

## How to perform electroretinography

According to ISCEV standard (International Society for Clinical Electrophysiology of Vision, ISCEV Standard for full-field clinical electroretinography, 2008 update) the following tests are recommended to be performed:

Name according to the standard	Formerly name	Name in Neuro-MEP software
Light-adapted 3.0 ERG	Single-flash cone response	Cones
Light-adapted 3.0 flicker ERG	30 Hz flicker	Flicker
Dark-adapted 0.01 ERG	Rod response	Rods
Dark-adapted 3.0 ERG	Maximal or standard combined rod–cone response	Maximal response
Dark-adapted 3.0 oscillatory potentials	Oscillatory potentials	Oscillatory potentials

Local ERG (macular or focal ERG) is an additional test and there is no international standard for it.

### Room selection

It is required to have a room without windows or to cover windows in order to exclude the possibility of sun light appears in the room.

### Electrodes placement

There are two kinds of ERG electrodes in the Neuro-ERG delivery set: hook and loop.

Hook is got hold of the inferior eyelid.

Loop is placed under the eyelid or you can make a hook from the loop and get hold of the inferior eyelid.

Drop anesthetic in the patient eye some minutes before electrode placement.



Fig. 1. Hook electrode placement

Disinfect electrodes chemically before placement (see disinfectant solution manual) or put electrode in 70° alcohol for 1-2 minutes and after that wash carefully in sterile physiologic saline. After the exam wash electrodes in water with soap. Loop electrode is disposable.

Connect retinal electrode to the “+” plug of amplifier. Reference to the “-” plug.

Use ear electrodes as the reference and ground ones (like in EEG) or use cup electrodes (like for evoked potentials). Place reference and ground electrodes on the earlaps.

The skin should be prepared by cleaning, and a suitable conductive paste or gel should be used to ensure good electrical connection. Wipe the skin in the places of recording electrodes positioning with the cotton wool moistened in an alcohol. Use abrasive paste if needed.

Keep the ear electrodes in 0.9% sodium-chloride solution (physiological solution) during 5-10 minutes before the exam start.

Place cup electrodes using adhesive paste.

Place “-” ipsilateral (i.e. on the same side as retinal electrode), place ground electrode on the opposite ear. But according to our experience it does not influence on the final data.

Take care of impedance: it should not be more than 5 kOhm.

### **Tests order**

You can choose order of the tests to perform according to the standard. Start from the tests which need light adaptation and are performed in photopic conditions (light in the room is turned on). Then perform tests in scotopic conditions (light in the room is turned off) after dark adaptation occurs. As example you can use the following tests order:

1. Local ERG (use white or red penlight with concentrator, photopic conditions)
2. Cones ERG (use ganzfeld stimulator or red, green or blue penlight without concentrator, photopic conditions)
3. Flicker ERG (use ganzfeld stimulator, photopic conditions)
4. Rods ERG (use ganzfeld stimulator or blue penlight without concentrator, scotopic conditions)
5. Oscillatory potentials (use ganzfeld stimulator, scotopic conditions)

Start from the stronger eye and then repeat all tests for the other one. Results reproducibility is the criteria of tests significance. Therefore repeat each test twice as minimum.

## 1. Local ERG

Use red penlight. Red cones are dominating in the macula centre so using red light we are more confident that we are stimulating eye centre exactly.

Stimulus intensity is 0 logarithmical units. It means that flash brightness is maximal.

Light in the room is turned on.

Stimulate macula from 5-7 mm distance.



Fig. 2. Position of the penlight for local ERG test

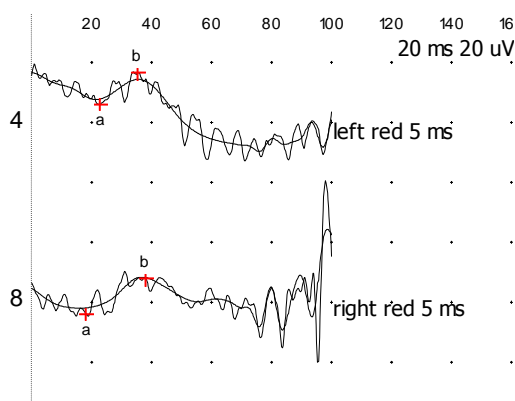


Fig. 3. Local ERG curves in Neuro-MEP software. Real and smoothed curves are displayed

Local ERG it is an additional, optional test. Here we stimulate only 18° of the retina therefore the resulting response is unstable, often has low amplitude and multiple test performing sometimes are needed.

## 2. Cones ERG

Use ganzfeld stimulator.

Stimulus intensity is 0 logarithmical units. It means that flash brightness is maximal.

Background illumination in ganzfeld stimulator is turned on.

Light in the room is turned on.

