MonCvONE-CR
Multifunction perimeter

Jacques.charlier@metrovision.com
Early developments
discovery of semiology
Landolt
Paris ~1900

Standardization
of stimulation
Goldmann,
Bern ~1940

Automation

Time line of perimetry
MonCvONE perimeter

- projection
- Unique LED source for stimulus
- LED controlled background illumination

- 4 versions
  SAP   Standard Automated Perimetry
  PRO   Interactive Goldmann and imaging
  CR    Clinical Research
  CR++  Clinical Research with ERG
SAP  Standard Automated Perimetry
PRO  Interactive Goldmann and video imaging
CR   Clinical Research
CR++ Clinical Research with ERG

MonCvONE-SAP

Standard Automated Perimetry
Elimination of the lens rim artefact

MonCvONE - Multifunction perimeter

Magnet technology
Elimination of the lens rim artefact

<table>
<thead>
<tr>
<th></th>
<th>Metal rim trial lens</th>
<th>Vision Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful diameter (mm)</td>
<td>34</td>
<td>55</td>
</tr>
<tr>
<td>Maximum eccentricity (degrees) (*)</td>
<td>22.6</td>
<td>36.7</td>
</tr>
</tbody>
</table>

(*) Vertex distance = 13 mm
Decentration = 5 mm
Standard Automated perimetry

MonCvONE - Multifunction perimeter
Standard Automated perimetry

FAST30: an optimized arrangement of test points

FAST 30

Standard 30/2
Standard Automated perimetry

Problems with 30/2 and 24/2 standards

References

- WEBER & al, Ophthalmologica, 1986
- WESTCOTT & al, BJO, 2002
- SCHIEFER & al, Archives, 2003
- NEVALAINEN & al, Graefes, 2009
- PARK & al, Ophthalmology, 2013
- HANGAI & al, JJO, 2013
- TRAYNIS & al, JAMA, 2014
- CHEN & al, ARVO, 2015
- NOMOTO & al, ARVO, 2016

TRAYNIS: in glaucoma
16% fields with central deficit are found normal with 24/2
Mixed perimetry

- kinetic for periphery
- static for center

MonCvONE - Multifunction perimeter
Mixed perimetry on MonCvONE

Key points
• Reduced testing time for large deficits
• Evaluation of the peripheral extension of deficits

MonCvONE - Multifunction perimeter
Visual aptitudes

Key points
- TRUE BINOCULAR stimulation
- TRUE BINOCULAR control of fixation

Drivers Group 1

Drivers Group 2

Low vision (Esterman)
TRUE BINOCULAR control of fixation

<table>
<thead>
<tr>
<th></th>
<th>Standard perimeters</th>
<th>Vision Monitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image field width (mm)</td>
<td>28-30</td>
<td>115</td>
</tr>
</tbody>
</table>
SAP  Standard Automated Perimetry
PRO  Interactive Goldmann and video imaging
CR   Clinical Research
CR++ Clinical Research with ERG

MonCvONE-PRO

Interactive Goldmann and Video Imaging
Limits of automated perimetry

In about 30% of patients, visual fields cannot be realized or are not reliable.

Special needs:
- Infants
- Old age
- Low vision
- Cognitive handicap

Solutions:
- Truly interactive interface
- High resolution video imaging
Modern Goldmann perimetry

- Selection of parameters similar to Goldmann

MonCvONE - Multifunction perimeter
Modern Goldmann perimetry

Direct, real time, mouse control of the stimulus

Show stimulus  Record patient’s response

Move stimulus

MonCvONE-PRO

TRULY interactive interface
Modern Goldmann perimetry

- 11 years old girl

MonCvONE - Multifunction perimeter
Modern Goldmann perimetry

- Zoom in and out

- evaluation of macula
Modern Goldmann perimetry

- Import of eye fundus image
- Import a previous perimetry exam

 toxoplasmosis
**Video imaging**

- Automated video image processing
- Measure pupil size
- Control fixation
- Record compressed video

MonCvONE - Multifunction perimeter
Attraction perimetry for pediatric ophthalmology

- Noah, 2 years old
- Hemiparesis, developmental delay
Attraction perimetry for pediatric ophthalmology

- Lola, 4 years old
Attraction perimetry for pediatric ophthalmology
Ptosis evaluation

- Replay of exam at high speed
Ptosis evaluation

Printed report
Cardinal positions of gaze
Cardinal positions of gaze
Low vision: functional field of vision

- Mathis, 7 years old
- Optic glioma
Diplopia field

MonCvONE - Multifunction perimeter
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MonCvONE-CR
Clinical Research
Ultra wide field perimetry

