



Vitrectomy for macular pucker and vitreomacular traction syndrome

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Abstract. During the course of a so-called posterior vitreous detachment, a thin layer of the posterior vitreous cortex often remains adherent to the underlying retina. Tangential stretch of this vitreous pseudomembrane may cause vitreomacular traction syndrome, edema, and macular hole formation. The same process appears to underlie the development of true epimacular membranes (idiopathic macular pucker). Vitrectomy is generally agreed to be the most appropriate treatment for these clinical situations. We evaluated the incidence of vitreomacular adhesion and of visual improvement after vitrectomy of eyes with macular pucker (group 1; $n=60$) and vitreomacular traction syndrome (group 2; $n=50$). Vitreomacular attachment was assessed during vitrectomy under the condition of continuous air infusion. In the two groups, complete or partial vitreous attachment to the macula was observed in 57.4% and 74%, respectively. We conclude that vitreomacular adhesion is a common feature of the two clinical situations. Visual improvement was achieved in 73% of both groups. High rates of postoperative visual acuities of 20/50 or better (60.6% in group-1; 65.7% in group-2 cases) occurred only in eyes with preoperative values of 20/100 or better. It is reported that the visual outcome of vitreoretinal surgery for the two clinical conditions deteriorates with increasing duration after initial manifestation. Vitrectomy should not be postponed in patients who complain of disturbing visual symptoms such as reduced visual acuity, metamorphopsia and disturbance of binocular reading.

Key words: idiopathic epimacular membrane, macular edema, macular pucker, macular traction, vitrectomy, vitreomacular traction syndrome

Introduction

During the course of vitreous collapse and liquefaction, a thin layer of the posterior vitreous cortex often remains adherent to the underlying retina. Tangential stretch of this residual pseudomembrane may lead to macular traction and edema, and, ultimately, to the development of a macular hole. Vitreomacular traction is implicated also in the formation of true epimacular membranes (macular pucker) [1]. Typical symptoms of these three conditions (macular pucker, vitreomacular traction syndrome and macular hole) include a deterioration in visual acuity and metamorphopsia. Many patients also complain of disturbed binocular vision, this being attributable to image

distortion in the affected eye. Visual improvement has been reported after the performance of vitrectomy to relieve vitreomacular traction [2–8].

We compared the functional consequences of vitrectomy in eyes with macular pucker (idiopathic epimacular membranes) and in those with vitreomacular traction syndrome (no evidence of a true epimacular membrane formation).

Methods

We retrospectively evaluated the records of 110 patients who were consecutively operated on by one single surgeon (FK) for two distinct vitreoretinal disorders, namely, idiopathic macular pucker (group 1: 60 eyes between 1983 and 1998) and vitreomacular traction syndrome (group 2: 50 eyes between 1992 and 1998). All eyes in group 1 manifested idiopathic epimacular membranes. Eyes which had been previously treated for retinal breaks, retinal detachment, retinovascular diseases, trauma or uveitis were excluded from the evaluation. In both group-1 and group-2 patients, vitrectomy was indicated due to a substantial deterioration in visual acuity and the manifestation of symptoms such as metamorphopsia or a disturbance in binocular reading capacity.

The age of group-1 patients ranged from 14 to 82 years (median: 70.2 years); that of individuals in group 2 from 8 to 89.8 years (median: 70.9 years). Fifty-eight percent of patients in the former category were female as against 32% in the latter ($p < 0.01$). Prior to surgery, the posterior vitreoretinal situation was assessed by slitlamp biomicroscopy using a three-mirror Goldmann contact lens. During vitrectomy, it was further evaluated under the condition of continuous air infusion. The posterior vitreous was defined as being either completely attached, partially attached with vitreomacular adhesion or completely detached.

