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Decreased retinal vein diameter after intravitreal triamcinolone for retinal vein occlusions

Recent studies have suggested that macular oedema caused by central retinal vein occlusion may be treated by intravitreal triamcinolone acetate.^{1–5} In these investigations, macular oedema and retinal thickening markedly decreased and visual acuity temporarily increased after the intravitreal application of triamcinolone acetate. The purpose of the present study was to evaluate whether the diameters of the retinal veins change after the intravitreal injection of triamcinolone acetate. It may give hints for alterations in the retinal haemodynamics after the intravitreal application of triamcinolone acetate.

Care report

The comparative non-randomized clinical interventional investigation included a study group of 21 patients (21 eyes) with central retinal vein occlusion (n = 9) or branch retinal vein occlusion (n = 12) who received an intravitreal injection of approximately 20 mg triamcinolone acetate as described recently.³ Mean age was 69.3 ± 8.6 years, mean refractive error was 0.36 ± 1.12 diopters, and mean follow-up was 8.9 ± 5.9 months (range 2.1–22.2 months). A control group consisting of 24 patients (24 eyes) with central retinal vein occlusion (n = 9) or branch retinal vein occlusion (n = 15) did not receive any treatment. Mean age was 61.8 ± 14.3 years, mean refractive error was 0.32 ± 1.81 diopters, and mean follow-up was 7.6 ± 5.8 months (range 2.0–23.3 months). On fluorescein angiograms obtained at baseline and during the follow-up, the diameters of the affected veins were measured at the inferotemporal and superotemporal optic disc border, above and below the fovea, and between the optic disc and the infrafoveal location or the suprafoveal location.

Figure 2 Scattergram showing the change in retinal vein diameter related to the change in visual acuity during follow-up in 21 patients with retinal vein occlusions receiving an intravitreal injection of approximately 20 mg triamcinolone acetate; the relationship was statistically not significant (p=0.18).

The measurements were obtained in relative size units.

At baseline, the study group and control group did not vary significantly in age (p = 0.09), gender (p = 0.56), refractive error (p = 0.34), and follow-up (p = 0.43), nor in the diameter measurements of the retinal veins (p>0.30). In the study group and in the control group, retinal vein diameters decreased significantly during follow-up (table 1; fig 1). The amount of decrease in the retinal vein diameters did not vary significantly between the study groups (p>0.15; table 1). Visual acuity increased significantly from 0.95 ± 0.60 logarithm of the minimum angle of resolution (logMAR) to 0.78 ± 0.69 logMAR (p = 0.006; 95% confidence intervals (CI) –0.28, –0.05) in the study group, and did not change significantly in the control group (0.51 ± 0.36 logMAR versus 0.44 ± 0.35 logMAR; p = 0.17; 95% CI –0.17, 0.03). In the study group, the change in retinal vein diameter was

statistically not associated with a change in visual acuity (p>0.15) (fig 2).

Comment

The results suggest that in patients with retinal vein occlusions, a triamcinolone-associated increase in visual acuity is statistically independent of a concurrent decrease in retinal vein diameter. In agreement with other studies, it may be an indication that the anti-oedematous effect of intravitreal triamcinolone occurs at other vascular levels, such as the capillary bed, than at the level of the large retinal veins. As the decrease in retinal vein diameters did not vary significantly between the treatment group and the control group, one may infer that intravitreal triamcinolone may not have a marked effect on retinal vein dilatations, and indirectly, on the retinal vein outflow resistance, in eyes with retinal vein occlusions.

Table 1 Diameters of retinal veins in relative size units (mean ± SD) at baseline of the study and during follow-up in 45 patients with retinal vein occlusions who either received an intravitreal injection of triamcinolone acetate (study group) or who did not receive any treatment (control group)

	Baseline	Follow-up	p Value	95% CI
Study group				
n	21			
Temporal inferior vessel arcade	0.125 ± 0.032	0.111 ± 0.027	0.031	–0.023, –0.001
Temporal superior vessel arcade	0.135 ± 0.029	0.114 ± 0.025	0.002	–0.030, –0.008
Total	0.130 ± 0.025	0.113 ± 0.022	0.001	–0.024, –0.007
Control group				
n	24			
Temporal inferior vessel arcade	0.127 ± 0.035	0.104 ± 0.021	<0.001	–0.032, –0.010
Temporal superior vessel arcade	0.126 ± 0.034	0.100 ± 0.027	<0.001	–0.037, –0.015
Total	0.126 ± 0.029	0.102 ± 0.021	<0.001	–0.033, –0.015

CI, Confidence interval.
p Value, Statistical significance of difference between baseline values and measurements obtained during follow-up.

