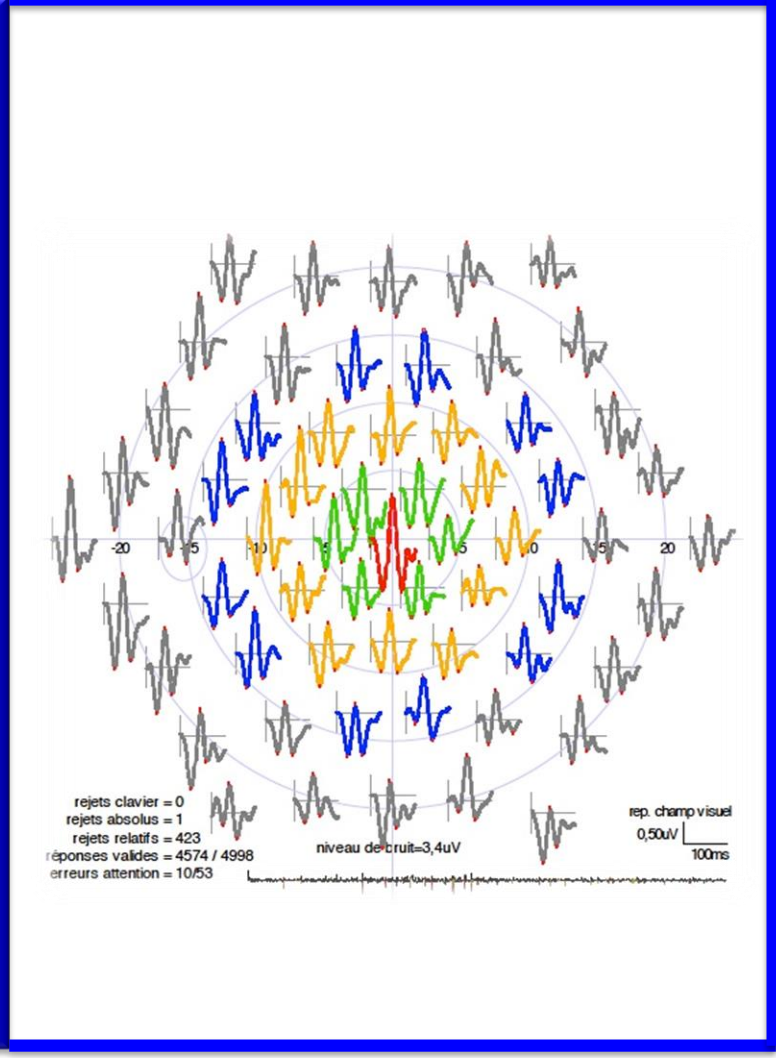
ERG MULTIFOCAL
PRINCIPES ET INDICATIONS



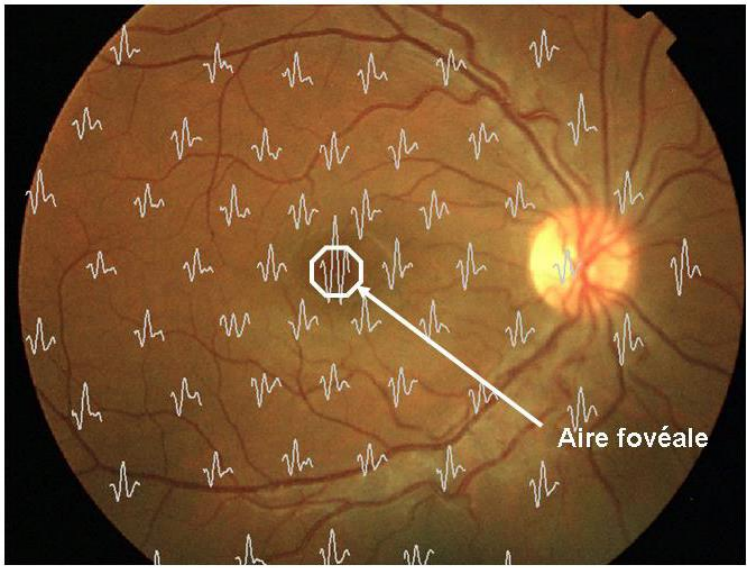
Pr MINA LAGHMARI

LIMITES DE L'ERG GLOBAL

- **Réponse de masse des 2 systèmes (cônes et bâtonnets)**
- L'ERG global peut rester normal alors que 20% à 30% de la surface de la rétine est affectée!
- DMLA avancées, autres maculopathies…
- Correlation clinique nécessaire

INTÉRÊT DE L'ERG MULTIFOCAL

- Repérer les **zones rétiniennes du pôle post** qui présentent des **réponses d'amplitudes diminuées** par rapport aux **zones voisines**.
- Localiser des dysfonctionnements **rétiniens centraux non systématisés**.