Epimacular membranes or vitreous cortex were peeled under microscopic control. The absence or presence of an epimacular layer of vitreous cortex was revealed after gentle suction with a flute needle under conditions of continuous air infusion. In instances where a residual vitreous cortex was thus identified, attempts were made to aspirate and excise it. But in some group-2 individuals, premacular adhesion was so strong as to render impossible the complete removal of this layer.

Visual acuity was measured using a standardized visual acuity projector. Postoperatively, this was determined by unmasked ophthalmologists; not by the surgeon. The follow-up period for group-1 patients varied from 0.2 to 112 months (median: 13.8 months; mean: 24.7 ± 27.3 months); that for individuals

Table 1. Posterior vitreous attachment associated with macular pucker and vitreomacular traction syndrome

Posterior vitreous	Group 1* Macular pucker	Group 2* Vitreomacular traction syndrome
Completely attached	28 (46.7%)	35 (70.0%)
Partially attached	7 (10.7%)	2 (4.0%)
Detached	18 (30.5%)	9 (18.0%)
Not defined	7 (10.7%)	3 (6.0%)
Total	60	50

*Differences between groups were not significant (chi square statistics).

in group 2 from 0.2 to 43.3 months (median: 7.2 months; mean: 9.9 ± 10.2 months).

Postoperative complications, such as retinal detachment, recurrent epimacular fibrosis, macular edema and posterior and/or nuclear cataracts were evaluated in each group.

Statistical analyses included Student's paired *t*-test (comparison of pre- and postoperative visual acuities) and the chi-square test (with Yates' correction for frequencies below 10).

Results

Vitreoretinal situation

The definitive state of vitreoretinal attachment/detachment was usually assessed during vitrectomy. In many cases, large, fluid-filled pockets were observed between the residual posterior vitreous cortex and the vitreous gel. Preoperative examination by slitlamp biomicroscopy had frequently misinterpreted this situation as complete detachment of the posterior vitreous. The state of vitreomacular relation could not be determined unequivocally in 7 group-1 individuals and in 3 of those in group 2.

The posterior vitreous was completely detached in 30.5% of group-1 eyes and 18% of those in group 2. Partial or no posterior vitreous detachment, with vitreomacular adhesion, occurred in 57% and 74% of group-1 and group-2 individuals, respectively, the difference being statistically insignificant (Table 1).

In five group-1 eyes, epimacular membranes could not be peeled away in their entirety; in three of these there was complete, and in one questionable,

Table 2. Visual acuity prior to and at least one month after vitrectomy

Visual acuity (VA)	Group 1* Macular pucker	Group 2* Vitreomacular traction syndrome
No. of eyes	52	46
Initial VA	0.26±0.18	0.29±0.20
Best postoperative VA	0.47±0.29	0.51±0.31
Final postoperative VA	0.37±0.28	0.47±0.33

Values represent means±standard deviations.

*Differences between groups were not statistically significant.

Table 3. Number of eyes (percentages in parentheses) with postoperative visual acuities of 20/50 or better subdivided according to the preoperative value after a follow-up of at least one month

	Group 1 Macular Pucker		Group 2 Vitreomacular Traction	
	Total no. of eyes	Final VA ≥20/50	Total no. of eyes	Final VA ≥20/50
All cases	52	22 (42.3%)	46	28 (60.9%)
Preop VA <20/100	19	2 (10.5%)	11	4 (45.5%)
Preop VA ≥20/100	33	20 (60.6%)*	35	23 (65.7%)**

