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Alterations in central retinal sensitivity after intravitreal triamcinolone injection for diffuse diabetic macular edema

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PURPOSE. *To evaluate alterations in central retinal sensitivity following intravitreal triamcinolone injection in patients with diffuse diabetic macular edema that persisted after laser treatment.*
METHODS. *Fourteen eyes of 14 patients that received 4 mg 0.1 cc intravitreal triamcinolone underwent macular threshold test using computerized visual field analyzer before and after 1, 2, 3, and 5 months of triamcinolone injection. Pre- and postinjection values of total defect depth, total threshold, and best-corrected visual acuity were compared and correlated.*
RESULTS. *At the last follow-up, compared to baseline, visual acuity improved from 1.4±0.4 (logMAR, mean ± standard deviation) to 1.0±0.4 (p=0.01). Total defect depth tended to recover from 148±64 dB to 121±48 dB (p=0.12), and total threshold tended to increase from 241±87 dB to 271±68 dB (p=0.16), but these values did not reach significance. There was a significant correlation between baseline and 5 months postinjection values of total defect depth (rho=0.60, p=0.02), and of total threshold of light sensitivity (rho=0.55, p=0.04).*
CONCLUSIONS. *Best-corrected visual acuity was found improved in patients with diabetic macular edema 5 months after triamcinolone injection. Improvement in central retinal sensitivity did not reach significant level at the last follow-up. Macular threshold test may be a valuable tool in the follow-up of patients with diffuse diabetic macular edema after intravitreal triamcinolone injection. (Eur J Ophthalmol 2007; 17: 780-4)*

KEY WORDS. *Diabetic macular edema, Intravitreal triamcinolone, Macular threshold test, Visual field*

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INTRODUCTION

Recent randomized, controlled trials found, in the short term, a significant beneficial effect of intravitreal triamcinolone on macular thickness (1, 2) and visual acuity (2) in eyes with refractory diabetic macular edema. Another recent study (3) stressed the importance of detection of macular sensitivity as it is a relevant explanatory variable of visual function, independent of macular thickness in eyes with diabetic macular edema. The authors suggested documenting macular sensitivity changes in predicting the functional outcome of diabetic macular edema after interventions that seemed equally effective in restoring normal foveal thickness (3). We prospectively evaluated alterations in central retinal sensitivity after intravitreal triamcinolone acetonide injection for diffuse diabetic edema.

METHODS

This study was approved by the Institutional Review Board of Süleyman Demirel University. Fourteen eyes of 14 patients (13 female) with persistent diabetic macular edema were included in the study. All eyes were refractory

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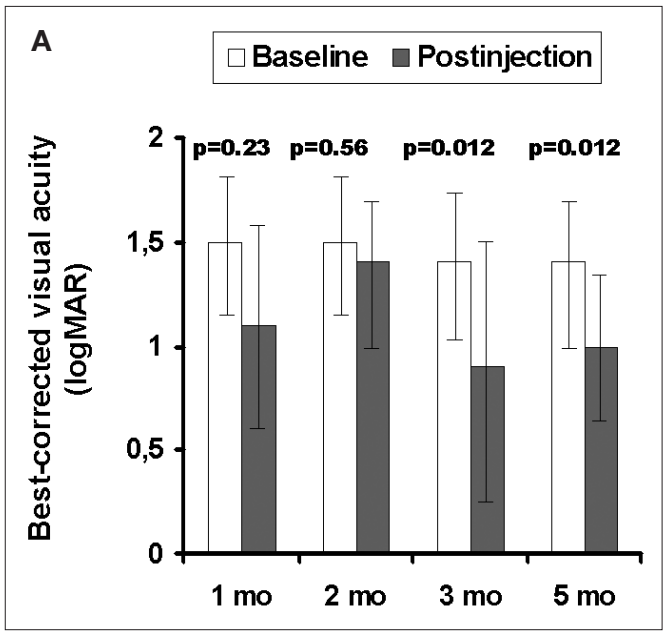