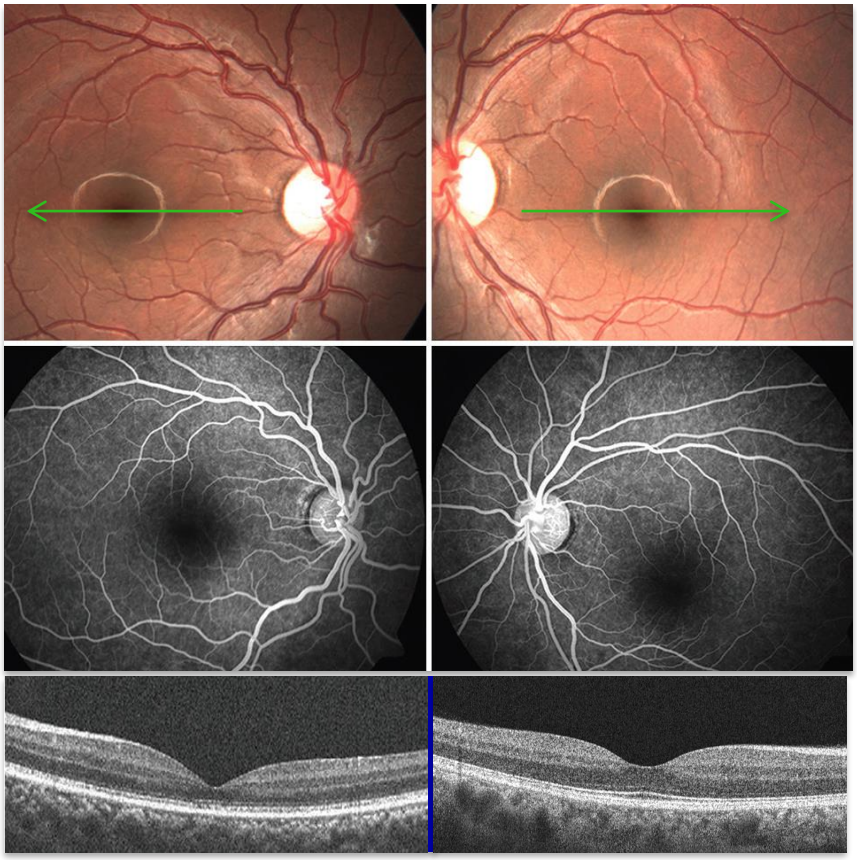


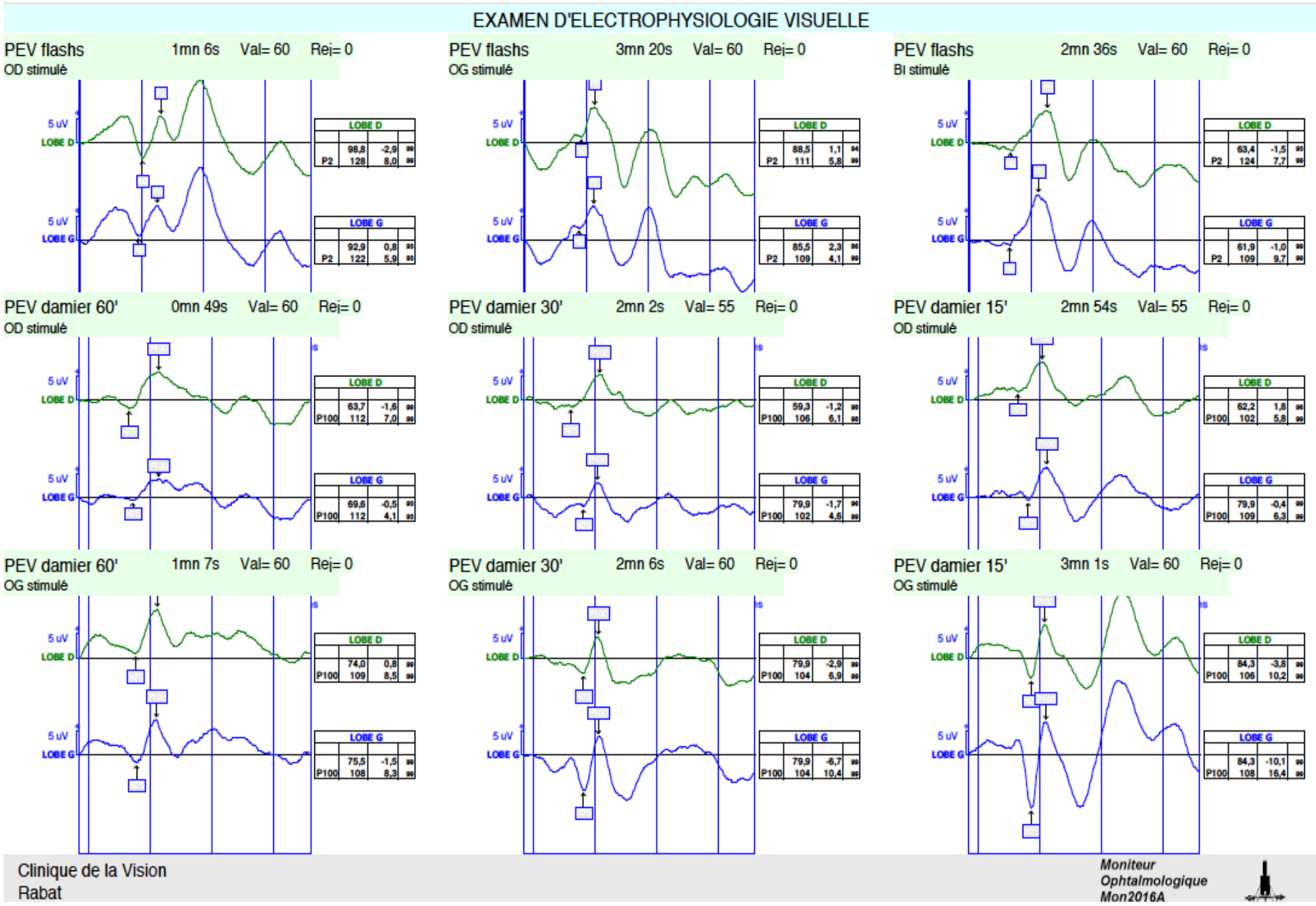

CASE STUDY

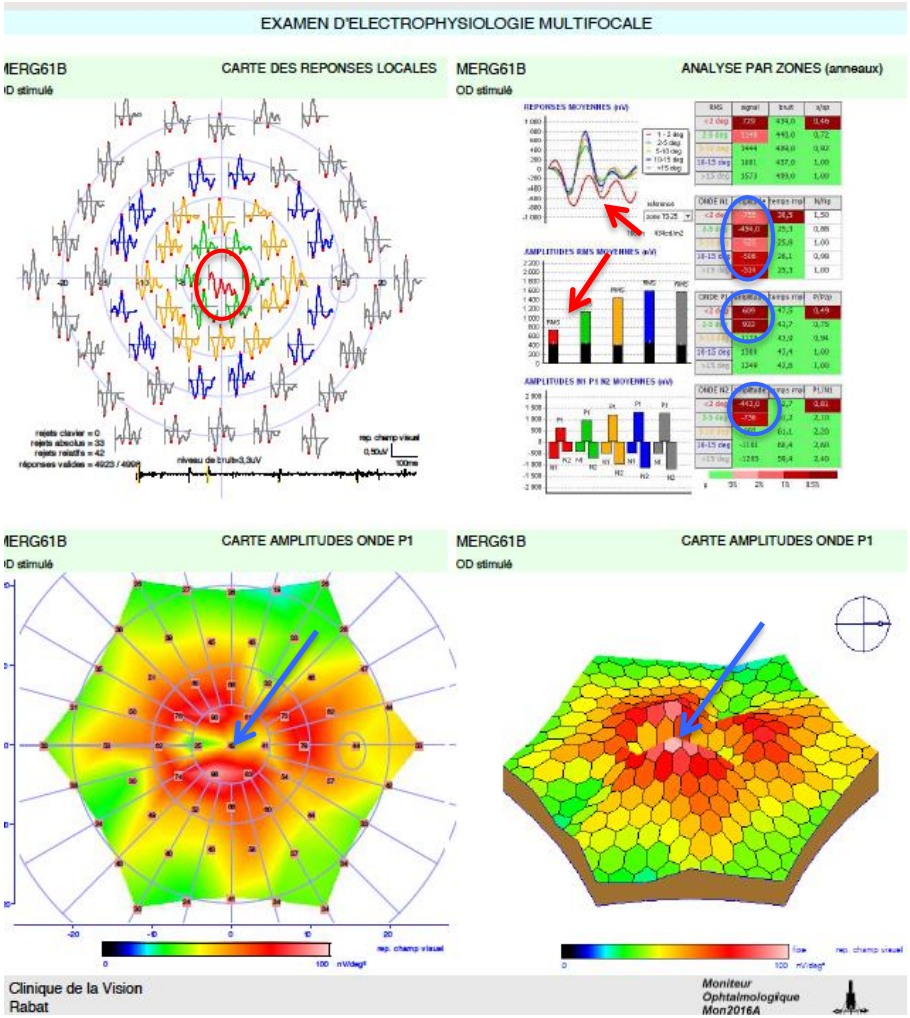
CAS N°1

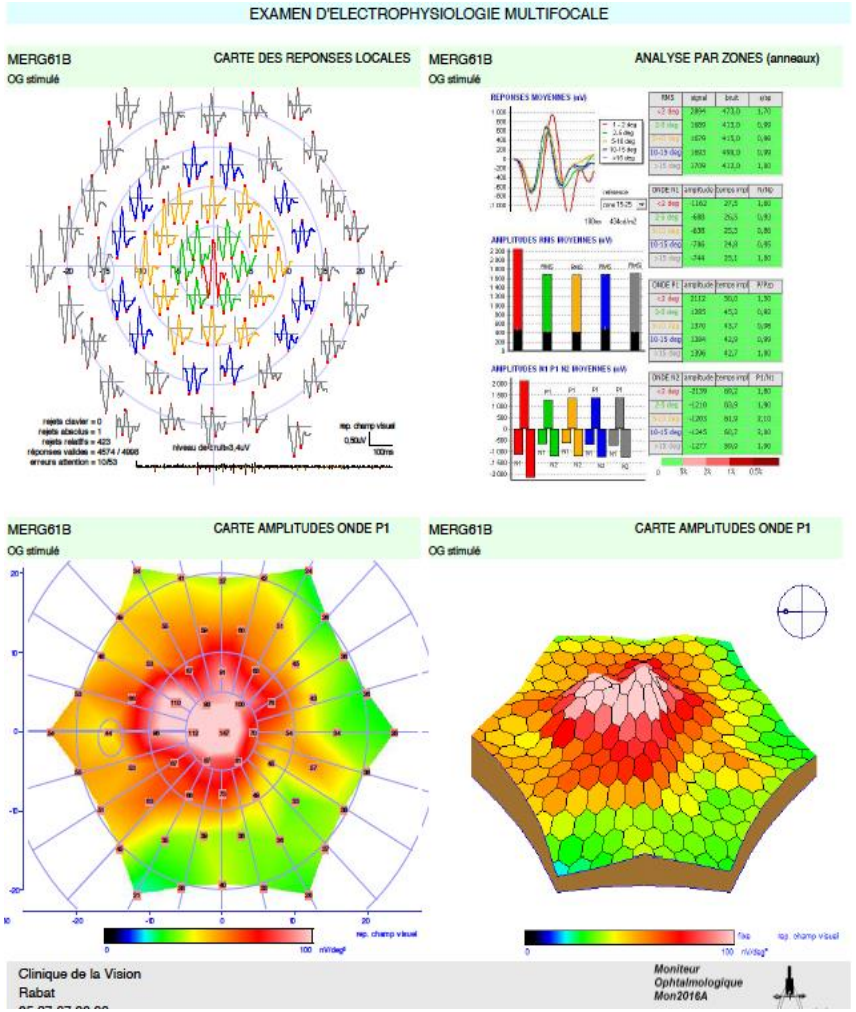
- L H, 38 ans, ATCD=0
- BAV récente de l'OD,
- MAVC: **<u>OD: 4/10</u>**

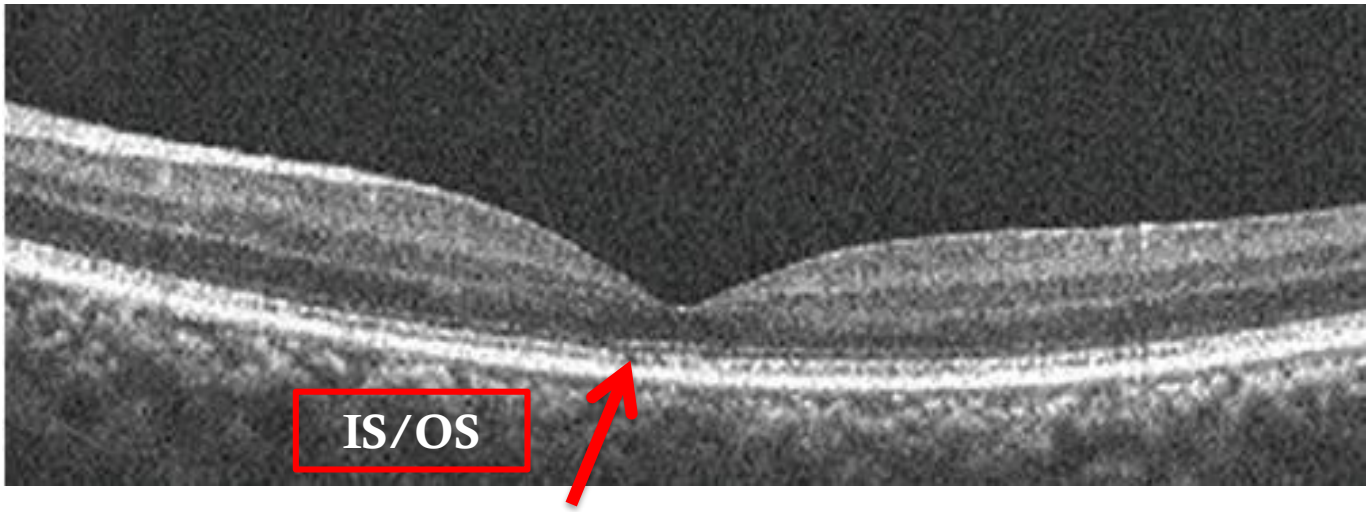
  OG: 10/10
- LAF + FO+ AF: RAS
- OCT macula: RAS?



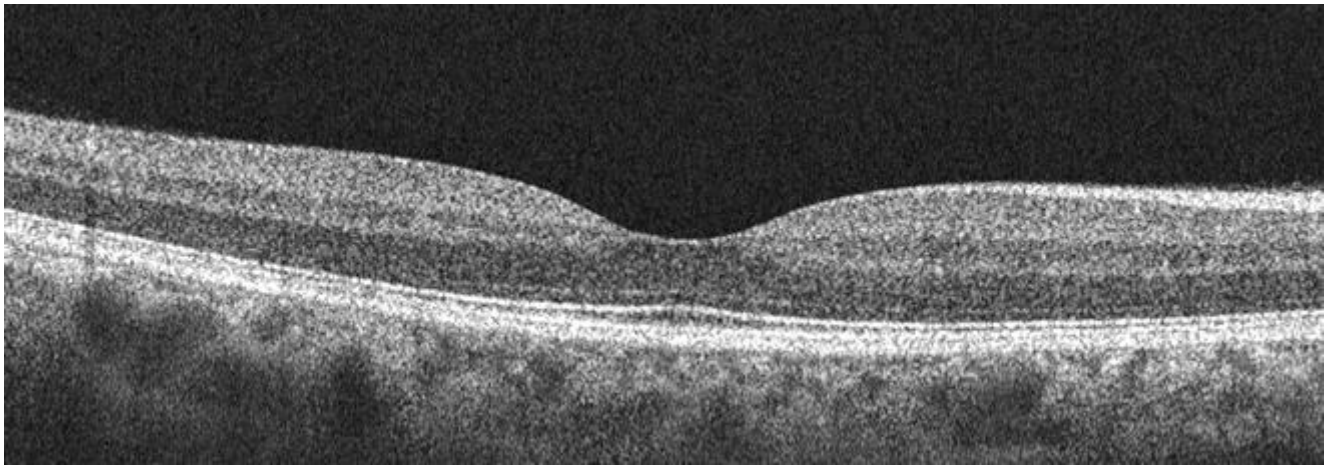

EXAMEN D'ELECTROPHYSIOLOGIE VISUELLE
PEV flashs 1mn 6s Val= 60 Rej= 0
OD stimulé
PEV flashs 3mn 20s Val= 60 Rej= 0
OG stimulé
PEV flashs 2mn 36s Val= 60 Rej= 0
BI stimulé
PEV damier 60' 0mn 49s Val= 60 Rej= 0
OD stimulé
PEV damier 30' 2mn 2s Val= 55 Rej= 0
OD stimulé
PEV damier 15' 2mn 54s Val= 55 Rej= 0
OD stimulé
PEV damier 60' 1mn 7s Val= 60 Rej= 0
OG stimulé
PEV damier 30' 2mn 6s Val= 60 Rej= 0
OG stimulé
PEV damier 15' 3mn 1s Val= 60 Rej= 0
OG stimulé
5 uV
LOBE D
LOBE G
Clinique de la Vision
Rabat
Moniteur
Ophtalmologique
Mon2016A


EXAMEN D'ELECTROPHYSIOLOGIE MULTIFOCALE
MERG61B
CARTE DES REPONSES LOCALES
OD stimulé
MERG61B
ANALYSE PAR ZONES (anneaux)
OD stimulé
MERG61B
CARTE AMPLITUDES ONDE P1
OD stimulé
MERG61B
CARTE AMPLITUDES ONDE P1
OD stimulé
Clinique de la Vision
Rabat
Moniteur
Ophtalmologique
Mon2016A


EXAMEN D'ELECTROPHYSIOLOGIE MULTIFOCALE
MERG61B
CARTE DES REPONSES LOCALES
OG stimulé
MERG61B
ANALYSE PAR ZONES (anneaux)
OG stimulé
MERG61B
CARTE AMPLITUDES ONDE P1
OG stimulé
MERG61B
CARTE AMPLITUDES ONDE P1
OG stimulé
Clinique de la Vision
Rabat
Moniteur
Ophtalmologique
Mon2016A



