

# Paracentral scotomata: a new finding after vitrectomy for idiopathic macular hole

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Accepted for publication  
3 August 2000

## Abstract

**Aims**—To report the occurrence of paracentral scotomata after pars plana vitrectomy for idiopathic macular holes.

**Methods**—In 15 patients static microperimetry using a Rodenstock scanning laser ophthalmoscope (SLO-105) was performed preoperatively and 6 or 12 weeks postoperatively (stimulus size 0.2° (Goldmann II), employed intensity 0 and 12 dB, 20° fields in all tests). Surgery consisted of standard three port vitrectomy including removal of epiretinal membranes and the inner limiting membrane.

**Results**—Postoperative paracentral scotomata were detected in areas that were tested normally before surgery. They were mostly located temporally and/or

inferiorly and often appeared like nerve fibre bundle defects. The greatest dimension varied from 1.2° to 4.0° (360–1200 µm), smallest dimension from 0.25° to 2.0° (75–600 µm). In three patients more than one scotoma was observed.

**Conclusion**—Small, mostly asymptomatic, paracentral scotomata as a complication after vitrectomy for idiopathic macular hole have not been reported in the literature so far. Whether they are caused by trauma to the nerve fibres during surgery or other factors remains unknown.

(Br J Ophthalmol 2001;85:231–233)

Before Kelly and Wendel<sup>1</sup> reported the successful closure of full thickness idiopathic macular holes by removal of the cortical vitreous over the macula followed by gas tamponade, this condition was considered untreatable. Along with the development of operative techniques both the anatomical success and functional results have improved.<sup>2–4</sup> Reported postoperative complications have included cataract, retinal detachment, retinal breaks, retinal pigment epitheliopathy, late reopening, and peripheral visual field loss.<sup>2–5–9</sup> We report the occurrence of paracentral scotomata in patients after vitrectomy for macular hole, a finding that, to our knowledge, has not been described previously.

## Patients and methods

Clinical examination was performed in 15 patients, six men and nine women, with a mean age of 71 years (range 63–79 years) preoperatively and 6 or 12 weeks postoperatively. The diagnosis of a macular hole was made by the presence of a full thickness neurosensory defect confirmed by high resolution cross sectional imaging of the retina provided by optical coherence tomography (OCT). Using Gass's classification scheme,<sup>10</sup> holes were designated as stage 3 and stage 4. Only idiopathic macular holes were included.

Scanning laser ophthalmoscopy with a Rodenstock scanning laser ophthalmoscope (SLO-105) was performed at all visits. This method allows the examiner to view a real time image of the macula and assess fixation while performing microperimetry with high spatial resolution. A minimum of 80 test stimuli were distributed both in the macular and paramacular areas, covering the central 8° to 10° of the visual field. Stimulus size was 0.2° (Goldmann II), intensity was 0 and 12 dB. To cover the a large enough area, 20° fields were used for all tests. All patients were examined 1 day before

