A 40° GAZE DOWN POSITION FOR PNEUMATIC DISPLACEMENT OF SUBMACULAR HEMORRHAGE

Clinical Application and Results

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Purpose: To test the validity of the geometric conclusion that 40° gaze down is optimal for pneumatic displacement of a subretinal hemorrhage (SRH) in the macula.

Methods: Nine consecutive patients with SRH in the macula had an intravitreal injection of perfluorocarbon gas sufficient to cover the macula when the patient gazed down 40° below the horizontal. They were asked to maintain the gaze down position for 20 minutes every hour while awake.

Results: The SRH in eight of nine patients was displaced rapidly in the first week. Visual acuity improved in seven patients. Visual recovery was limited by the presence of a subpigment epithelial component.

Conclusions: Gaze 40° below the horizontal will rapidly displace a subretinal hemorrhage that is covered by a gas bubble.

RETINA 28:56–59, 2008

It is customary to try to displace a subretinal hemorrhage in the macula with an intraocular gas injection and face down positioning. There are numerous reports describing successful displacement with this technique and with modifications including vitrectomy and the use of tissue plasminogen activator.[1–12] It is noteworthy that hemorrhages in these studies are almost always displaced inferiorly. It was our experience with face down positioning for pneumatic displacement of the serous elevation associated with optic pit maculopathy that flattening of the maculopathy and improvement in vision coincided with displacement of the elevation below the inferior arcade. Further, the incidence of displacement coincided with patient noncompliance; the more frequently the patient looked up, the more likely displacement would occur and vision would improve. In 1993 we recommended a program of rotations of the eye from gaze down to horizontal gaze for optic pit maculopathy and subsequently for subretinal hemorrhage in the maculas.[13] We mistakenly ascribed the efficacy of the maneuver to a massage effect of the intraocular bubble as the macular elevation, serous or hemorrhagic, passed over it. Krepler, in a Letter to the Editor, suggested that gravity may play a part.[14] A geometric analysis of the physical forces involved by Stopa et al[15] indicates that gravity alone is responsible for the benefits observed with an intraocular gas bubble, and that in horizontal gaze there is a maximum gravity force tan-

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Supported by The Edward L. Grayson Retinal Research Fund, West Orange, New Jersey; The Kuri family, Mexico City, Mexico; and The Samuel I. Newhouse Foundation, New York, New York.

The authors have no proprietary interest in any of the aspects of this study.

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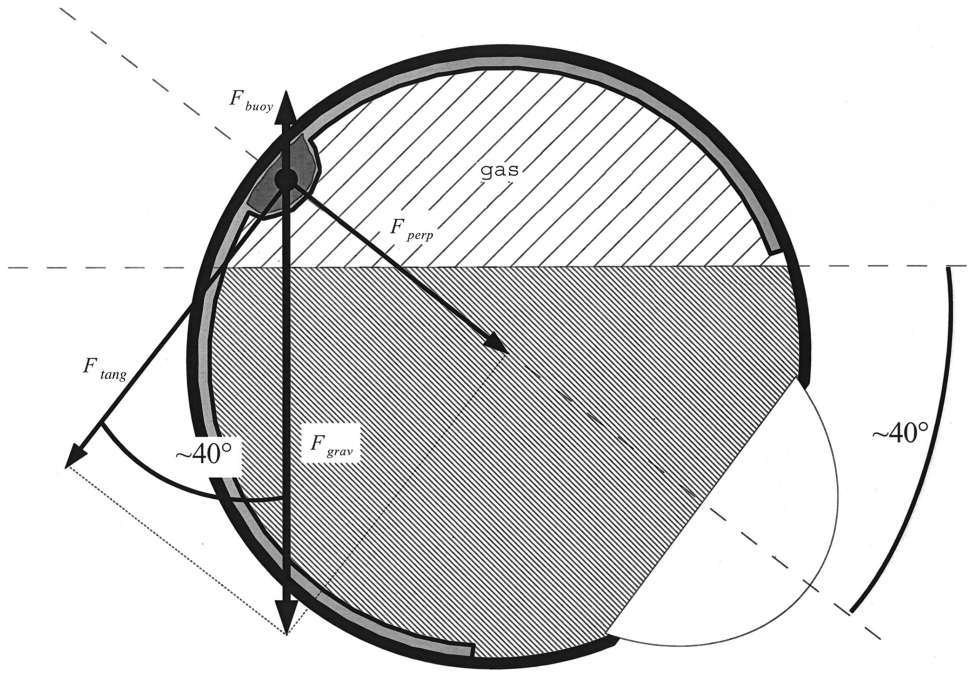

Fig. 1. A 40% gas bubble in an eye with subretinal hemorrhage at gaze down 40°. The gravity vector (F grav) exceeds the buoyancy vector (F bouy). The tangential vector (F tang) is 77% of the gravity vector. A perpendicular vector (F perp) might serve to loosen the hemorrhage.

gential to the retina to move a subretinal hemorrhage in the macula.