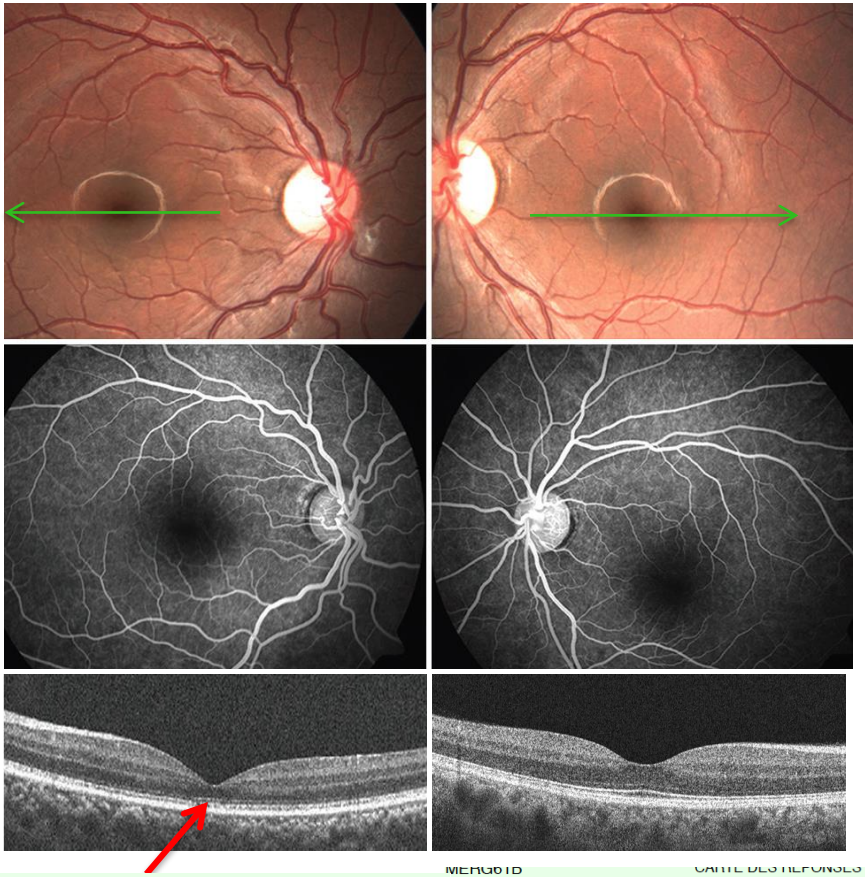
OD

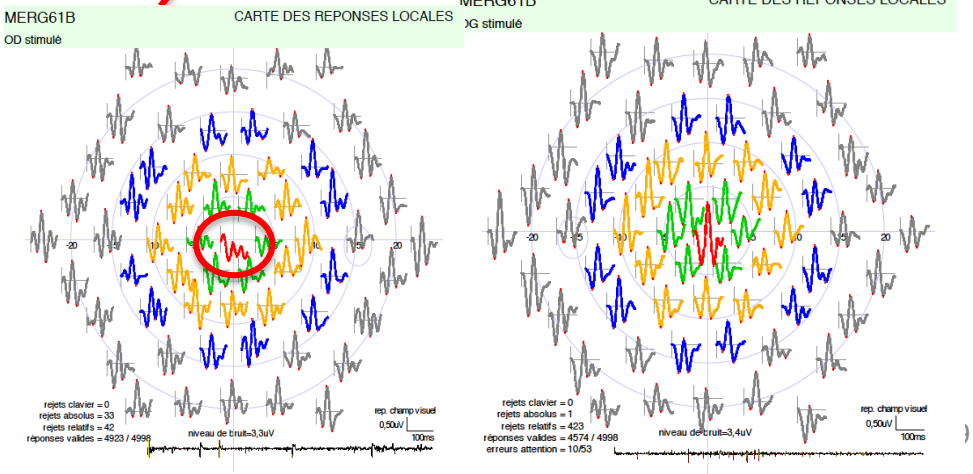


OG

CAS N°1

- L H, 38 ans, ATCD=0
- BAV récente de l'OD,
- MAVC: **<u>OD: 4/10</u>**, OG: 10/10
- LAF + FO+ AF: RAS



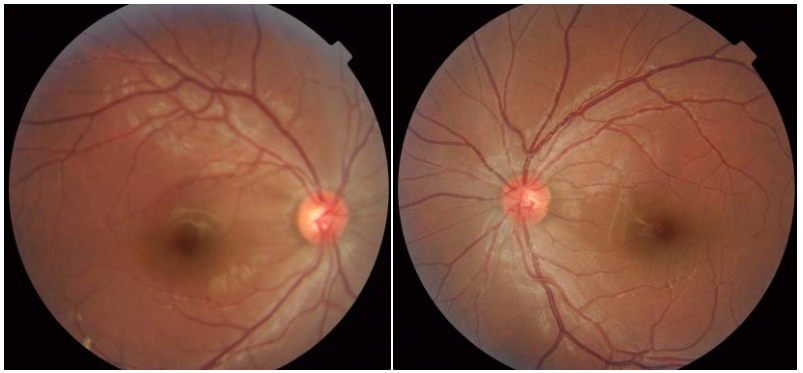


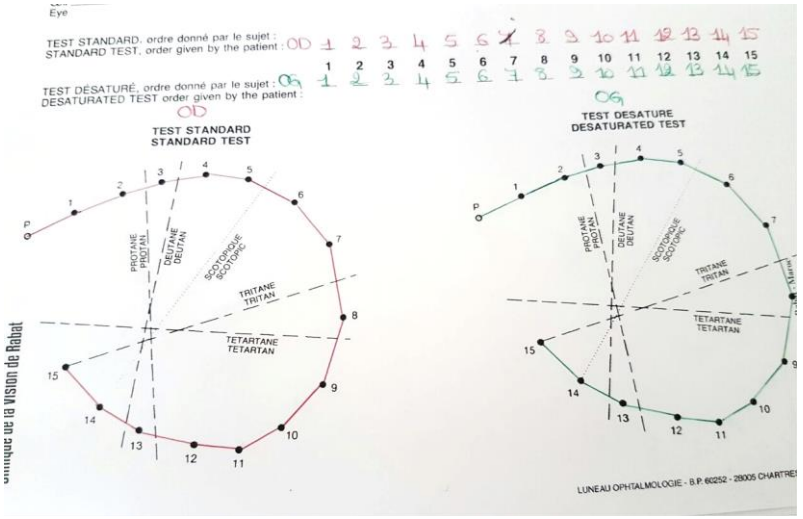
Diagnostic:

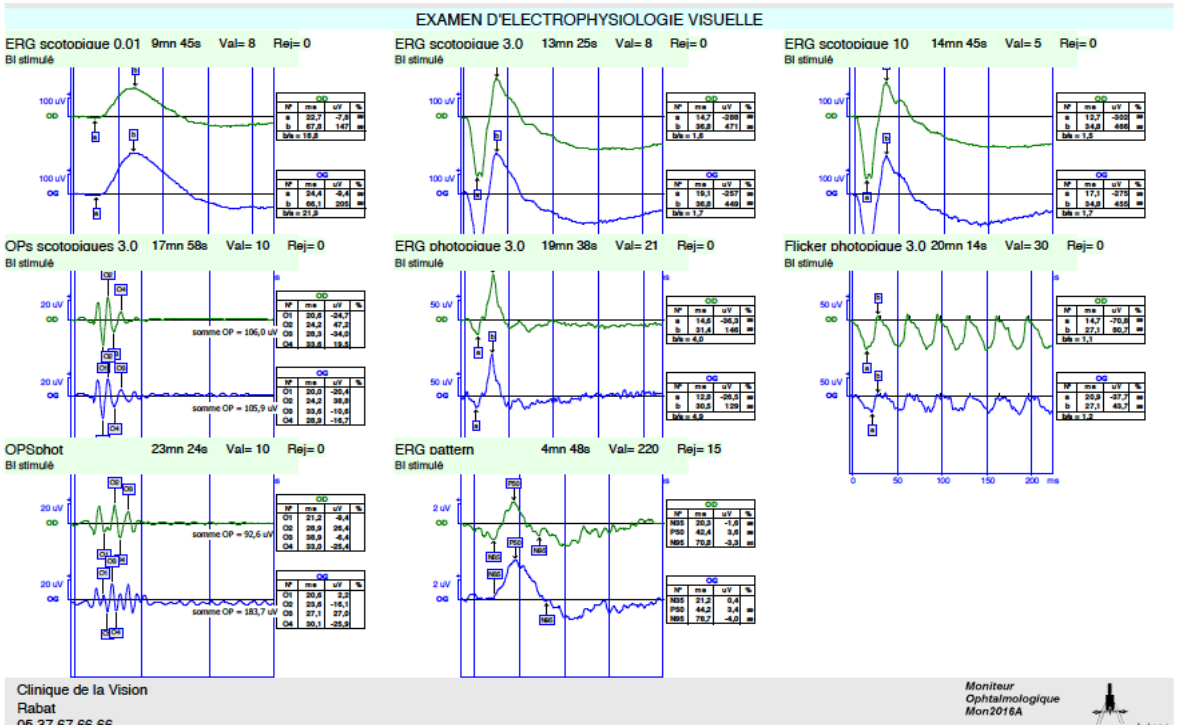
dystrophie maculaire occulte ?

CAS N°2

- D F, 44 ans,
- Traitée pour Lupus
- Nivaquine: 300 mg/j, 10 ans,
- Dépistage de rétinopathie/APS
- AV: ODG: 10/10
- FO: normal ODG
- VC 15 hue: RAS






