Local diascleral light stimulation of the peripheral retina: Influence on colour perception in the foveal area

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Our aim was to obtain some quantitative data on changes in foveal colour hue recognition caused by diascleral local light stimuli that were invisible or visible depending on the stimulus location on blind or sighting retina. Ambient illumination was 300 lx. Foveal test stimuli of varying size and colour were taken from Rabkin, 1971, Suppl. 4, 1B. Parameters of the scleral stimuli in all locations were identical (1x3 mm, 20000 lx). The subjects were 6 adolescents 14-18 yr. It was found that, in the cases of small size and low saturation, invisible peripheral diascleral stimuli exerted significantly larger effects than more central visible stimuli. After invisible stimulation of peripheral retina, the number of right responses could fall to zero while visible stimuli had no effect. Our data evidence in favor of Yarbus's idea of specific role that peripheral blind retina could play in visual perception but only in the range of weak visual stimuli.

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Introduction & Purpose

Local stimulation of the peripheral retina can be invisible or visible depending on the stimulus location on **blind** (extreme periphery) or sighting (mid-periphery) retina [1, 2]. In his qualitative experiments A. L. Yarbus found that though invisible to subject, local diascleral stimulation of blind retina with small bright light stimulus caused changes in foveal stimuli perception [3, 4, 5]. These findings led Yarbus to the idea of specific role of blind retina in visual perception.

The **purpose** of this work was to obtain some quantitative data on changes in foveal colour hue recognition caused by diascleral local light stimulus that wase invisible or visible depending on its location in the area of blind or sighting retina.

Subjects & Procedure

Subjects: 6 adolescents (12 eyes) aged 14-18 years with normal colour vision.

Foveal test stimuli of varying size and colour were taken from [6]. The stimuli of different saturation (low, middle, high) were organized into three charts each containing sets of 4 coloured circles (red, yellow, green and blue) of diameters 2, 3, 6, 8 and 10 mm (Fig. 1). Opaque black mask having a window of diameter 15 mm was used to present only one circle at a time (Fig. 2). Illumination of the foveal stimulus was 100 lx (ambient illumination 300 lx), viewing distance was 40 cm.

Local diascleral stimulation: we used ophthalmic slit lamp Reichert XCEL 255; the subject was sitting in the patient's place. A small bright light spot was projected onto the eye surface at one of the two positions along the horizontal meridian: over blind and sighting retina. Parameters of the diascleral stimulus were 1x3 mm, 20 000 lx.

Procedure: the task of the subject was to report the perceived colour hue of the test stimulus. The number of right responses was registered.

3 series of experiments were conducted in conditions of (1) blind retina stimulation, (2) sighting retina stimulation, (3) no diascleral stimulation. Both left and right eyes were tested; both nasal and temporal sides of each eye were used for diascleral stimulation.

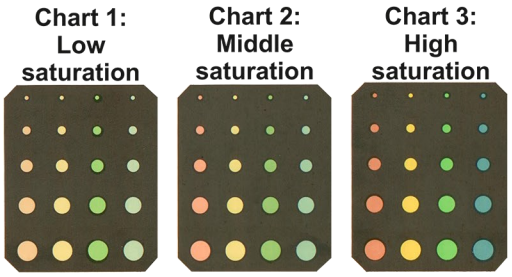


Fig. 1

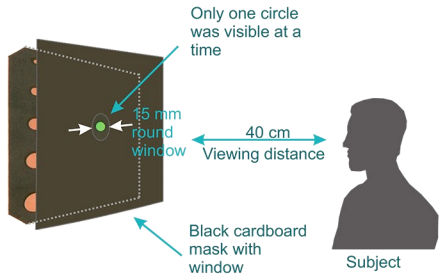
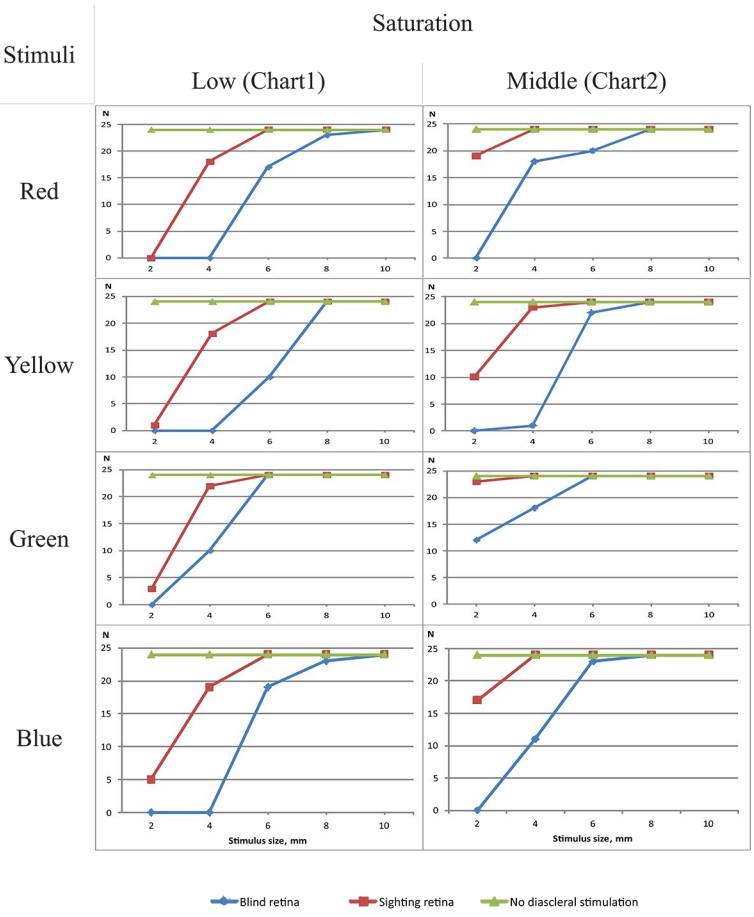


Fig. 2

Results



In the graphs presented, the number of right responses (N) is shown as a function of foveal stimulus size. Maximal number of right responses was 24 (6 subjects x 2 eyes x 2 eye sides).

In the absence of diascleral stimulation, colour hue of all foveal stimuli was correctly recognized by all subjects.

Diascleral stimulation of blind retina was invisible to all subjects.

Diascleral stimulation of the blind and sighting retina almost completely excluded recognition of the colour hue for foveal stimuli of small size and low saturation. For stimuli of medium and larger sizes it significantly reduced the number of right responses.

The effect of diascleral stimulation of the blind retina was more powerful in all subjects compared to the case of sighting retina stimulation.

In the case of saturated foveal stimuli (Chart3) the influence of diascleral stimulation on recognition of colour hue was insignificant in all conditions.

Conclusions

Our data evidence in favor of Yarbus' idea about the specific role of the peripheral blind retina in visual perception. Though the diascleral stimulation of blind and sighting retina both affected foveal hue recognition especially for weak visual stimuli, the influence of the blind retina simulation appeared to be more powerful than stimulation of the sighting retina.

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