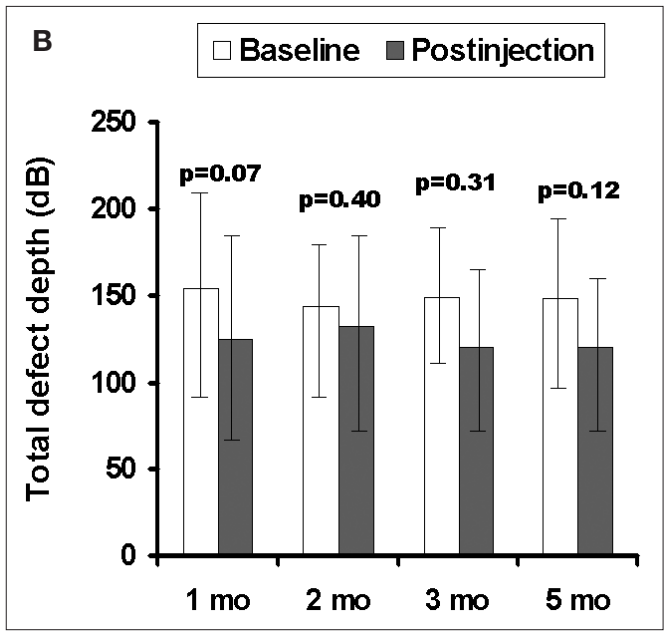

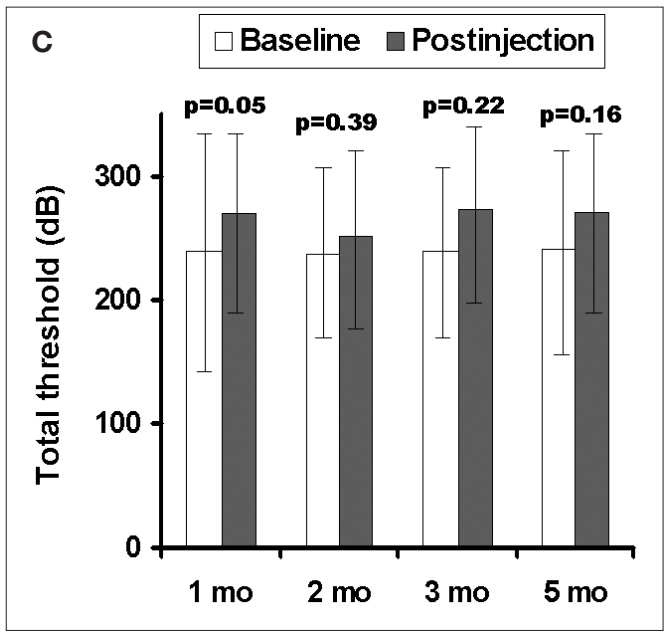

Fig. 1 - (A) *Mean (± standard deviation) postinjection best-corrected visual acuity values compared to baseline.* **(B)** *Mean (± standard deviation) postinjection total defect depth values compared to baseline.* **(C)** *Mean (± standard deviation) postinjection total threshold of light sensitivity values compared to baseline.*

to adequate laser treatment at least 3 months prior to triamcinolone injection. Snellen best-corrected visual acuity (BCVA) of 5/10 (logMAR equivalent = 0.3) or worse were included in this study. Diffuse macular edema was defined by central macular thickening on contact lens biomicroscopic evaluation, and diffuse fluorescein leakage involving most of the macular area on fluorescein angiography. Macular threshold test using computerized visual field analyzer (Model 750, Humphrey Instruments Inc., San Leandro, CA, USA) that comprised 16 stimulus locations within 5º eccentricity of the fovea were performed before and 1, 2, 3, and 5 months after the injections. Testing parameters included full threshold, stimulus size 3, and white stimulus color. Patients with a history of glaucoma or ocular hypertension, one or more disc diameters of ischemic capillary closure on fluorescein angiography, loss of vision due to any other eye disease or disorder including prominent lenticular opacity, proliferative diabetic retinopathy, and its sequela, a refractive error greater than ±6.00 diopters sphere or ±1.50 diopters cylinder or both, and central nervous system disorder or psychiatric illness were excluded. No patients were taking drugs known to interfere with visual psychophysical functions.