EXAMEN D'ELECTROPHYSIOLOGIE VISUELLE
ERG scotopique 0.01 9mn 45s Val= 8 Rej= 0
BI stimulé
ERG scotopique 3.0 13mn 25s Val= 8 Rej= 0
BI stimulé
ERG scotopique 10 14mn 45s Val= 5 Rej= 0
BI stimulé
OPs scotopiques 3.0 17mn 58s Val= 10 Rej= 0
BI stimulé
ERG photopique 3.0 19mn 38s Val= 21 Rej= 0
BI stimulé
Flicker photopique 3.0 20mn 14s Val= 30 Rej= 0
BI stimulé
OPSphot 23mn 24s Val= 10 Rej= 0
BI stimulé
ERG pattern 4mn 48s Val= 220 Rej= 15
BI stimulé
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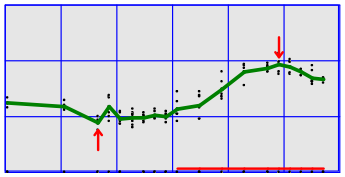
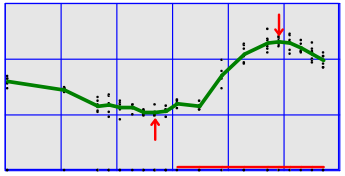
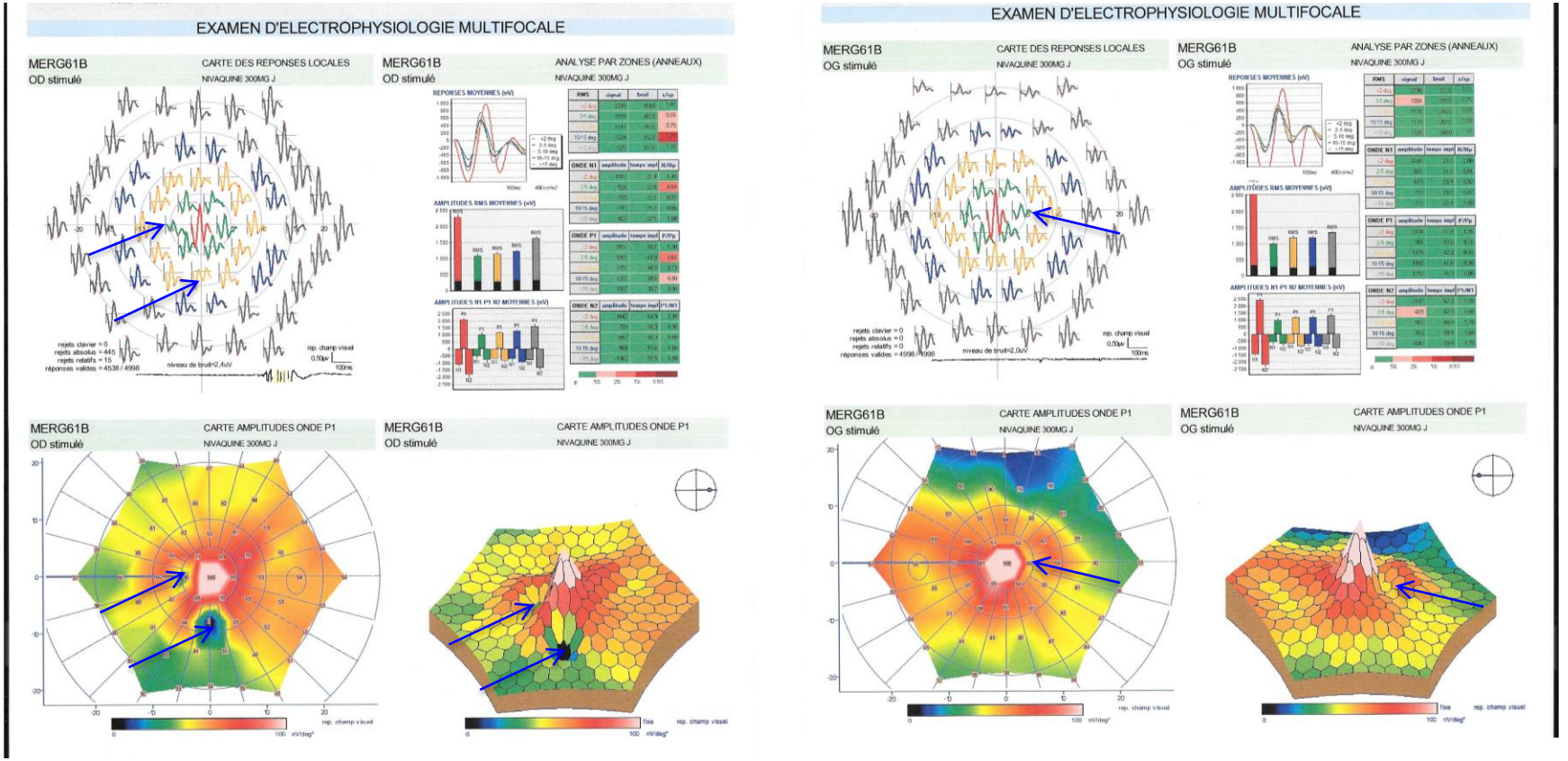




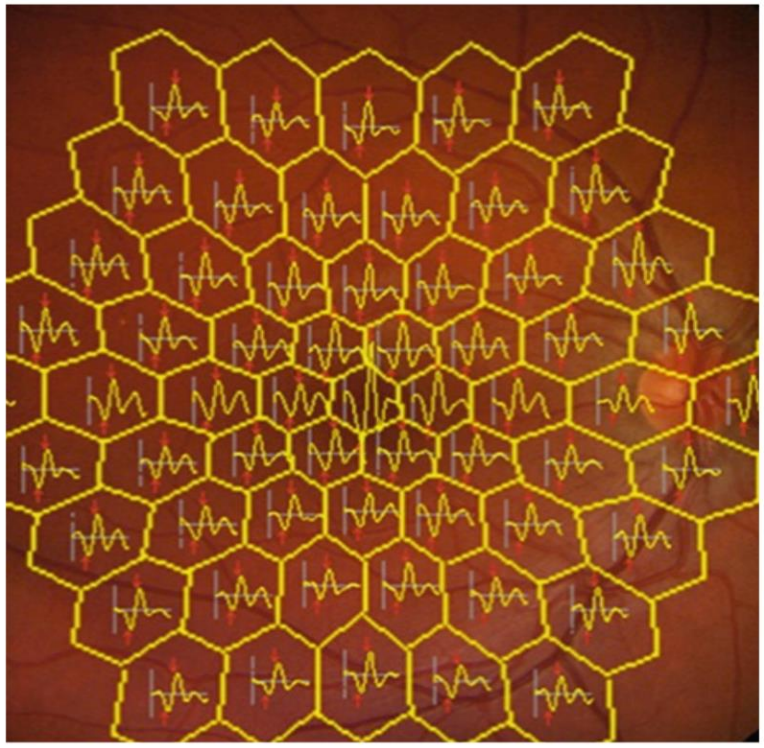


Rétinopathie à la chloroquine: stade pré-clinique

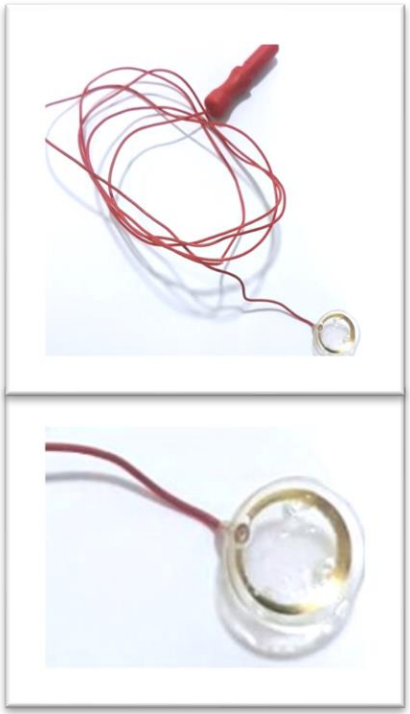
PRINCIPE DE L'ERG MULTIFOCAL

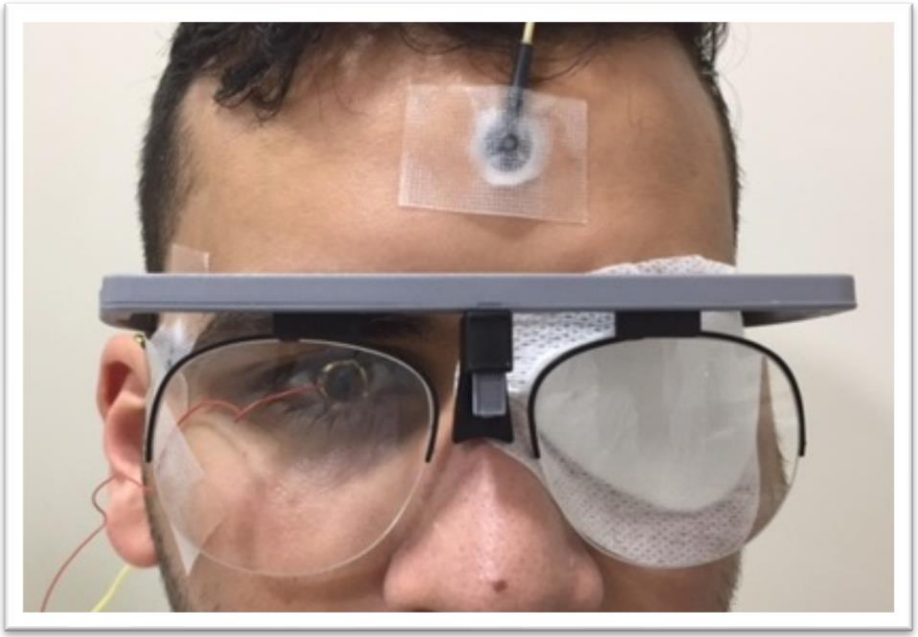
- Projeter sur le pôle post une matrice de petites **surfaces hexagonales, conjoint** de tailles **croissantes** (61, 103, 243…)
- Anneaux concentriques autour de **l'aire fovéale**
- ERG restreint à la surface testée, amplitudes comparables

Mosaïque de 61 hexagones



DÉROULEMENT DE L'EXAMEN



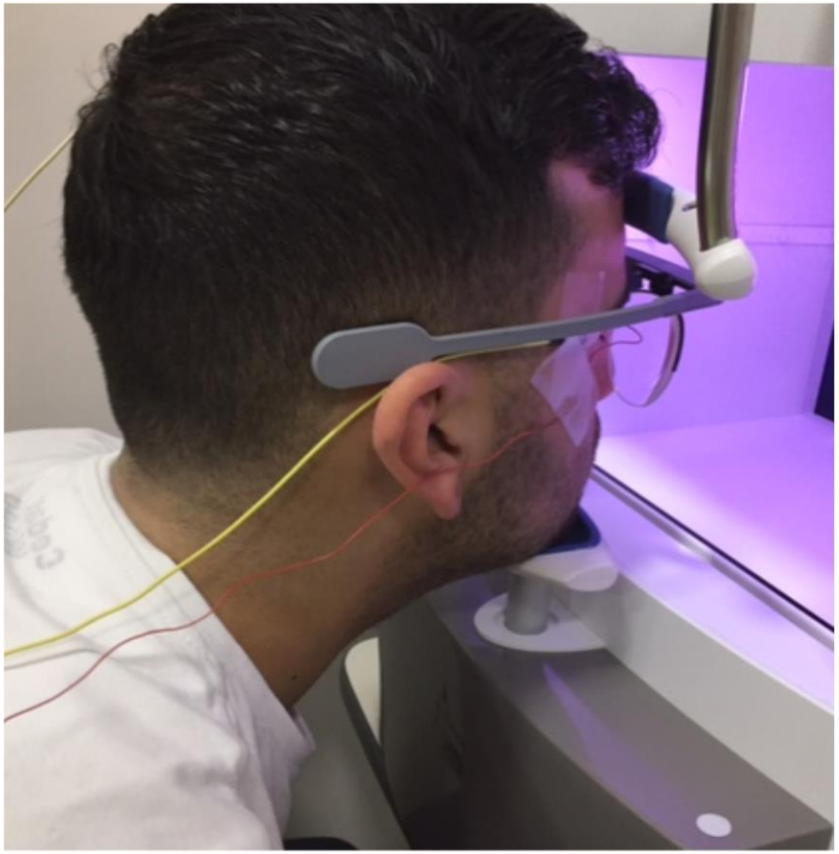


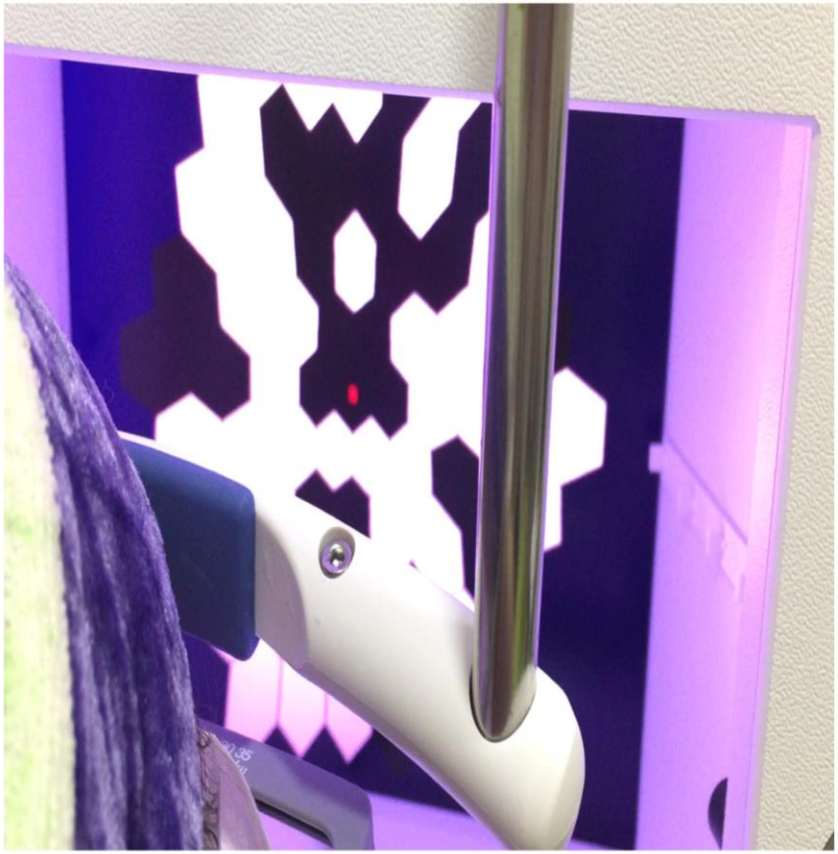
Pupilles dilatées, CO 30 cm

Électrodes cornéennes: ERG-jet (anesthésie topique)