- Reaches the TRUE limits of the visual field

<table>
<thead>
<tr>
<th>(degrees)</th>
<th>MonCvONE limits</th>
<th>HFA3 limits</th>
<th>Normal limits</th>
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</thead>
<tbody>
<tr>
<td>Temporal</td>
<td>105</td>
<td>89</td>
<td>~105</td>
</tr>
<tr>
<td>Up</td>
<td>60</td>
<td>40</td>
<td>~60</td>
</tr>
<tr>
<td>Down</td>
<td>70</td>
<td>60</td>
<td>~70</td>
</tr>
</tbody>
</table>

MonCvONE - Multifunction perimeter
Ultra wide field perimetry

❖ Comparison with UWF imaging
❖ Complete visual function assessment
❖ Evaluation of dysphotopsia
Goldmann perimetry
Quantification of isopters and scotoma

- Square degrees
- Steradians (more accurate)

With the Goldmann planar projection, circular scotoma at 80 degrees of eccentricity appear 40% wider and their area is increased by 40%.

Solution: use solid angles in steradians.
Scotopic and mesopic perimetry
Robert MASSOF (1979..), Samuel JACOBSON (1986..)

- Highlighted the fact that there are different types of retinitis pigmentosa.
Dark adapted chromatic perimetry

![Graph showing relative sensitivity of rods and cones for different wavelengths. The graph indicates that rods are more sensitive to shorter wavelengths (400-500 nm) whereas cones are more sensitive to longer wavelengths (500-800 nm). The graph also highlights that the sensitivity for 500 nm is higher for cones than for rods.]
Scotopic and mesopic perimetry

MonCvONE - Multifunction perimeter
### Scotopic and mesopic perimetry

<table>
<thead>
<tr>
<th>Luminance (cd/m²)</th>
<th>Level</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>10⁻⁶</td>
<td>SCOTOPIC</td>
<td>Absolute threshold</td>
</tr>
<tr>
<td>10⁻⁵</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10⁻⁴</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.01</td>
<td></td>
<td>Full moon night</td>
</tr>
<tr>
<td>0.1</td>
<td>MESOPIC</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Cloudy sky</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>PHOTOPIC</td>
<td></td>
</tr>
<tr>
<td>10⁻⁴</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10⁻⁵</td>
<td></td>
<td>Bright sky</td>
</tr>
</tbody>
</table>
Programmable background luminance

- Programmable background luminance:
  Scotopic, Mesopic: 0.032, 0.10, 0.32, 1.0, 3.2 cd/m²
  Photopic: 10, 32, 100, 320 cd/m²

- Programmable background color:
  white, yellow (591nm), blue (447nm), red (655nm)
Programmable stimulus

- Stimulus color: white + ND 30dB + 4 user defined dichroic color filters
- Stimulus size: I .. V
- Dynamic range: 110 dB for white stimuli
- Dynamic range: 70 dB for color stimuli
Mesopic vision - Driving at night
Patient with complaint driving at night

| 10  | 0.001 |
| 100 | 0.01  |
| 1000 | 0.1   |
| $10^{14}$ | $10^{15}$ |
| PHOTOPIC | MESOPIC |
Stimulus: white size III
Background: scotopic
Procedure: static 8-4-2 staircase
Stimulus: white size III  
Background: scotopic  
Procedure: manual
Dark adaptometry

- Programmable light adaptation up to 600 cd/m²
- Deep red fixation spot
- Goldmann size V
- Up to 10 different locations anywhere in the entire visual field
- Choice of color: white +ND 30 dB + 4 user defined color filters
- 75 dB dynamic range
Dark adaptometry

DA exam performed with white stimulus on a normal subject:

- Automated quantification of
  - Alpha point
  - Rod intercept time (RIT)
  - Maximum sensitivity
Can test up to 10 different locations / colors

DA exam performed with 4 colors on a normal subject:
violet 420nm, blue 480nm, green 560nm, red 640nm

6 degrees below fixation
0dB=318cd/m²
Full field stimulus threshold (FST test)

- Roman & al (2005)
- Measure the terminal threshold using a full field stimulus

**PRO**
- Rapid
- Less fixation constraint

**CON**
- No local information (localization and spread of alternations)
# Pupillometry

## Summary of Exams

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Right</strong></td>
<td></td>
<td><strong>Left</strong></td>
<td></td>
<td><strong>Right</strong></td>
<td></td>
</tr>
<tr>
<td>Pupil diameter = 5.3 mm</td>
<td></td>
<td>Pupil diameter = 5.3 mm</td>
<td></td>
<td>Pupil diameter = 4.0 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Right</strong></td>
<td></td>
<td><strong>Left</strong></td>
<td></td>
<td><strong>Right</strong></td>
<td></td>
</tr>
<tr>
<td>Pupil diameter = 4.0 mm</td>
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<td>Pupil diameter = 4.0 mm</td>
<td></td>
<td>Pupil diameter = 3.0 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Right</strong></td>
<td></td>
<td><strong>Left</strong></td>
<td></td>
<td><strong>Right</strong></td>
<td></td>
</tr>
<tr>
<td>Pupil diameter = 3.0 mm</td>
<td></td>
<td>Pupil diameter = 3.0 mm</td>
<td></td>
<td>Pupil diameter = 2.0 mm</td>
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</tr>
</tbody>
</table>