Triamcinolone acetonide injections (4 mg 0.1 cc) were performed 4 mm posterior to limbus using a 27-gauge needle under sterile conditions. Informed consent was obtained from each patient before each injection. Pre- and postinjection values of total defect depth (sum of all defects obtained from 16 stimulus locations within central 5 degrees), total threshold (sum of all threshold val-

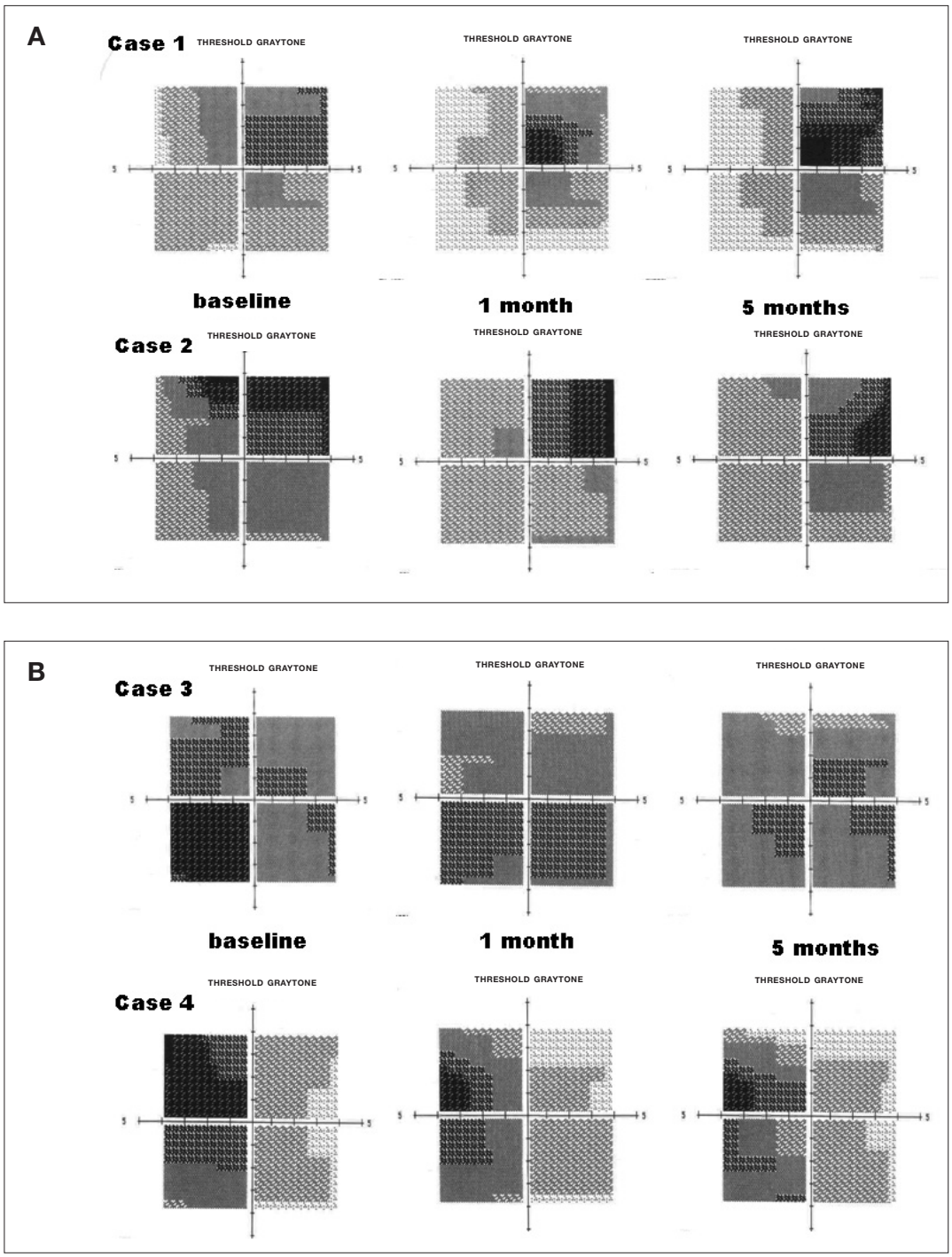

Fig. 2 - *Macular threshold test results of four cases before and 1 and 5 months after triamcinolone injection.*

ues obtained from 16 stimulus locations within central 5 degrees), and BCVA were compared and correlated. Wilcoxon test and Spearman correlation test were used to compare data. BCVA values were converted to log-MAR values for statistical comparisons. A p value less than or equal to 0.05 was considered significant.