Methods

To cover the macula with gas in horizontal gaze requires a volume of gas that fills 70% of the eye. To obtain the space for a 70% fill requires a vitrectomy. We calculated that a 40% fill of gas would cover the macula if the patient's gaze was directed 40° below the horizontal plane and a 40% fill could be obtained without prior vitrectomy by injecting small volumes of undiluted perfluorocarbon gases. At 40° gaze down the tangential force to move the subretinal hemorrhage is 77% of the gravity force that might be obtained with a 70% fill and the eye in horizontal gaze (Figure 1). A 40% intraocular bubble was obtained with an injection into the vitreous of 0.25 mL of undiluted C_2F_6 or 0.2 mL of undiluted C_3F_8 on subsequent days. The meniscus of the expanded bubble in horizontal gaze appears 1 to 2 disk diameters (old) above the disk 24 to 36 hours after the second injection. The patient was instructed to direct gaze 40° below the horizontal for 20 minutes every hour while awake. Clinically, 40° of gaze down was achieved by the patient, in sitting position, directing gaze at a sheet of paper on the floor 6 feet in front. At other times there were no restrictions while awake; for sleep the patient was asked to lie with the head turned to the side of the affected eye.

The height of the patient, the distance of the object of gaze, and the volume of the patient's eye are variables that made it necessary to verify ophthalmoscopically that the expanded bubble covered the macula in the 40° gaze down position. When it did not, additional gas was injected in one patient. A less morbid alternative was chosen for two other patients who were directed to alter the angle of gaze to 50° and 60° below the horizontal, positions in which the gravity force tangential to the sclera is 65% and 50% of the gravity force in horizontal gaze.[15] The patients were taught to recognize the level of the meniscus of their intraocular bubble; in horizontal gaze the meniscus of a 40% bubble should appear below the line of gaze, at 40° gaze down the meniscus is perceived above the line of gaze.

Results

All of the subretinal hemorrhages were displaced rapidly in the first days after the gas bubble covered the macula in gaze down 40° to 60° (Figure 2). Visual acuity improved in seven of nine patients. Visual recovery was limited because of the concurrent presence of subpigment epithelial hemorrhage, which resisted displacement. All of the patients reported a decrease in the extent of their central scotoma (Table 1).