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## PUPILS photopic high Bi stimulated

<table>
<thead>
<tr>
<th>Test 0 Bi stimulated</th>
<th>23/11/2007</th>
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</thead>
<tbody>
<tr>
<td><strong>Right</strong></td>
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</tr>
<tr>
<td>Pupil diameter = 2.0 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Left</strong></td>
<td></td>
</tr>
<tr>
<td>Pupil diameter = 2.0 mm</td>
<td></td>
</tr>
</tbody>
</table>

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**MonCvONE-CR**

MonCvONE - Multifunction perimeter
SAP  Standard Automated Perimetry
PRO  Interactive Goldmann and video imaging
CR   Clinical Research
CR++ Clinical Research with ERG

MonCvONE-CR++
Clinical Research with ERG (*)

(*) Not available in the US
Flash Electroretinography

- Ganzfeld background and flash stimuli
- Stimulus / Background color: white, yellow (591nm), blue (447nm), red (655nm)
- Programmable stimulus intensity, duration and frequency
- ISCEV protocol
- NIR video monitoring and recording
Flash Electroretinography

MonCvONE - Multifunction perimeter
Sensory EOG

MonCvONE - Multifunction perimeter
Computer interface and networking

- standard PC or tablet operating under Windows 10
- access to results from work stations
- exportation under PDF, DICOM or EXCEL format
### MonCvONE version SAP

<table>
<thead>
<tr>
<th>Feature</th>
<th>SAP</th>
<th>PRO</th>
<th>CR</th>
<th>CR+++</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full field projection</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Stimulus size I to V</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Photopic background (10 cd/m²)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FAST60, FAST30, FAST24 FAST12, FOVEA</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mixed perimetry (kinetic+static)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Binocular driving test</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Binocular low vision test</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Large field correction for refraction</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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</table>
## MonCvONE version PRO

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<th>PRO</th>
<th>CR</th>
<th>CR+++</th>
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</thead>
<tbody>
<tr>
<td><strong>Blue / yellow perimetry</strong></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Manual Goldmann perimetry</strong></td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Video imaging</strong></td>
<td></td>
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<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Attraction perimetry (for infants...)</strong></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Fusion field (diplopia test)</strong></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Ptosis evaluation</strong></td>
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**MonCvONE - Multifunction perimeter**
## MonCvONE versions CR

<table>
<thead>
<tr>
<th>feature</th>
<th>SAP</th>
<th>PRO</th>
<th>CR</th>
<th>CR+++</th>
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<tbody>
<tr>
<td>Ultra wide field perimetry</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Programmable background from scotopic to photopic</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>User defined dichroic filters (4)</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dark adapted chromatic perimetry</td>
<td></td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Dark adaptometry</td>
<td></td>
<td></td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>FST test</td>
<td></td>
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<td>Yes</td>
</tr>
<tr>
<td>Pupillometry</td>
<td></td>
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<td>Yes</td>
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</table>
# MonCvONE versions CR++

<table>
<thead>
<tr>
<th></th>
<th>SAP</th>
<th>PRO</th>
<th>CR</th>
<th>CR+++</th>
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<tbody>
<tr>
<td>Vision electrophysiology (flash ERG VEP)</td>
<td></td>
<td></td>
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<tr>
<td>Vision electrophysiology (EOG)</td>
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MonCvONE - Multifunction perimeter
### MonCvONE-CR / other products

<table>
<thead>
<tr>
<th></th>
<th>Standard Automated Perimetry</th>
<th>Goldmann Perimetry</th>
<th>DA Static Perimetry</th>
<th>DA Goldmann perimetry</th>
<th>Dark Adaptometry</th>
<th>FST Test</th>
<th>Pupillometry</th>
<th>ERG</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Image 1" /></td>
<td><img src="image2.png" alt="Image 2" /></td>
<td><img src="image3.png" alt="Image 3" /></td>
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<td>MonCvONE - Multifunction perimeter</td>
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</tr>
</tbody>
</table>
Advantages of a multifunction instrument

- Gain of space
- Optimization of use
- A single interface
- A single database
- International
  Metrovision, Lille, France
  www.metrovision.com
  contact@metrovision.com
  +33.320.17.1950

- In USA
  SRD Vision, Philadelphia
  www.srdvision.com
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  +1.347.321.8518