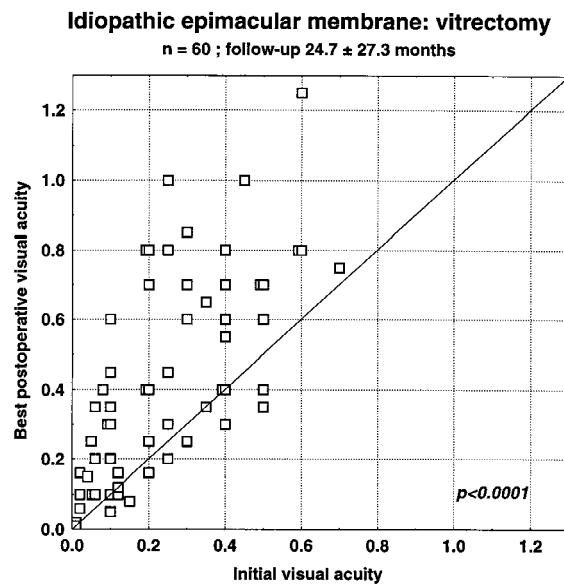
* $p < 0.005$.

**not significant (chi square statistics; Yates' correction).

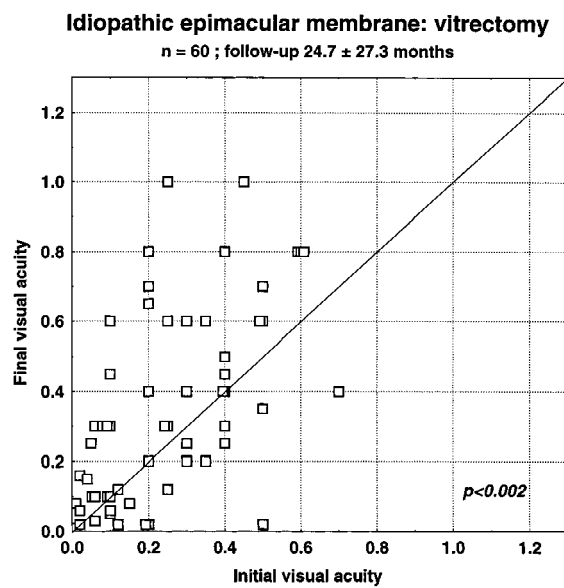
vitreomacular attachment. A marginal improvement in postoperative visual acuity was achieved in only one of these five individuals.

Visual acuity

In both group 1 and group 2, initial postoperative visual acuity was improved in 73% of eyes (Figures 1a and 2a), the final value being better than the preoperative one in 57% and 60% of group-1 and group-2 patients, respectively (Figures 1b and 2b). After a follow-up period of 1 month or more, the number of cases with a visual acuity of 20/40 or better increased from 17% preoperatively to 33% postoperatively in group 1, and from 18% to 49% in group 2 (no statistical significance between groups). Means and standard deviations of preoperative, and best and final, postoperative visual acuities in patients with a follow-up time of 1 month or more are presented in Table 2.



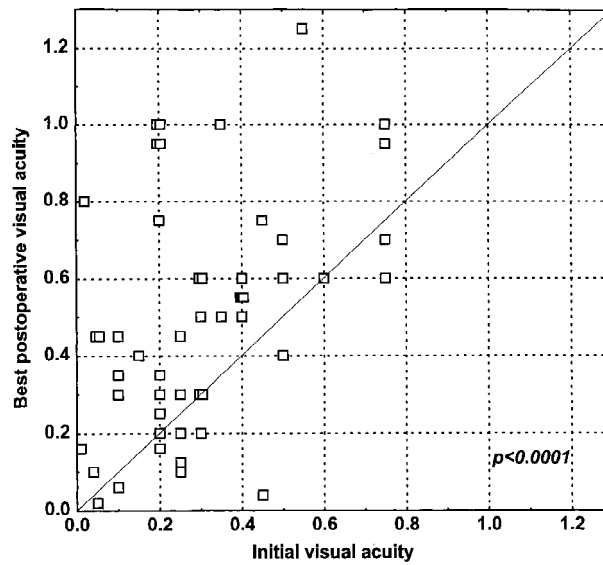
(a)



(b)

Figure 1. (a) Pre- and best postoperative visual acuity of 60 eyes with idiopathic epimacular membranes (macular pucker; group 1). Follow-up period: 24.7 ± 27.3 months. (b) Pre- and final postoperative visual acuity of 60 eyes with idiopathic epimacular membranes (macular pucker; group 1). Follow-up period: 24.7 ± 27.3 months.

