Local diascleral stimulation of the peripheral retina: Influence on pupillary responses

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To study functions of the far peripheral retina, pupillary responses to diascleral light stimulation were measured at different stimulus positions along the retinal horizontal meridian in 9 subjects (14-27 yr.). A stimulus was a small light spot (1x3 mm, $2x10^5$ lx) projected onto the eye surface at 5 positions: at the canthus, ¼, ½, and ¾ of the distance from the canthus to the limbus, and at the limbus. Maxima of the pupil contraction were observed at positions ¼ and ¾. The stimulation near the limbus did not change pupil size. The reasons for the non-monotonic changes of the pupil contraction with changing stimulus position on the eye surface could be both anatomical and functional: differences in thickness and structure of tissues between eye surface and the retina, neuronal organization of the pupillary responses, etc. Taking this complexity into account is essential for interpretation of the outcomes of diascleral stimulation experiments.

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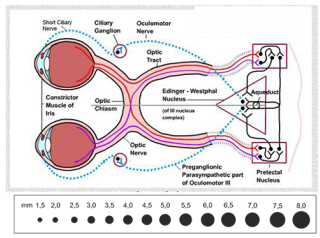
Introduction & Purpose

Taking into account the results of his experiments Yarbus proposed the hypothesis that a narrow retinal ring running along the *ora serrata* could be considered as a blind retina having certain specific functions [1].

The results of our previous work [2, 3] supported the view of Yarbus that the blind retina is really different from the adjacent sighting retina: light stimulation of the blind retina doesn't evoke clear visual images but exerts specific influence on perception in the form of paradoxical darkening of central stimuli.

We have reported also difficulties in experimental investigation such as impossibility to isolate the investigated mechanism and the dependence of concurrent relationship between simultaneously functioning mechanisms on the stimulus parameters.

For this reason, to continue our research, we needed additional information, in particular, about the pupil response to the diascleral stimulation.



Haab O. Atlas und Grundriss der Ophthalmoskopie und ophthalmoscopischen Diagnostik

We assumed that the pupillometry method would help us to get a more complete understanding of the processes in the visual system during our experiments. **Pupillometry** (measurement of pupil diameter) is used in clinic practice in order to clarify the localization of the pathological process that develops in the peripheral, intermediate or central parts of the innervation of the sphincter and dilatator of the pupil. Along with the long-proposed simple methods there are different modern types of pupillometry (laser, applique, television etc.) as well as pupil perimetry [4, 5]. However all these methods use transpupillary stimulation while we were interested in the use of diascleral stimulation of the extreme periphery of the retina taking into account the pupil's response to this stimulation.

Therefore the **purpose** of this work was to assess pupillary purpose response to the diascleral stimulation of different areas of the peripheral retina.

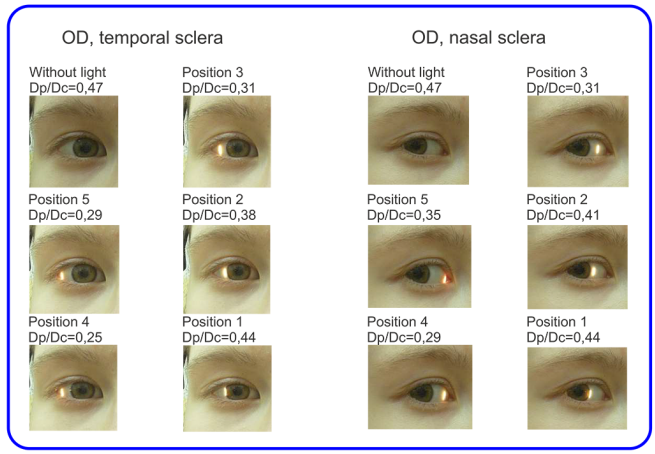
Subjects & Procedure

Pupillary responses to diascleral light stimulation were mesured at different stimulus positions along the retinal horizontal meridian in 9 subjects (18 eyes) at the age 14-27 yr. A stimulus was a small light spot (1x3 mm, 20000 lx) projected by using the ophthalmic slit lamp onto the eye surface at 5 positions: at the canthus, 1/4, 1/2 and 3/4 of the distance from the canthus to the limbus and at the limbus.

During the illumination of the temporal sclera, the eye was turned to the nose. During the illumination of the nasal sclera the eye was turned to the temple.

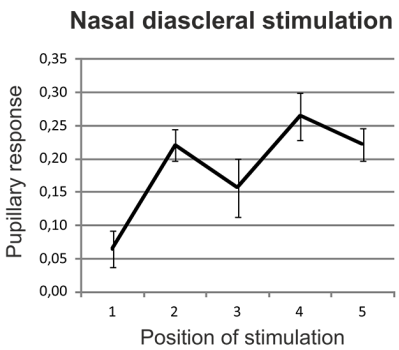
The other eye was covered by the occluder at this time.

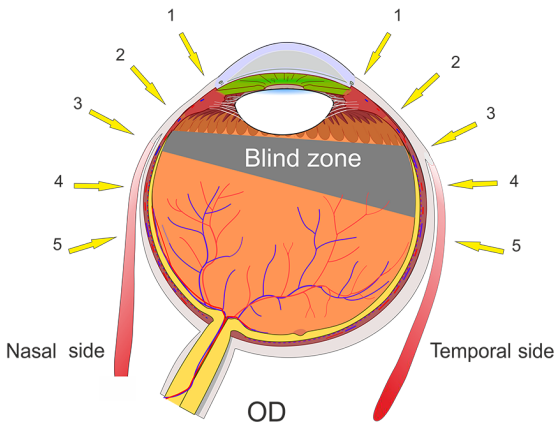
We estimated the ratio of pupil diameter to the diameter of the cornea (Dp/Dc).



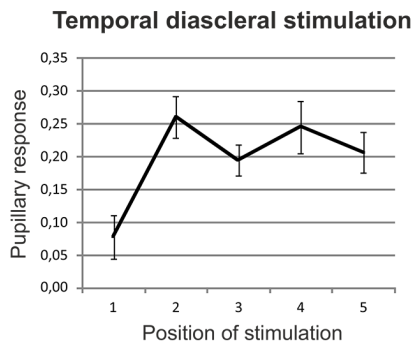
Results

Without light: Dp/Dc=0,5 ± 0,01 for nasal sclera,
Dp/Dc=0,48 ± 0,01 for temporal sclera.





Spot illumination of the sclera



All subjects perceived images of blood vessels on the background of the "luminous" retina during the spot illumination of the sclera at the position 5, 4 and 3. The majority of the subjects reported appearance of unstable bright image like the little "sun" at the position of spot illumination 3 and 4. All subjects reported paradoxical darkening of central part of the field of vision at the position of light illumination from 5 to 2.

Conclusions

The reasons for the nonmonotonic changes of the pupil contraction with changing stimulus position on the eye surface could be both anatomical and functional: differences in thickness and structure of tissues between eye surface and the retina, neuronal organization of the pupillary responses, etc. Taking this complexity into account is essential for interpretation of the outcomes of diascleral stimulation experiments.

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