Demonstrating a **PATTERN** for the visual field defect *(e.g. hemianopia, quadrantanopia, respecting vertical/horizontal meridia)*
        » Avoiding the pitfall of a grossly defective field appearing grossly normal on the pattern deviation plot
Interpreting the Results

• Check plots →
  – Plots types ➔
    • Total deviation plot: (numerical/grey scale)
      – Performs age-matched adjustments of retinal sensitivity thresholds
**Interpreting the Results**

- Check plots ➔
  - Plots types ➔
    - Pattern deviation plot: *(numerical/grey scale)*
      - Subtracts the effect of **generalized depression** of the hill of vision *(i.e. generalized reduction of sensitivity resulting from e.g. nuclear cataract, diffuse homogenous corneal opacity, miosis, etc)*
      - Is useful for demonstrating **localized** field defects *(e.g. glaucoma)*
Interpreting the Results

• Check global indices →
  – Mean deviation (MD) → overall height of hill of vision
  – Pattern standard deviation (PSD) → localized deviation from normal
  – Short term fluctuation (STF) → intratest variability
  – Corrected pattern standard deviation (CPSD) → PSD with STF subtracted
  – Long term fluctuation → intertest variability (requires repeat serial fields)

• Check Glaucoma Hemifield Test (HFA ™) & Bebe curve (Octopus ™)
Interpreting the Results

• Check Glaucoma Hemifield Test (HFA ™)
  – Calculated by comparing the superior & inferior hemifields across the horizontal meridian (in 10 locations)
  – Possible messages:
    • Outside normal limits
    • Borderline
    • General reduction of sensitivity
    • Abnormally high sensitivity
    • Within normal limits

Interpreting the Results

• Visual Field Index (VFI):
  – “Is a new global metric that represents the entire visual field as a single percentage of normal,”
    – “Is based largely on the pattern deviation & weighs central points more than peripheral ones.”
    – “A full visual field has a VFI of 100% while a perimetrically-blind visual field has a VFI of 0%.”
Interpreting the Results

• CORRELATE PERIMETRY FINDINGS WITH CLINICAL FINDINGS
  • (mismatch → review clinical data, technique of field testing, diagnosis)

Interpreting the Results

• Glaucoma investigation:
  – Defects respect horizontal meridian (*nerve fiber bundle type*)
  – Pattern follows known field defects characteristic of glaucoma →
    • If a single hemifield is involved, it is the superior in 60% of the time
    • Normally MD asymmetry between both fields is less than 2.0 dB
    • Significant MD changes → difference of 1.5 dB over 2 field tests, or 1 dB over 4 field tests
Interpreting the Results

• Glaucoma investigation:
  – Establish a **baseline** field for future comparison and detection of progression →

  • Repeat field testing over short intervals (1 – 4 weeks) until variability in results disappears (**learning effect**) →

  • Up to 3 field tests may be required, discard the least reliable
Interpreting the Results

• Glaucoma investigation:
  – Earliest field findings suggestive of glaucoma →

    • Increased short term fluctuation (intratest variability)
    • Generalized reduction of retinal sensitivity
    • Abnormal glaucoma hemifield test
Interpreting the Results

• Glaucoma investigation:
  – Glaucoma field defects are constant, irreversible, persist once occurred

  – For diagnosing an abnormality, it MUST BE CONFIRMED (REPRODUCIBLE) ON AT LEAST 2 SEQUENTIAL FIELD TESTS A SHORT INTERVAL APART
Interpreting the Results

- **Minimal criteria** for diagnosing acquired glaucomatous damage:
  - A GHT outside normal limits on at least 2 fields or
  - A cluster of 3 or more non-edge points in a location typical for glaucoma, all of which are depressed on the pattern deviation plot at a $p<5\%$ level & 1 of which is depressed at a $p<1\%$ level on 2 consecutive fields or
  - A CPSD that occurs in $<5\%$ of normal fields on 2 consecutive fields

Examples
Normal field test

Inferior arcuate scotoma

(superior notch)
Double arcuate scotoma
(*circumferential enlargement*)

Dense upper arcuate scotoma
(*total cupping*)
Tubular field

Temporal island

Scotoma encroaching on fixation
Pitfalls & Artifacts

Refraction +5.25 DS

Lens rim artifact
Dryness artifact

Nuclear Cataract

MD: -3.45 dB
Pseudophakic, PCO

PSD: 2.87 dB

Macular grid laser

?double arcuate scotoma
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Thank you