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Non-penetrating deep sclerectomy for glaucoma surgery using the femtosecond laser: a laboratory model

Non-penetrating deep sclerectomy (NPDS) is a non-perforating filtration procedure used for the surgical treatment of medically uncontrolled open angle glaucoma. This procedure was developed in an attempt to avoid many of the postoperative complications of trabeculectomy.¹ The major advantage of NPDS is that it precludes the sudden hypotony that occurs after trabeculectomy by creating progressive filtration of aqueous humour from the anterior chamber to the subconjunctival space, without perforating the eye.² Preservation of the thin trabeculo-Descemet's membrane, however, is technically challenging, particularly before the surgeon gains experience with this procedure.

Previous studies investigated the ability to use the femtosecond laser for photodisruption in the human sclera,^{3,4} and concluded that complete subsurface photodisruption can be accomplished in human sclera *in vitro*.

Toyran *et al.*⁵ in 2005 published their *in-vitro* study that tested the feasibility of using femtosecond laser pulses to fistulise the human trabecular meshwork and concluded that, with appropriate exposure time and pulse energy, femtosecond photodisruption can be employed to create partial and full thickness ablation in the human trabecular meshwork without damaging the surrounding tissues.

In the study described here, we used femtosecond laser technology to perform subsurface photodisruption in the opaque sclera for NPDS surgery in a laboratory model.

Materials and methods

Eight NPDS operations were performed in five cadaver eyes for this study.

The donor eye was placed in an eye holder with a suction ring to immobilize it.

Conjunctiva and Tenon's capsule were reflected. A 200 µm thick, limbal-based, 7 mm diameter round scleral flap was performed using the femtosecond laser (IntraLase Corp Irvine, California, USA). The IntraLase used a raster spot pattern for creating 1–2 micron bubbles with bed energy of 2.6 µJ. The spot separation was 6/7 µm and the firing rate was 60 kHz. The hinge was placed 1–2 mm into clear cornea (fig 1). The scleral flap separation was started on the corneal side, using a Siebel spatula, and was continued in the same plane into the sclera using corneal dissectors. The flap was lifted and a second circular flap of 400 microns depth, 5 mm diameter, was performed, dissected (fig 2A) and amputated (fig 2B), leaving a thin layer of deep sclera over the choroid posteriorly. Anteriorly, the dissection was into Schlemm's canal, which was unroofed. The corneal stroma was excised to the level of Descemet's membrane and aqueous humour began percolating through the remaining thin trabeculo-Descemet's membrane. Methylene blue was injected to the anterior chamber, using a 25 gauge needle, in order to demonstrate aqueous humour percolation (fig 2B). The superficial scleral flap could then be repositioned and sutured with two single 10–0 nylon sutures.

Results

The creation of a scleral flap was achieved using an IntraLase without damage to overlying tissue in all eight NPDS operations. A thinned sclera was observed underneath the flaps with percolating aqueous humour (fig 1).

One case had an intraoperative perforation of the sclera with choroid prolapse after performing the second scleral flap with the femtosecond laser.

Discussion

Despite the advantages of decreased postoperative complications when compared with trabeculectomy in primary open angle glaucoma surgery, deep sclerectomy has not gained wide acceptance partly because of the difficulty of the technique, with a long learning curve, and as a result of studies that indicate that NPDS is less effective than trabeculectomy for

Figure 1 Photograph of the first limbal-based, 200 µm thick, 7 mm diameter circular scleral flap performed on cadaver eye using the femtosecond laser. Flap was dissected using a Siebel spatula and cornea dissectors and lifted on the cornea.

Figure 2 Photograph of the second, 400 µm thick, 5 mm diameter circular scleral flap performed on cadaver eye using the femtosecond laser. The flap was dissected and the two flaps were lifted on the cornea (A). Methylene blue was injected into the anterior chamber. The second flap was amputated, the anterior trabeculum and Descemet's membrane were exposed, and methylene blue percolated through the remaining membrane (arrow) (B).

intraocular pressure reduction on a medium and long-term basis.⁶ When intrascleral collagen implants are used, however, deep sclerectomy yields improved results according to some authors.⁷ Our preliminary study on cadaver eyes suggests that high precision, subsurface scleral photodisruption can be achieved for NPDS surgery, using the femtosecond laser. This could simplify and facilitate this surgical procedure.

The major known intraoperative complication of this surgery is perforation of the thin trabeculo-Descemet's membrane during the deep sclerectomy dissection.^{8,9} No case of intraoperative perforation of the trabeculo-Descemet's membrane was observed in all eight surgeries performed by us using the femtosecond laser.

Lifting of the scleral portion of the flap was harder than the corneal one. We thus had to use higher bed energies and a sharper corneal dissector to complete the scleral dissection at the same plane as the corneal.

One case of scleral perforation and choroidal prolapse occurred in our series. This could be attributed to a deeper dissection plane in the sclera made by the surgeon using the cornea dissectors during dissection of the first flap (which was thicker than planned). Therefore, when the second circular flap of 400 microns depth, 5 mm diameter was performed, it perforated the sclera.