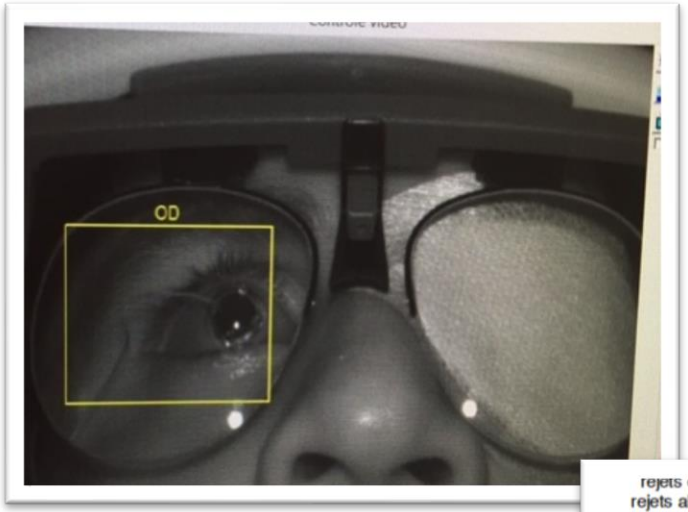
Stimulation monoculaire

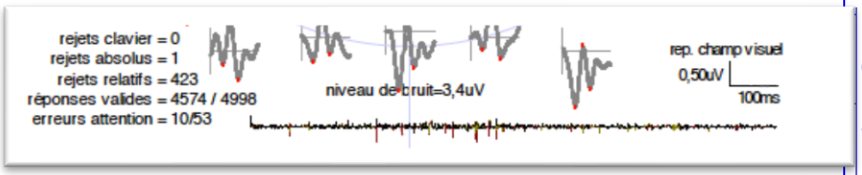
DEROULEMENT DE L'EXAMEN



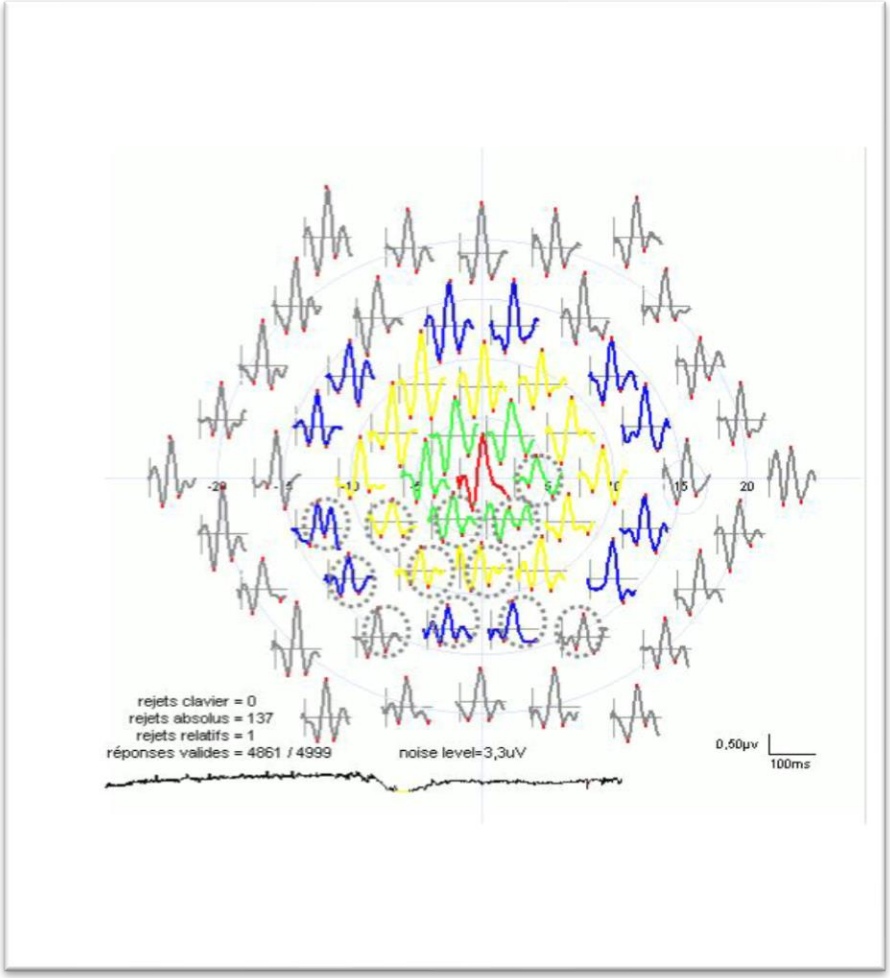


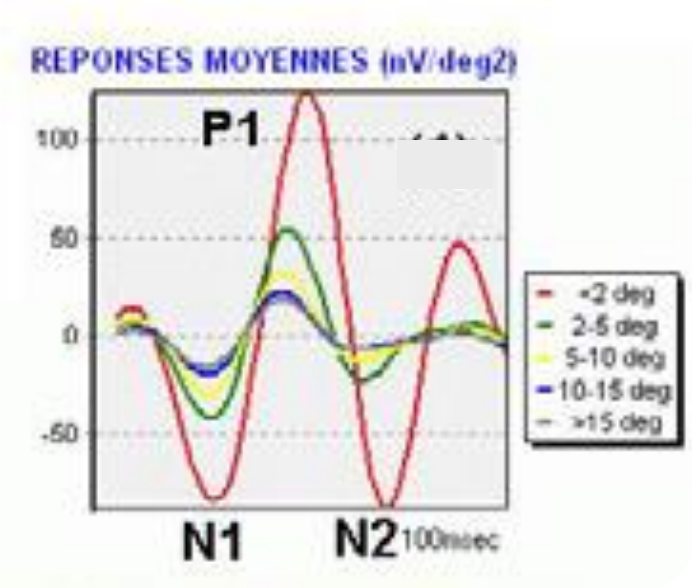
STABILITÉ DE LA FIXATION



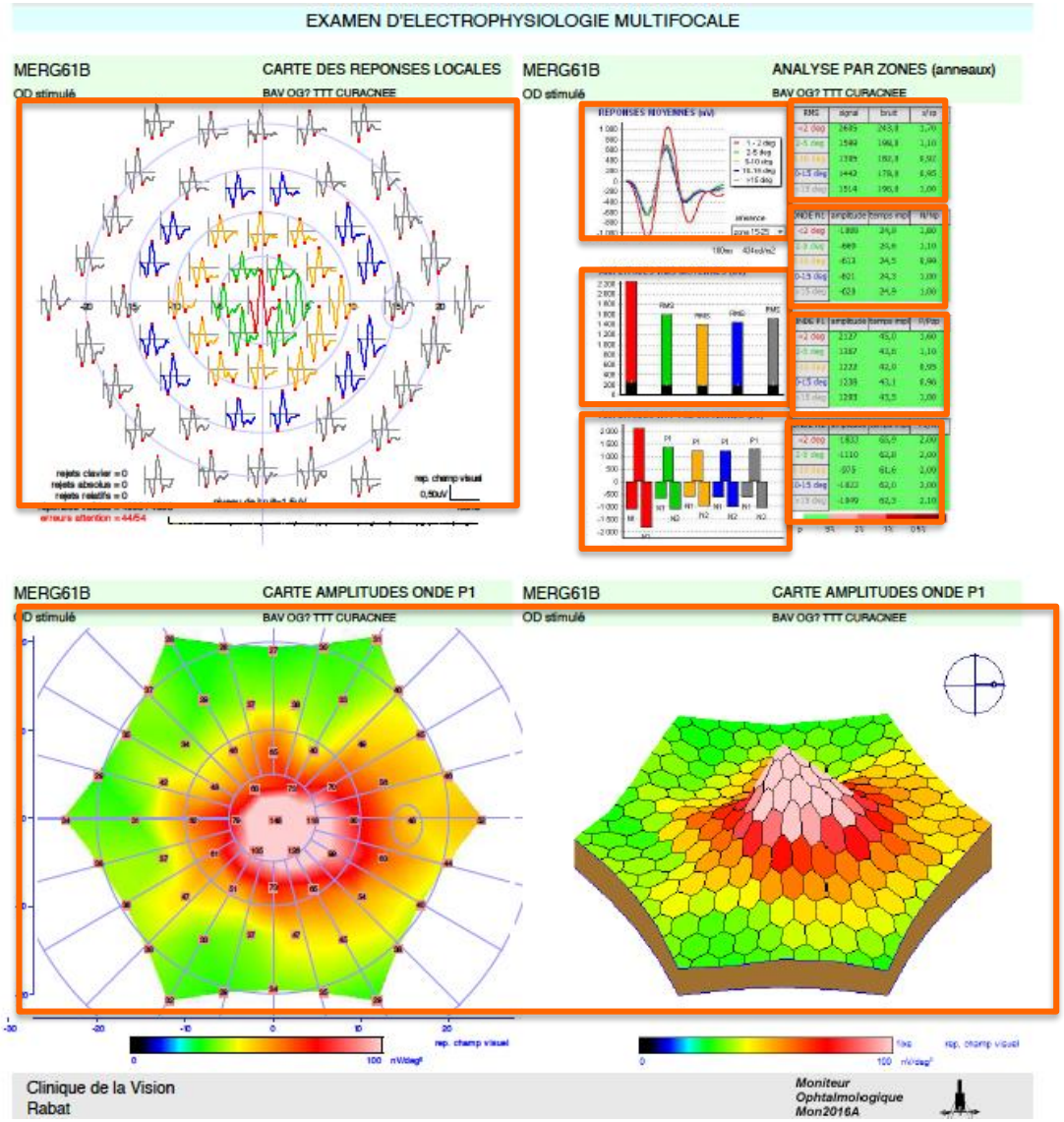


RESULTATS DE L'ERG MF





REPRÉSENTATION ET INTERPRÉTATION DES RÉSULTATS



INDICATIONS DU MF ERG

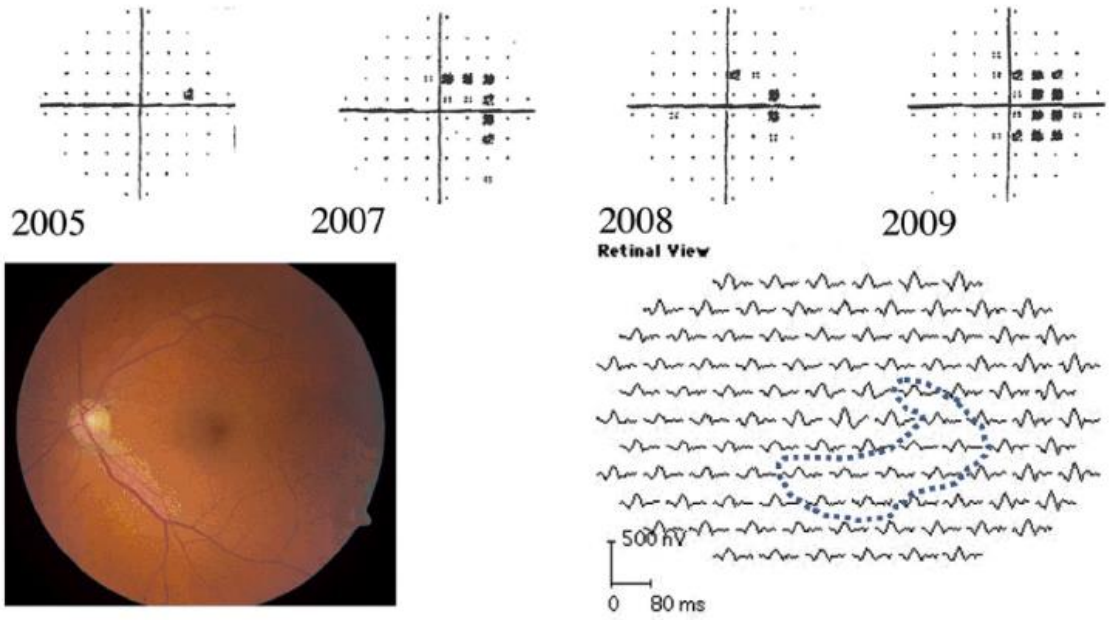
- Maculopathies (acquises ou congénitales):
  - Acquises:
    - **Toxicité médicamenteuse (APS +++)**
    - Inflammations rétiniennes (MEWDS, AZOOR, Birdshot syndrome….)
    - DMLA, RD, CRSC, trou maculaire, MER, OVR,
  - Congénitales (dystrophies)
    - Stargardt (SMD), OMD, cone-rod et rod-cone dystrophies, Best…