(a) **Vitreomacular traction syndrome: vitrectomy**
 n = 50 ; follow-up 10.6 ± 10.4 months



(b) **Vitreomacular traction syndrome: vitrectomy**
 n = 50 ; follow-up 10.6 ± 10.4 months

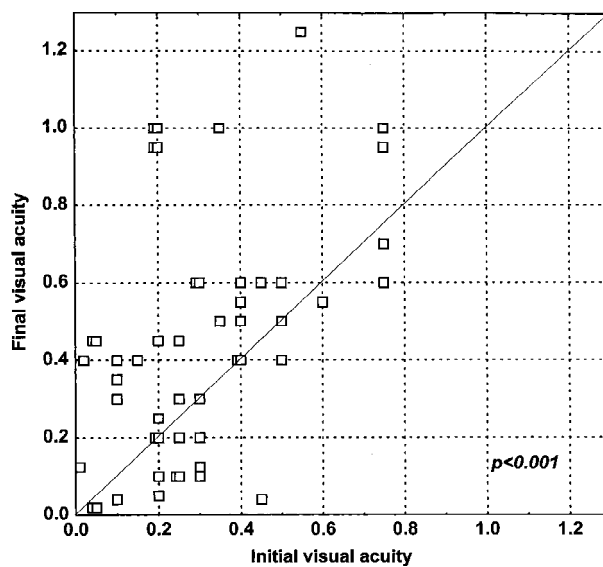


Figure 2. (a) Pre- and best postoperative visual acuity of 50 eyes with vitreomacular traction syndrome (group 2). Follow-up period: 10.6±10.4 months. (b) Pre- and final postoperative visual acuity of 50 eyes with vitreomacular traction syndrome (group 2). Follow-up period: 10.6±10.4 months.

Table 4. Causes of vitrectomy failures (final visual acuity worse than preoperative visual acuity). Follow-up at least one month

	Group 1 Macular pucker	Group 2 Vitreomacular traction syndrome
No. of eyes	16/52	13/45
Cataract	8 (50.0%)	7 (53.8%)
Macular pathology	7 (43.8%)	4 (30.8%)
Residual or recurrent PVR	5 (31.3%)	2 (15.4%)
Keratopathy	0 (0.0%)	1 (7.7%)
Optic atrophy	0 (0.0%)	1 (7.7%)

In order to evaluate the influence of preoperative visual acuity on the final visual outcome, we compared the latter with the former in eyes with initial visual acuities of less than 20/100 and in those with initial values of 20/100 or better. In group 1, a significant visual improvement to 20/50 or better was achieved in 60.6% of individuals with a preoperative visual acuity of 20/100 or better but only in 10.5% of those with preoperative visual acuities of less than 20/100 ($p < 0.005$). The respective rates in group-2 patients were 65.7% and 40%, the difference not being statistically significant (Table 3).

Failures of vitrectomy

A postoperative visual deterioration was defined as failure (Table 4).

Nuclear and/or posterior cataracts developed postoperatively in 23 (38%) and 22 (44%) of eyes in groups 1 and 2, respectively. Group-1 individuals thus affected were between 60 and 80 years of age. In group 2, 19 of the 22 cases were between 50 and 90 years of age; the other 3 fell within the 40- to 50-year range.

Amongst patients with a follow-up period of 1 month or more (52 in group 1 [1.4 to 112 months]; 45 in group 2 [1 to 44 months]), final visual acuity was less than the preoperative value in 16 (31%) group-1 eyes and in 13 (29%) of those in group 2. Within this category, a transient visual improvement was obtained in 7 of the 16 group-1 cases and in 3 of the 13 group-2 eyes. Nuclear and/or posterior cataract formation was the main cause of visual deterioration, macular pathology (edema, cellophane appearance) and residual or recurrent posterior PVR being the next most common (Table 4). Postoperative ret-

inal detachment was never observed. No statistically significant differences between groups existed for any of the various complications manifested.