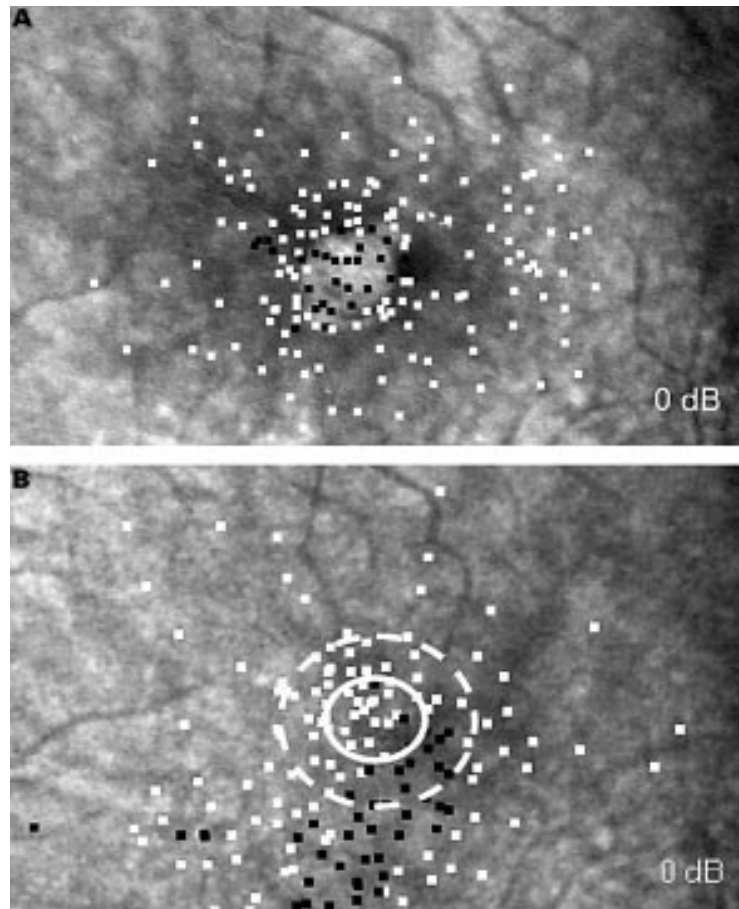


Figure 1 (A) Preoperative and postoperative (B) microperimetry of a left eye. White squares represent stimuli that were seen by the patient, black squares represent relative (12 dB) or deep (0 dB) scotomata. The white circle marks the area of the preoperative macular defect, the broken circle the area of the preoperative neurosensory detachment. Postoperatively a large deep scotoma inferior to the closed macular hole can be seen in an area that was tested normally before surgery. The scotoma had the shape of a nerve fibre bundle defect.

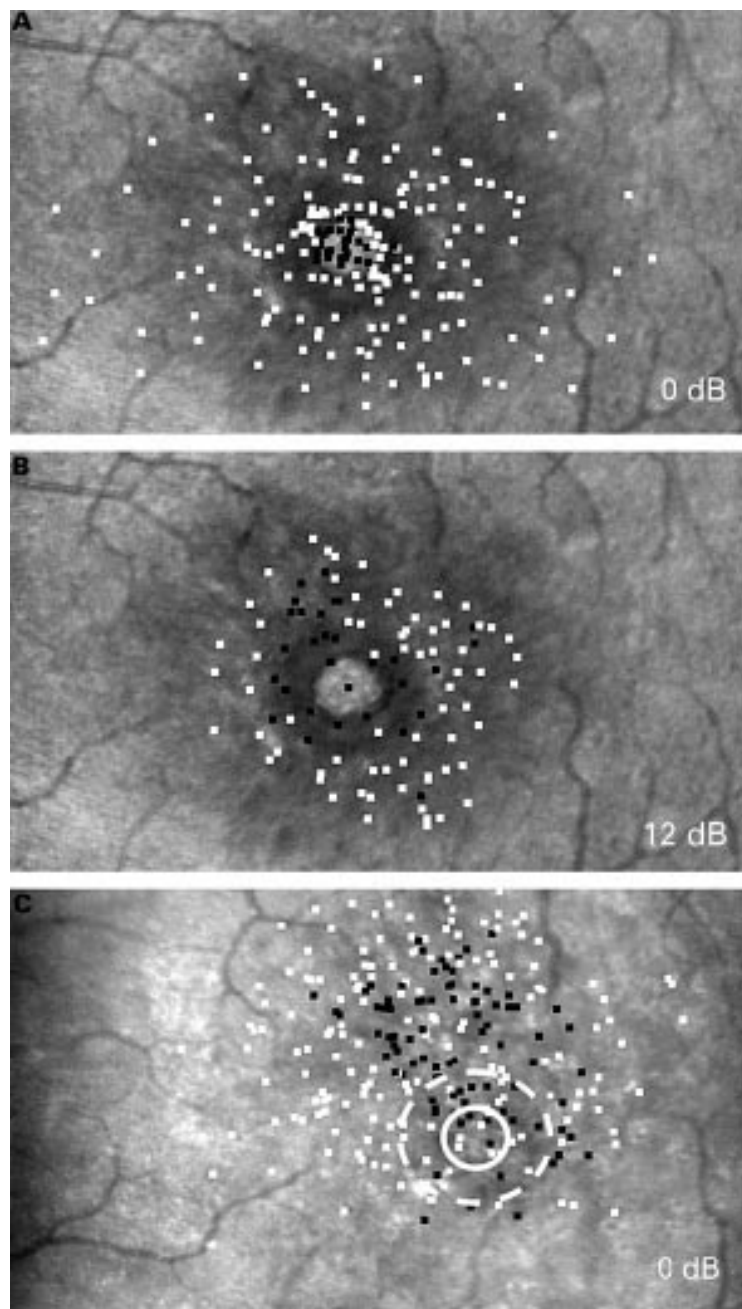


Figure 2 (A, B) Preoperative and postoperative (C) microperimetry of a left eye. Preoperatively a deep scotoma in the macular hole area is seen (A), which is surrounded by a relative scotoma (B). Postoperatively a large deep scotoma with irregular boundaries was found temporal to the area of the closed macular hole (C).

surgery and either 6 (n=12) or 12 weeks (n=3) postoperatively.