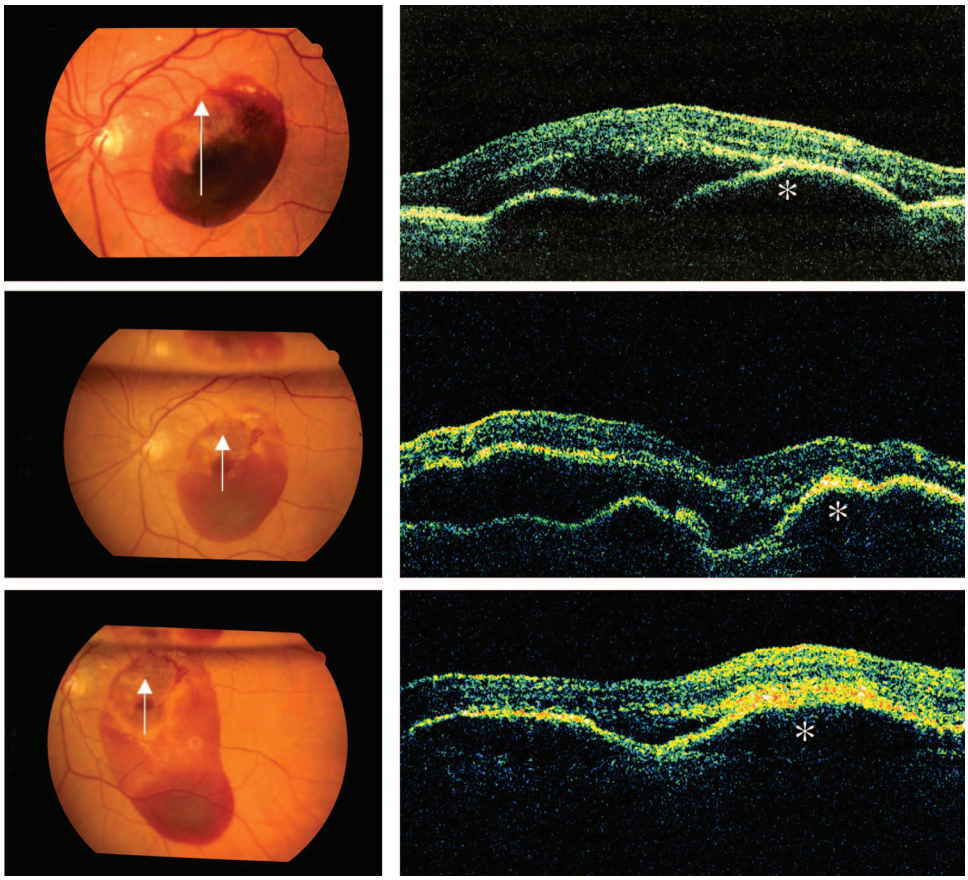

Fig. 2. Affected eye of Patient 3. Top left: Photograph of the hemorrhage in the macula of 2 days duration. Top right: Optical coherence tomography reveals a subretinal hemorrhage (SRH) with a subpigment epithelial component (*). Middle left and right: 1 day after second injection of 0.25 mL of C_2F_6 and 60° gaze down, some of the subretinal hemorrhage is displaced below; the subpigment epithelial hemorrhage (*) was not moved. Bottom left: After 3 additional days of 40° gaze down most of the subretinal hemorrhage is displaced below. Bottom right: The subpigment epithelial hemorrhage (*) is unmoved.

Conclusion

The face down position for pneumatic displacement of subretinal hemorrhage in the macula was a mistake; when successful, it was an effect of patient noncompliance. The primary force to displace a central retinal elevation, serous or hemorrhagic, is gravity. In the prone position gravity, lacking a tangential vector, will not move a central subretinal elevation. It is conceivable that a face down position might loosen a hemorrhage from the pigment epithelium. In the 40° gaze down position, in addition to the tangential vector, there is a smaller

Table 1. Details of Subretinal Hemorrhage in the Macula

Patient	Extent (DD)	Thickness	Duration (d)	Subpigment Epithelial Hemorrhagein Fovea	% Displaced	Initial VA	Final VA
1	3 × 6	3+	14	+	90	5/200	20/200
2	4 × 5	3+	2	+	80	3/200	20/200
3	3 × 3.5	2+	2	+	100	20/200	20/50
4	4.5 × 7	3+	1	+	95	20/400	20/200
5	5 × 6	2+	8	+	60	20/400	20/200
6	3 × 2.5	2+	7	+	80	CF/2	20/200
7	3.5 × 4	4+	1	+	90	CF/1	20/200
8	4 × 7	1+	6	−	100	20/20	20/25
9	1.5 × 2	2+	2	+	50	20/70	20/100

VA = visual acuity; CF = count fingers.

perpendicular vector which may serve this purpose and facilitate displacement (Figure 1). The 40° gaze down position for 20 minutes per hour was well tolerated and the 40% gas fill could be obtained without prior removal of the vitreous.[16]

The subretinal hemorrhage in this series was accompanied by a subpigment epithelial hemorrhage in seven of nine patients. In a study of the pathology of excised lesions of age-related macular degeneration complicated by hemorrhage, Reynders et al found subpigment epithelial elevations with hemorrhagic or proteinaceous components in 13 of 30 specimens. [17] The subpigment epithelial elevations in our patients appeared dark, did not transilluminate, and were probably hemorrhagic. All seven subpigment epithelial hemorrhages resisted pneumatic displacement and limited visual recovery. Displacing the adjacent subretinal hemorrhage, however, reduced the extent of the central scotoma and diminished the likelihood of its breakthrough into the vitreous.[18–20] Thick subretinal hemorrhage forms a diffusion barrier for exchange between the retina and the pigment epithelium; it promotes rapid necrosis of the overlying retina and a breakthrough. None of the nine subretinal hemorrhages broke into the vitreous after pneumatic displacement.

Key words: subretinal hemorrhage, subpigment epithelial hemorrhage, pneumatic displacement, 40° gaze down.

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