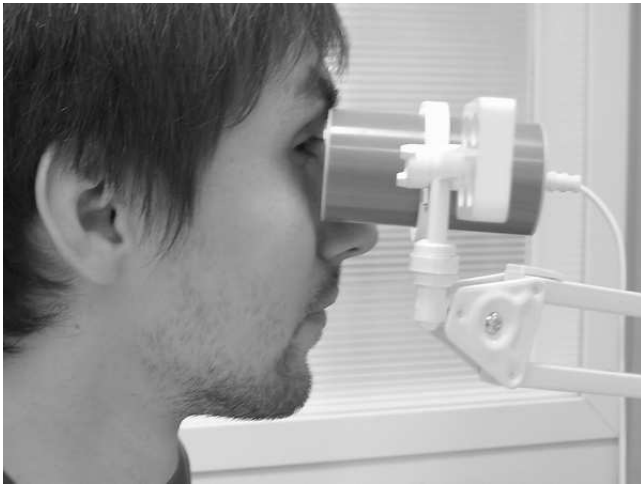


Fig. 4. Positioning of the ganzfeld stimulator

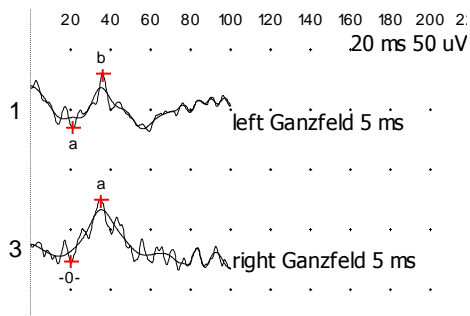


Fig. 5. Cone response

### 3. Flicker ERG

Use ganzfeld stimulator.

Background illumination in ganzfeld stimulator is turned on.

Light in the room is turned on.

Flash frequency is 30 Hz. According to the Standard brightness is 0 logarithmical units but some patients are not able to bear (tolerate) such brightness and you can decrease it but not less than -1 logarithmical units.

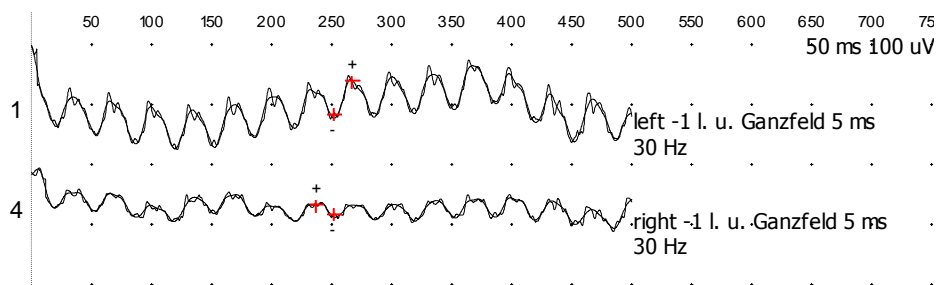


Fig. 6. Light-adapted 3.0 flicker ERG. Response reduction from the right side

#### 4. Rods ERG

Use ganzfeld stimulator.

Light in the room is turned off.

Stimulus intensity is -2 logarithmical units. It means 100 times less than maximum.

Dark adaptation is needed for some minutes before test so that rods become active.

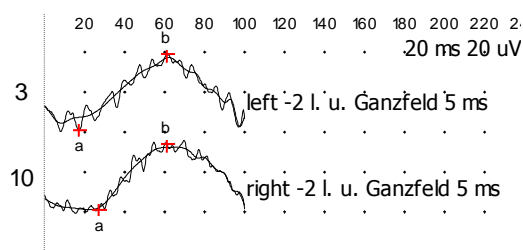


Fig. 7. Rod response

#### 5. Oscillatory potentials

Use ganzfeld stimulator.

Light in the room is turned off.

Stimulus intensity is 0 logarithmical units. It means that flash brightness is maximal.

Usually there are three major peaks often followed by a fourth smaller one. Simple observation of the presence of the three peaks and their normality relative to the standards of your laboratory is the aim of this test.

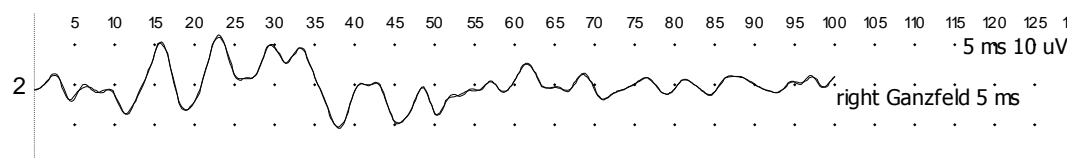


Fig. 8. Oscillatory potential

**Result reproducibility is the criteria of tests significance. Therefore repeat each test as minimum twice for each eye.** After the exam drop antiinflammatory drug in to the patients eyes.