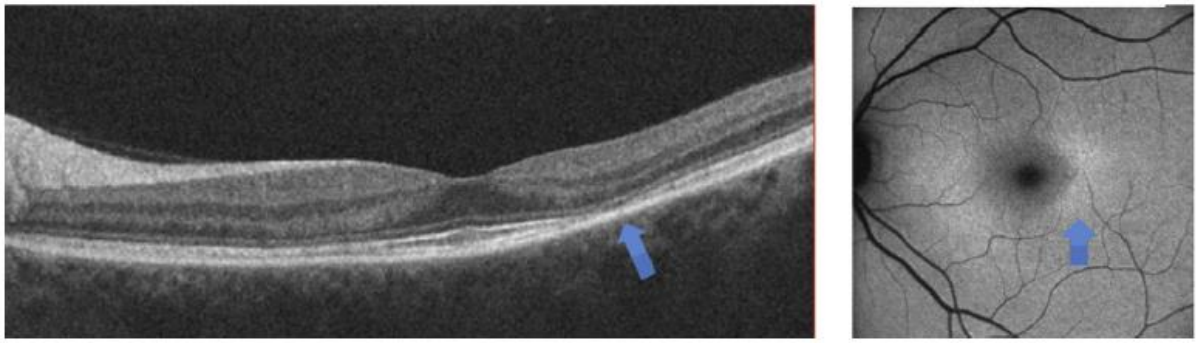
Rétinopathie à la chloroquine et à l'hydroxychloroquine(CQ, HCQ)

- Lupus, PR, maladies inflammatoires, dermatologiques…
- Prévalence globale variable: 0,5%-7,5% (1)
- Risque très dépendant de la dose quotidienne/kg (poids réel)
- Altération des PR puis de l'EPR parafovéolaires
- 5 -10 degrés centraux (2ème, 3ème anneaux): maculopathie en « oeil de bœuf »
- Potentiellement irréversible, pas de TTT, progression possible après l'arrêt TTT

1. Melles RB, Marmor MF. The risk of toxic retinopathy in patients on long-term hydroxychloroquine therapy. JAMA Ophthalmol 2014;132:1453–60.

Maculopathie à l'HCQ





HCQ: 8 mg /kg X 25 ans

Marmor et al 2011 (2)

2. Marmor MF, Kellner U, Lai TY, et al. Revised recommendations on screening for chloroquine and hydroxychloroquineretinopathy. Ophthalmology 2011;118:415–22.

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American Academy of Ophthalmology Statement

Recommendations on Screening for Chloroquine and Hydroxychloroquine Retinopathy (2016 Revision)

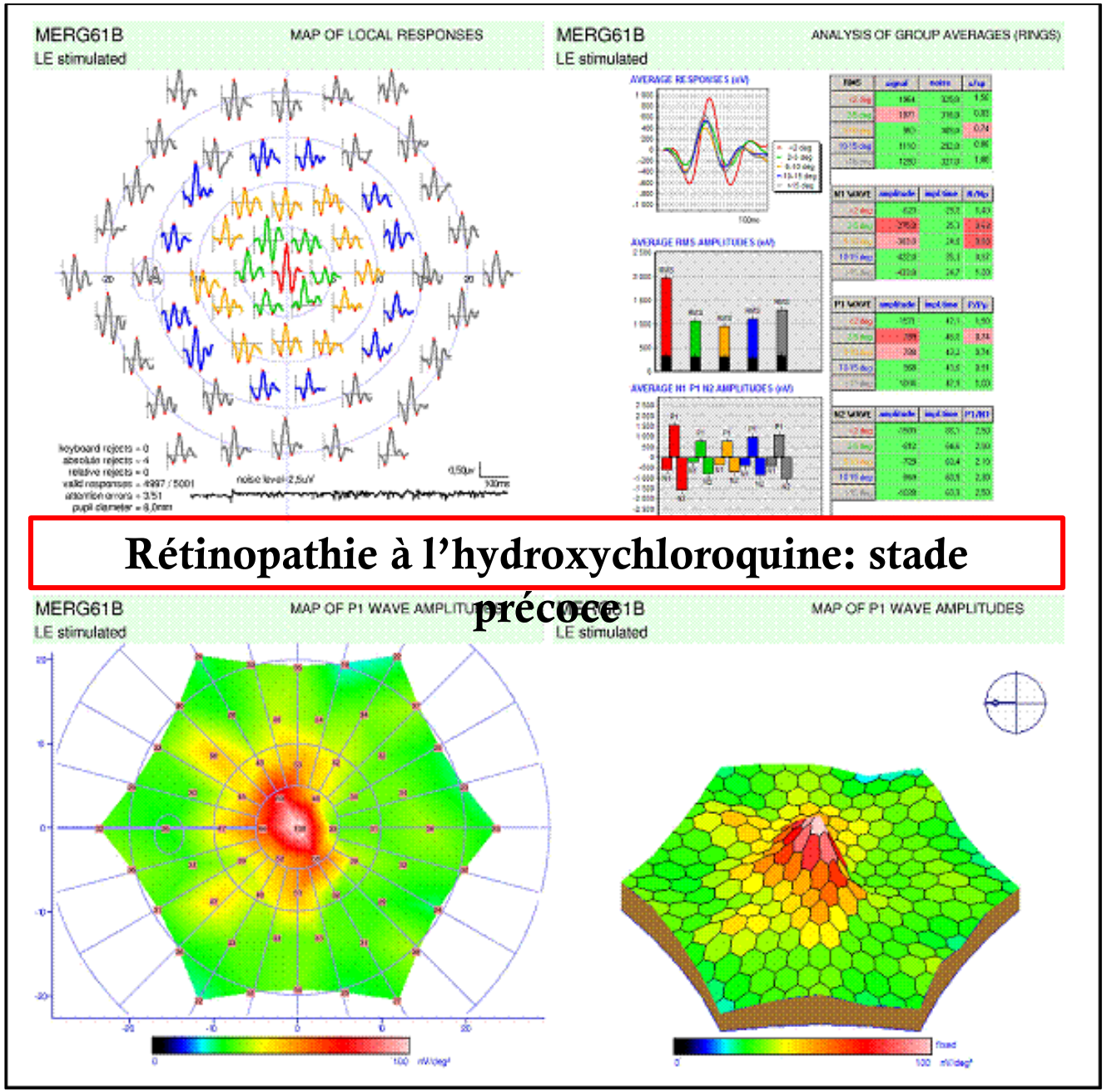
RECOMMENDED

Michael F. Marmor, MD,[1] Ulrich Kellner, MD,[2] Timothy Y.Y. Lai, MD, FRCOphth,[3] Ronald B. Melles, MD,[4] William F. Mieler, MD,[5] for the American Academy of Ophthalmology

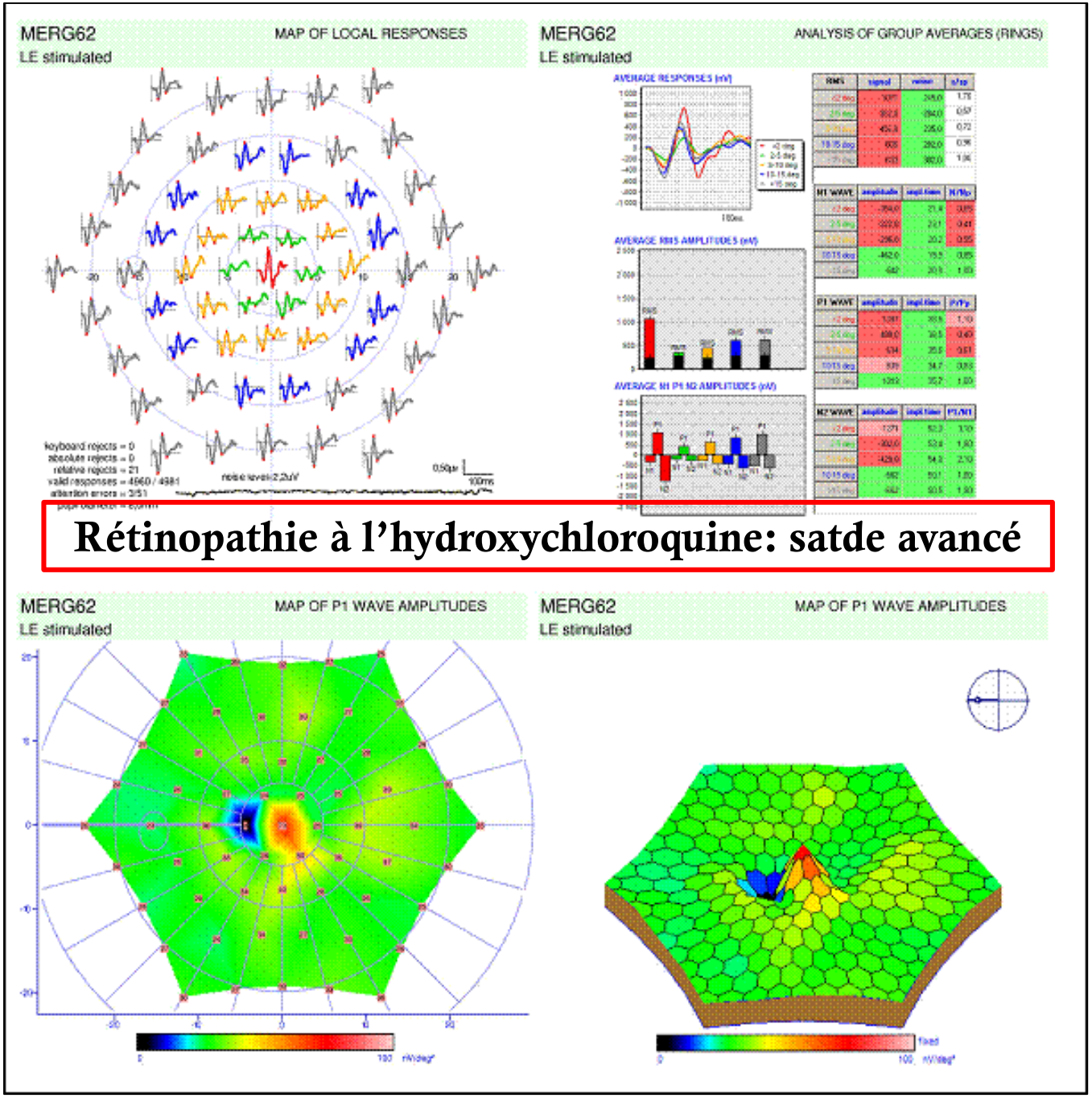
Table 3. Clinical Examination Techniques