RESULTS

The mean age of patients was 61 years (range 34–75). The mean duration of diabetes was 16 years (range 6–21). All patients were followed up for 5 months. Data were available for before (n=14) and 1 month (n=9), 2 months

(n=7), 3 months (n=12), and 5 months (n=14) after triamcinolone injection. Earliest improvement in BCVA compared to baseline was observed at the third month (0.9±0.7 logMAR versus 1.4±0.4, p=0.01). BCVA at 5 months (1.0±0.4) was also significantly better than that of baseline (p=0.01) (Fig. 1A). At the last follow-up, total defect depth tended to improve from 148±64 dB to 121±48 dB (p=0.12) (Fig. 1B), and total threshold tended to increase from 241±87 dB to 271±68 dB at the central 5°×5° scan field (p=0.16) (Fig. 1C), but these values did not reach significance.

The maximum improvement in macular sensitivity at central 5-degree area was observed at 1 month of injection: baseline total defect depth (154±57 dB) changed to 125±58 dB (p=0.07) while total threshold of light sensitivity increased from 240±97 dB to 270±80 dB (p=0.05).

No correlation was found between pre- and postinjection values of BCVA (rho=0.34, p=0.26). There were significant correlations between baseline and 5-month postinjection values of total defect depth (n=14, rho=0.60, *p*=0.02), and of total threshold of light sensitivity (n=14, rho=0.55, p=0.04).

At the last follow-up, intraocular pressure was significantly higher than that of baseline (18±3 mmHg versus 14±3 mmHg (p=0.003). Six eyes were started on glaucoma medication to normalize (≤21 mmHg) the intraocular pressures during the follow-up.

DISCUSSION

This prospective study demonstrated that the maximum recovery of central macular sensitivity occurs within the first month of triamcinolone injection (Fig. 2). At no other times did total defect depth and total threshold of light sensitivity demonstrate such improvement compared to their baseline values. BCVA started to improve at 3 months and stayed stable at 5 months of triamcinolone injection.

By using scanning laser ophthalmoscope fundus perimetry, light sensitivity was found to be reduced in areas of macular edema in diabetic patients; however, visual function showed no significant correlation to light sensitivity over 3 months following laser application (4). Light sensitivity may decrease although visual acuity increases (5). When the macular edema has already destroyed cones located inside the fovea, deterioration of the central retinal function may be observed although mean sensitivity shows stable or better values (4). Striph et al (6) showed no significant change in the foveal threshold test in patients who underwent modified grid laser treatment for diffuse macular edema. Midena et al (7) could not find any significant change in the different aspects of macular function, although laser photocoagulation maintained normal visual acuity and a beneficial effect on the clinical condition of the macula. The authors concluded that when macular function is abnormal, laser therapy is not effective in restoring even one of the various aspects of this function to normal (7).

Sutter at al (2) found significant gain in visual acuity in triamcinolone-injected eyes with diffuse diabetic macular edema compared to placebo after 3 months. In their study, authors included BCVA of 6/9 (logMAR equivalent = 0.2) or worse in the affected eye. Alterations in visual acuity at the first and second month following injection were not mentioned (2). Visual acuity results in the current study are in agreement with the study of Sutter et al (2) but not with Massin et al (1). In their study, Massin et al (1) included eyes with diffuse diabetic edema with a visual acuity range of 20/320 to 20/50 (logMAR equivalent = 1.2 to 0.4), and at no time did they find a significant gain in visual acuity up to 6 months although best improvement was noted 3 months after the injection. The authors also reported significant reduction of central macular thickness detected by optical coherence tomography at 3 months (1, 2) starting from the first month (1). At 6 months, the difference between the central macular thickness of injected and control eyes was no longer significant (1). Based on the data we found in the current study, it can be assumed that central 5-degree foveal threshold recovers prior to gain in visual acuity. Additionally, restoration capacity of macular functions is probably related to the onset and severity of the disease and macular function exhibits much limited recovery in long-lasting edema cases. Correlations between baseline and postinjection macular function tests serve as a reminder that the more preinjection defect in macular function the lesser the improvement after triamcinolone injection. This is a preliminary study that includes a small number of eyes and a larger series could give different statistical results.

In conclusion, macular function tests should be further evaluated as a valuable tool in the follow-up of patients with diabetic macular edema after intravitreal triamcinolone injection.

Proprietary interest: None.

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