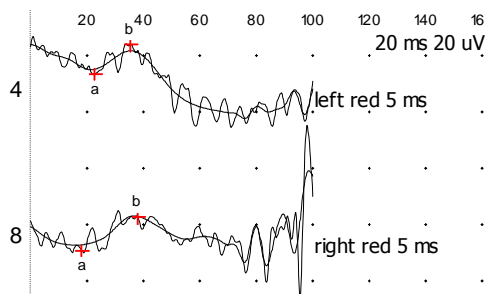
For more information please refer to the ISCEV Standard for full-field clinical electroretinography:  
<http://www.iscev.org/standards/index.html>

## Checkup protocol

**Patient:** Y. C., 5 years.

**Date:** 21.04.2010

### 1. Local ERG



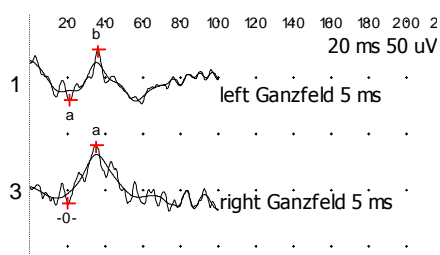
#### Amplitudes

Stimulus	Channel	Components	Ampl., uV(/)	Norm, uV	Dev., %
left eye red 5 ms	1	b	10,6	20,2	-47,7
right eye red 5 ms	1	b	11,8	20,2	-41,5

#### Latencies

Stimulus	Channel	Component	Lat., ms
left eye red 5 ms	1	a	22,6
		b	35,4
right eye red 5 ms	1	a	18
		b	38

### 2. Cones ERG



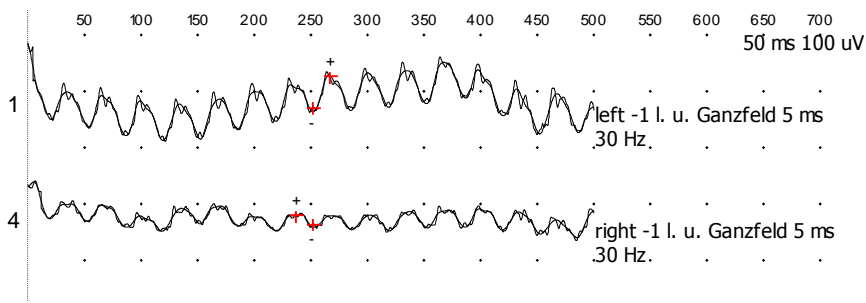
#### Amplitudes

Stimulus	Channel	Components	Ampl., uV(/)	Norm, uV	Dev., %
left eye Ganzfeld 5 ms	1	b	46,1	41	(N)
right eye Ganzfeld 5 ms	1	a	52,9	41	(N)

#### Latencies

Stimulus	Channel	Component	Lat., ms
left eye Ganzfeld 5 ms	1	a	21
		b	36
right eye Ganzfeld 5 ms	1	a	35

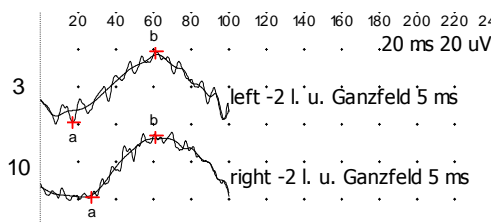
### 3. Flicker ERG



#### Amplitudes

Stimulus	Channel	Ampl., uV(/)	Norm, uV	Dev., %
left eye -1 l. u. Ganzfeld 5 ms	1	54	30	+80
right eye -1 l. u. Ganzfeld 5 ms	1	18,7	30	-37,7

### 4. Rods ERG



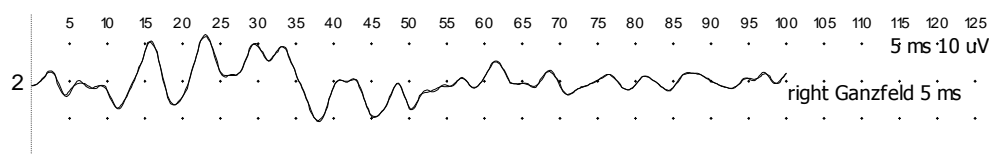
#### Amplitudes

Stimulus	Channel	Components	Ampl., uV(/)	Norm, uV	Dev., %
left eye -2 l. u. Ganzfeld 5 ms	1	b	37,2	110	-66,2
right eye -2 l. u. Ganzfeld 5 ms	1	b	33	110	-70

#### Latencies

Stimulus	Channel	Component	Lat., ms
left eye -2 l. u. Ganzfeld 5 ms	1	a	17
		b	61
right eye -2 l. u. Ganzfeld 5 ms	1	a	27
		b	61

### 5. Oscillatory potentials ERG



**Conclusion:**

1. Local ERG: mild decrease of response amplitude of both eyes
2. Cones ERG: normal for both eyes
3. Flicker ERG: normal for the right eye, mild decrease of response amplitude of the left eye
4. Rods ERG: significant decrease of response amplitude of both eyes (3 fold from lower limit of normal)

Moderate bilateral decrease in functional activity of peripheral retina.

Mild bilateral decrease in functional activity of central retina.

Cone dysfunction is more prominent in the right eye.

Recommendation: repeat test in a month to clarify the nature and the level of dysfunction.