Not Recommended for Screening
Fundus examination
Time-domain OCT
Fluorescein angiography
Full-field ERG
Amsler grid
Color testing
EOG

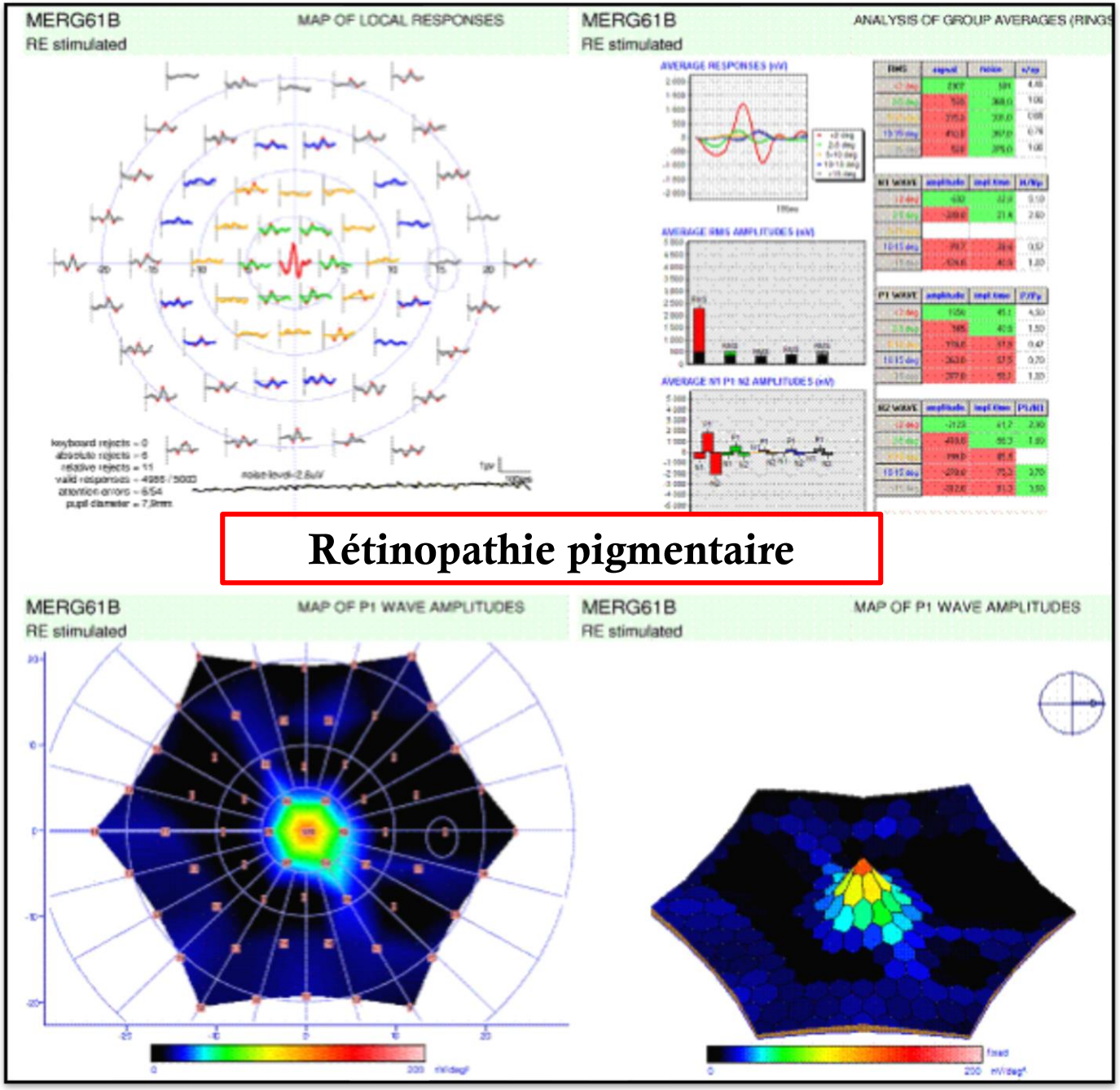
EOG = electro-oculogram; ERG = electroretinogram; FAF = fundus autofluorescence; mfERG = multifocal electroretinogram; SD OCT = spectral-domain optical coherence tomography.



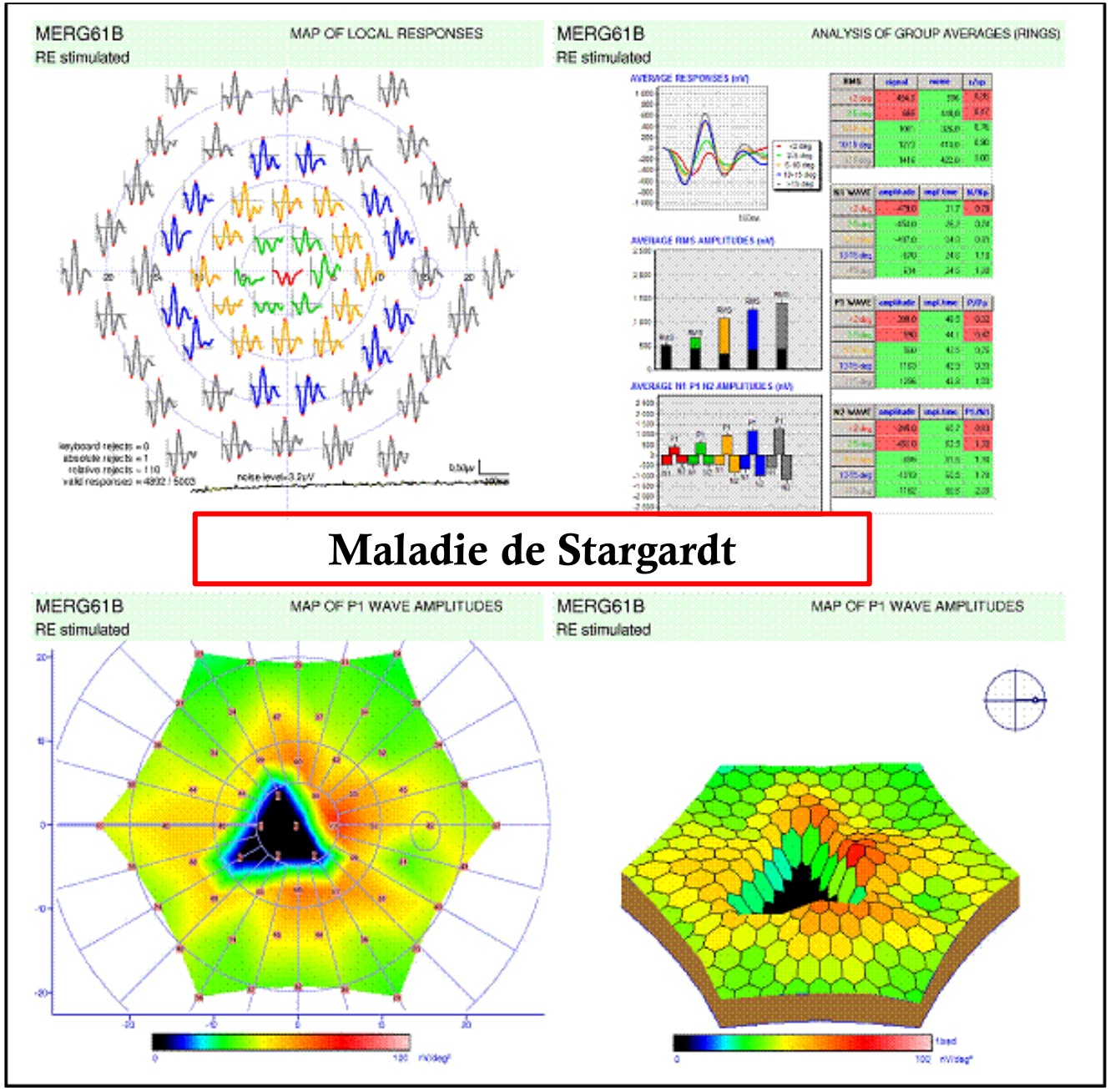
Rétinopathie à l'hydroxychloroquine: stade précoce

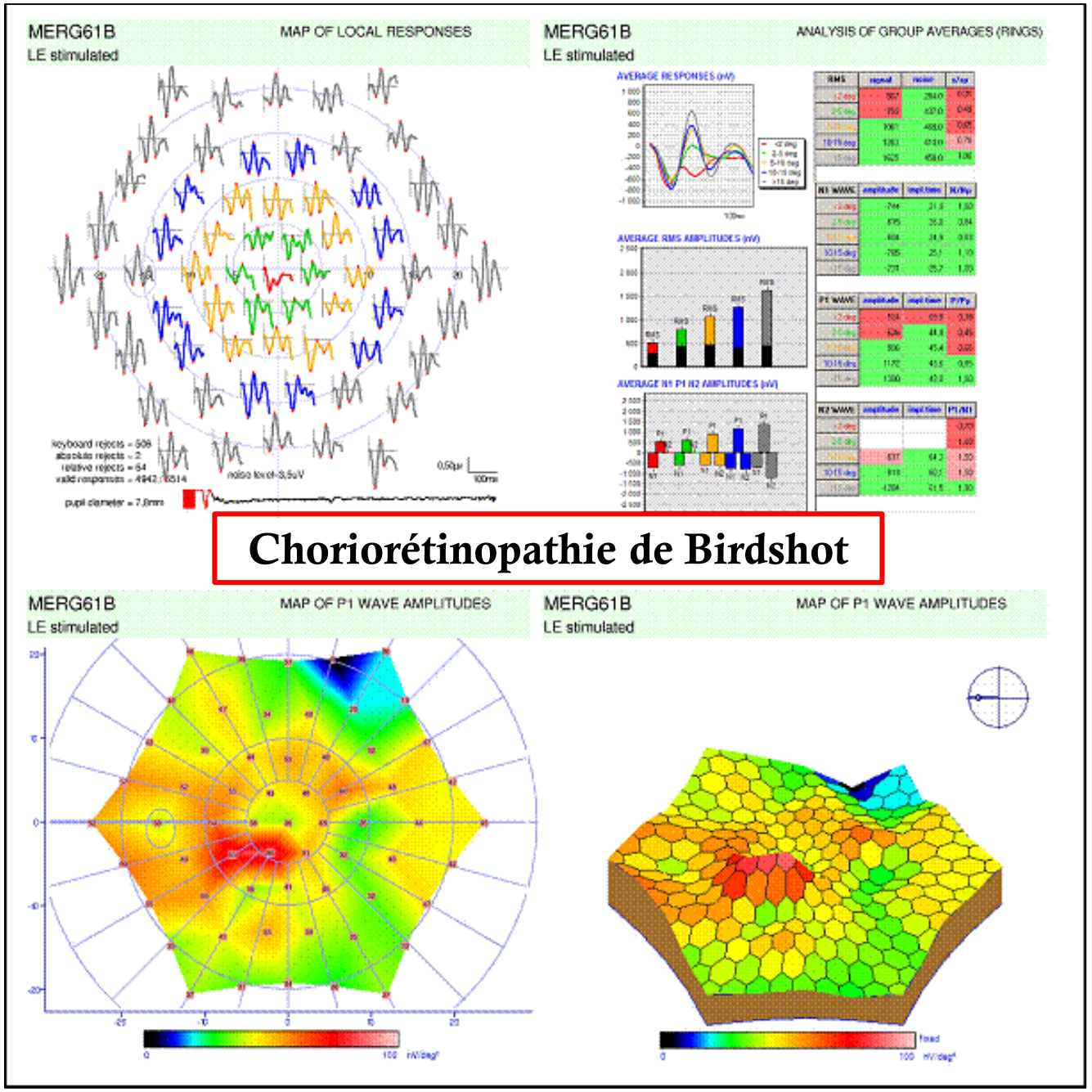

MERG62
LE stimulated
MAP OF LOCAL RESPONSES
MERG62
LE stimulated
ANALYSIS OF GROUP AVERAGES (RINGS)
AVERAGE RESPONSES (nV)
AVERAGE RMS AMPLITUDES (nV)
AVERAGE N1 P1 N2 AMPLITUDES (nV)
Rétinopathie à l'hydroxychloroquine: satde avancé
MERG62
LE stimulated
MAP OF P1 WAVE AMPLITUDES
MERG62
LE stimulated
MAP OF P1 WAVE AMPLITUDES

