

Local diascleral light stimulation of the peripheral retina: Influence on contrast sensitivity in the foveal area

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To verify Yarbus's idea of specific role of the peripheral blind retina in visual perception, we compared the changes in foveal contrast sensitivity caused by diascleral light stimuli (1x3 mm, 20000 lx) of the loci at the extreme periphery (supposedly blind retina) and in the mid-periphery (sighting retina). Ambient illumination was about 300 lx. Foveal tests were gratings 0.5-16 cpd with contrast 1-35%. To exclude influence of a possible difference in the two diascleral stimulus intensity on the results, pairs of the loci in the nasal and temporal halves of the retina were chosen so that they provided equal pupillary responses. Subjects were 6 adolescents 14-18 yr. We found that the peripheral diascleral stimuli exerted significantly larger effects: in the range of spatial frequencies 1- 4 cpd, foveal contrast thresholds typically increased 8 times after stimulation of the peripheral retina and only 3 times in the case of the mid-peripheral retina.

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Introduction & Purpose

In his later works, Yarbus hypothesised that extreme periphery of the retina plays certain role in assessment of ambient lighting [1, 2, 3].

Yarbus called this area "blind retina" since it can't evoke visual images. However, he suggested it could influence perception of central stimuli.

The **purpose** of this work was to assess the changes in foveal contrast sensitivity caused by diascleral light stimulation of the loci at the extreme periphery and mid-periphery of the retina.

Subjects & Procedure

The task of the subject was to distinguish grating from the uniform grey field. A fragment of the test chart was presented through a round window in the grey mask. Diameter of window was $\approx 3 \text{ cm} \approx 4.35^\circ$. The brightness of the mask corresponded to the level of the average brightness of the chart. We showed the chart by fragments in 7 frequency steps, and 5 contrast steps. For each frequency we found minimal contrast sufficient for subject to see the grating. One eye of the subject was occluded, the sighting eye was stimulated by projecting light spot on the nasal or temporal side of the eye ball in two locations.

Subjects: 6 adolescent (12 eyes), 14-18 y.o.

Diascleral stimulation: a small light spot, 1x3 mm, 20 000 lx, projected by ophthalmic slit lamp.

Diascleral stimulation locations:

- 1) at the loci of the extreme periphery (supposedly blind retina);
- 2) at the mid-periphery (sighting retina).

Ambient illumination: $\approx 300 \text{ lx}$

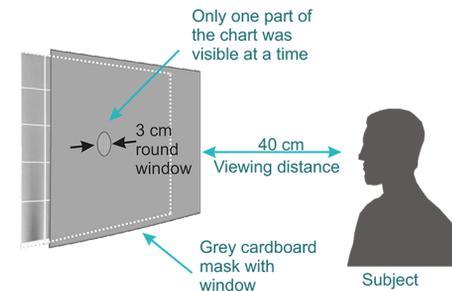
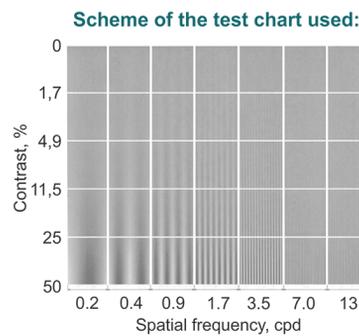
Test grating illumination: $\approx 100 \text{ lx}$

Foveal stimuli: Test chart consisted of fragments with different frequencies and contrasts.

Spatial frequency range: 0.5-16 cpd

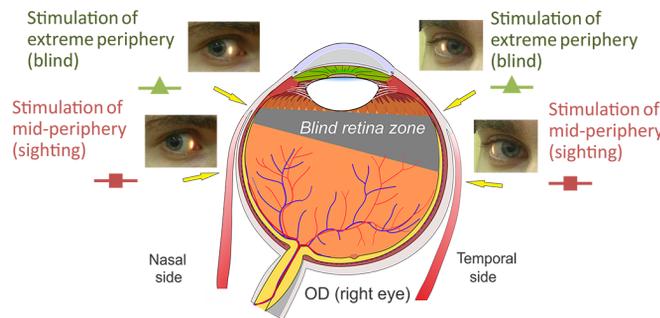
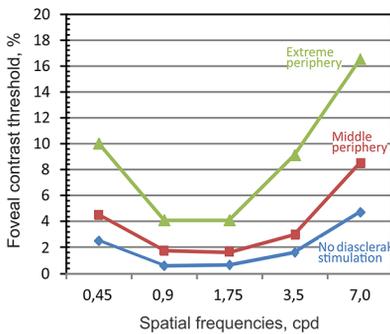
Contrast range: 1-35%

Viewing distance: 40 cm

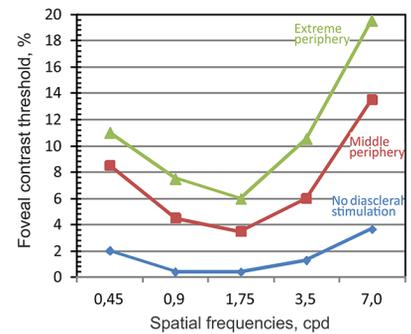


Results

Nasal diascleral stimulation



Temporal diascleral stimulation



Conclusions

In the range of spatial frequencies 1-4 cpd, foveal contrast thresholds increased 6-15 times after stimulation of the extreme peripheral retina (blind retina), and only 3-6 times in the case of the mid-peripheral retina (sighting retina).

Stimulation of the extreme retinal periphery exerts larger influence on foveal contrast sensitivity than comparable stimulation of mid-periphery.

References

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3. Yarbus A.L. Human visual system. II. The perceived colour. Biophysics. 1975. V. 20 (6). P. 1099-1104 (in Russian).

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