Discussion

The influence of vitrectomy on visual acuity was evaluated in 60 eyes with macular pucker (group 1) and in 50 with vitreomacular traction syndrome (group 2).

Prior to surgery, complete or partial vitreomacular attachment was apparent in 57% of individuals within the former category and in 74% of those within the latter. Complete detachment of the posterior vitreous (PVD) had occurred in only 30% of the macular-pucker cases and in 18% of those with vitreomacular traction syndrome. In several instances, the posterior vitreous was so firmly attached that the epimacular membrane could not completely be removed. Hirokawa et al. [9] report a 34%-incidence of vitreomacular attachment or traction amongst 250 eyes with biomicroscopically identified idiopathic macular pucker. This observation, as well as our own, contrasts with the findings of Smiddy et al. [1] who reported the pre-existence of posterior vitreous detachment in all 101 vitrectomized eyes with macular pucker. The latter authors thus considered macular pucker (with complete posterior vitreous detachment) to be an anatomic feature quite distinct from vitreomacular traction syndrome (without posterior vitreous detachment).

It should be borne in mind, however, that the majority of surgeons perform vitrectomy whilst infusing the eye with balanced salt solution. Under these conditions, a thin residual epiretinal layer of vitreous cortex may not be revealed. Indeed, we were generally able to identify such a layer only by means of gentle aspiration with a flute needle under conditions of continuous air infusion. It sometimes proved to be impossible to remove this layer completely without running the risk of causing retinal breaks by forced traction. This was found to be the case principally in eyes with vitreomacular traction syndrome.

We conclude that vitreoretinal adhesion and traction are features common to both macular pucker and vitreomacular traction syndrome. However, the pathogenetic mechanisms underlying the progression of vitreoretinal adhesion/traction to the formation of true idiopathic epimacular membranes are as yet unknown.

In both these clinical situations, the aim of vitreoretinal surgery is to relieve vitreomacular traction by peeling away epimacular membranes in pucker cases and by removing the vitreous cortex in eyes with vitreomacular traction syndrome. In our study, there were no differences in pre- and postoperative visual acuities between individuals with either macular pucker or vitreo-

macular traction syndrome. A visual improvement was achieved in 73% of both groups. However, good postoperative visual acuities of 20/50 or better were observed only in eyes with preoperative acuities of 20/100 or better (61% of group-1 and 66% of group-2 cases). These findings confirm those of Gaudric et al. [4] who reported that significantly poorer visual results were achieved with preoperative visual acuities of 20/200 or worse than in ones above 20/200.

A well-known side effect of vitrectomy in these clinical situations is its precipitation of nuclear and/or posterior cataract in 16 to 83% of cases [2, 3, 5–8]. We observed progressive cataracts in 38% and 44% of group-1 and group-2 individuals, respectively. Macular changes were the second most frequent cause of visual loss in both study groups.

Spontaneous resolution of macular pucker and vitreomacular traction syndrome is extremely rare. During a 5-year follow-up of individuals with vitreomacular traction syndrome, cystoid macular edema and a deterioration in visual acuity occurred in 67% of the 53 cases evaluated by Hikichi et al. [10]; the incidence of those with 20/40 vision dropped from 36% (preoperatively) to 8% at the final check up.

In conclusion, vitrectomy improves visual acuity in at least 70% of individuals with macular pucker or vitreomacular traction syndrome, values of 20/50 or better being achieved in one to two thirds of the cases [1, 4, 6, 8, own study]. However, the visual outcome of vitreoretinal surgery for the two pathological conditions deteriorates with increasing time after the initial manifestation of visual symptoms. For this reason, we tend not to postpone vitrectomy in patients who complain of disturbing symptoms.

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