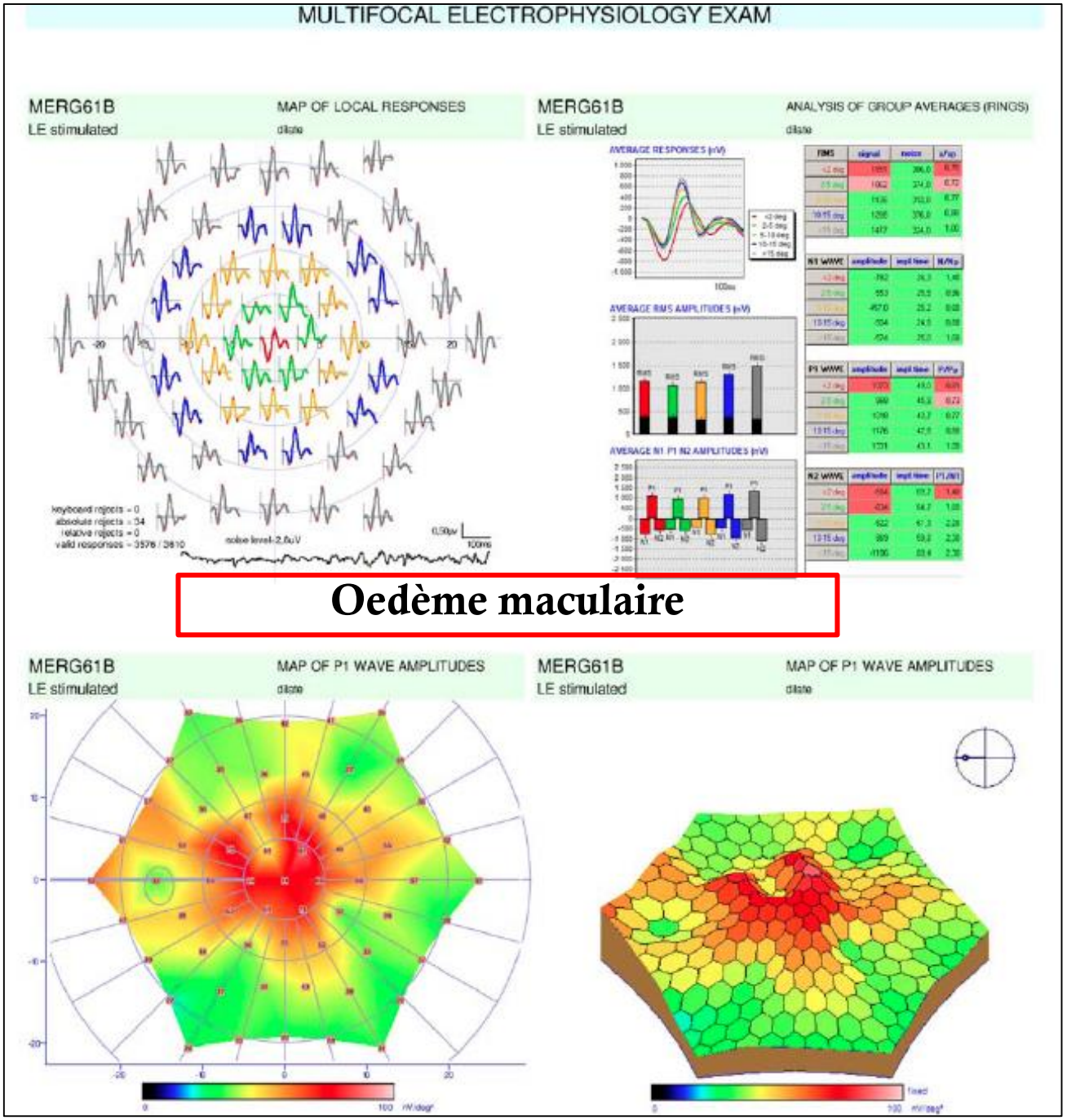
AUTRES EXEMPLES D'APPLICATION DE L'ERG MULTIFOCAL

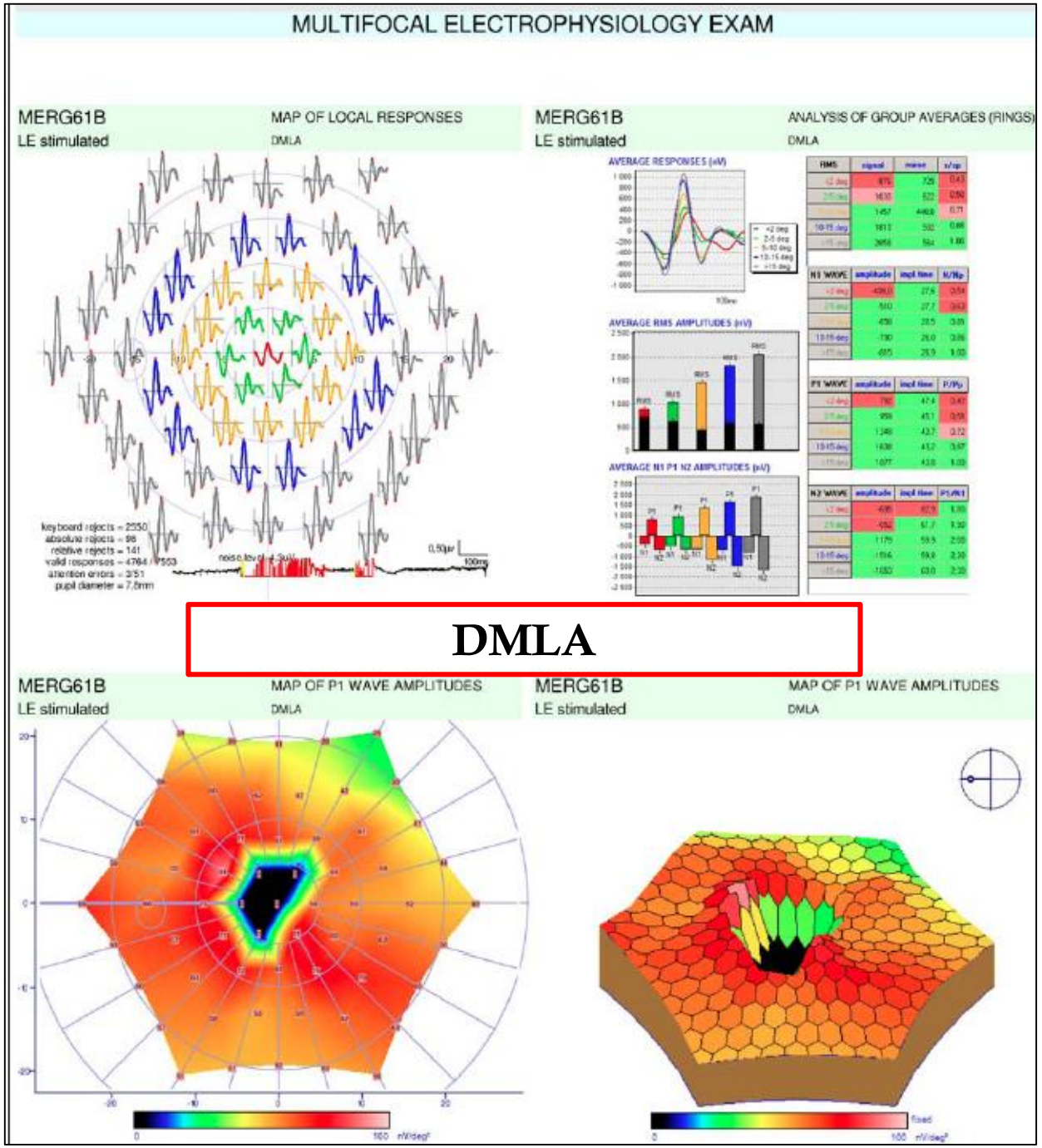


Rétinopathie pigmentaire


MERG61B
RE stimulated
MAP OF LOCAL RESPONSES
MERG61B
RE stimulated
ANALYSIS OF GROUP AVERAGES (RINGS)
AVERAGE RESPONSES (nV)
AVERAGE RMS AMPLITUDES (nV)
AVERAGE N1 P1 N2 AMPLITUDES (nV)
Maladie de Stargardt
MERG61B
RE stimulated
MAP OF P1 WAVE AMPLITUDES
MERG61B
RE stimulated
MAP OF P1 WAVE AMPLITUDES


MERG61B
MAP OF LOCAL RESPONSES
LE stimulated
MERG61B
ANALYSIS OF GROUP AVERAGES (RINGS)
LE stimulated
AVERAGE RESPONSES (nV)
AVERAGE RMS AMPLITUDES (nV)
AVERAGE N1 P1 N2 AMPLITUDES (nV)
Choriorétinopathie de Birdshot
MERG61B
MAP OF P1 WAVE AMPLITUDES
LE stimulated
MERG61B
MAP OF P1 WAVE AMPLITUDES
LE stimulated


MULTIFOCAL ELECTROPHYSIOLOGY EXAM
MERG61B
LE stimulated
MAP OF LOCAL RESPONSES
dilate
MERG61B
LE stimulated
ANALYSIS OF GROUP AVERAGES (RINGS)
dilate
AVERAGE RESPONSES (nV)
AVERAGE RMS AMPLITUDES (nV)
AVERAGE N1 P1 N2 AMPLITUDES (nV)
Oedème maculaire
MERG61B
LE stimulated
MAP OF P1 WAVE AMPLITUDES
dilate
MERG61B
LE stimulated
MAP OF P1 WAVE AMPLITUDES
dilate


MULTIFOCAL ELECTROPHYSIOLOGY EXAM
MERG61B
LE stimulated
MAP OF LOCAL RESPONSES
DMLA
keyboard rejects = 2550
absolute rejects = 98
relative rejects = 141
valid responses = 4764 / 9553
attention errors = 2/51
pupil diameter = 7.6mm
MERG61B
LE stimulated
ANALYSIS OF GROUP AVERAGES (RINGS)
DMLA
AVERAGE RESPONSES (nV)
AVERAGE RMS AMPLITUDES (nV)
AVERAGE N1 P1 N2 AMPLITUDES (nV)
DMLA
MERG61B
LE stimulated
MAP OF P1 WAVE AMPLITUDES
DMLA
MERG61B
LE stimulated
MAP OF P1 WAVE AMPLITUDES
DMLA

DMLA

TAKE HOME MESSAGES

- L'ERG flash peut occulter des déficits de fonctionnement **localisés** et **non systématisés** de la rétine centrale
- L'ERG multifocal détecte ces déficits et les localise
- Appoint important à l'imagerie multimodale moderne
- Doit **toujours** être interprété associé aux renseignements cliniques et aux résultats **des autres explorations**