Surgery consisted of a standard three port vitrectomy. If the posterior hyaloid was still attached, its detachment was induced by suction with the vitrector instrument around the optic nerve head. Epiretinal membranes and/or the inner limiting membrane (ILM) were removed using a bent 28 gauge needle and an intraocular end gripping forceps. The ILM was incised and then stripped using the forceps. An attempt to peel the ILM was made in all patients. The area of removal of the ILM was intended to be one disc diameter surrounding the macular hole. Air-fluid exchange and intraocular tamponade with  $C_2F_6$  gas mix-

ture (15%) were then performed. Patients maintained face down positioning for at least 5 days postoperatively.

## Results

Preoperative best corrected visual acuity ranged from 0.05 to 0.5 (median 0.2). There were 11 stage 3 holes and four stage 4 holes in this group.

Anatomical closure was achieved in 14 patients after one operation (93%). In one patient the macular hole persisted and was successfully closed with a second operation. Best corrected visual acuity improved in all patients. Visual acuity ranged from 0.2 to 1.0 (median 0.5) postoperatively. This represented a five line increase in the median visual acuity in comparison with the preoperative data.

Preoperatively, all patients showed a central deep scotoma, the size of which corresponded to the full thickness neurosensory defect of the macula (Figs 1A, 2A). The centre of the hole was surrounded by an additional relative scotoma in the area of the visible neurosensory detachment (Fig 2B). Postoperatively the deep (0 dB) scotomata observed in the centre of the macular hole before surgery either disappeared (n=11) (Fig 1B), decreased in size (n=2), or presented as relative scotomata (n=2) of reduced size. The relative scotomata around the centre of the hole had disappeared in 14 patients or become smaller in one patient postoperatively.

We observed new paracentral scotomata postoperatively in all 15 patients. Without exception, these scotomata were observed in areas that were unremarkable on preoperative microperimetry. To illustrate these findings, the results of preoperative and postoperative microperimetry of two cases were chosen (Figs 1, 2). There were 13 patients with deep (Figs 1B, 2C) and two patients with relative scotomata. The scotomata were located either temporally and/or inferiorly to the centre of the macula in most patients. No scotoma was detected in the nasal superior area. Eleven of these new scotomata had a nerve fibre bundle defect-like appearance (Fig 1B). In two patients we observed two and in one patient three paracentral scotomata were found. In four cases they reached less than  $2^\circ$  up to the area of preferred fixation. The longest dimensions of the scotomata varied from  $1.2^\circ$  to  $4.0^\circ$  ( $360$ – $1200 \mu\text{m}$ ) and the shortest from  $0.25^\circ$  to  $2.0^\circ$  ( $75$ – $600 \mu\text{m}$ ) ( $1^\circ$  corresponds with  $300 \mu\text{m}$ ). Only four patients subjectively realised the scotoma detected in microperimetry and one of them was able to draw the shape of the defect on the Amsler chart. None of the described scotomata changed in shape, density, or size during the postoperative follow up period (mean 11 months).

## Discussion

In patients with idiopathic macular holes, microperimetry with the scanning laser ophthalmoscope (SLO) has been shown to be useful in evaluating functional changes in the macula and the surrounding retina.<sup>11–15</sup> Less

attention has been paid to the visual field subserved by paramacular areas surrounding the hole itself.

The detection of paracentral scotomata explains our clinical impression that some patients complain of small defects in the paracentral visual field despite good postoperative results in distance and reading acuity. However, most of the patients included in this report were asymptomatic.

The origin of the observed paracentral scotomata is not completely understood. As most of them appear like nerve fibre bundle defects, one might hypothesise that our operative procedure, which includes the peeling of the ILM, is responsible for their occurrence. Interestingly, paracentral scotomata were also detected in patients in which the removal of the ILM was not successful. Nevertheless, an attempt to peel the ILM with a sharp tipped dissecting needle was made in all patients. Therefore it cannot be excluded that the observed scotomata might be due to a direct trauma to the nerve fibres during ILM peeling. However, additional (and so far unknown) causative factors have to be considered and will be the subject of further studies.

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