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Long Term Effectiveness of Photocoagulation for Diabetic Maculopathy

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Summary

The long term visual results of photocoagulation for diabetic maculopathy were determined in 128 eyes of 95 patients followed over ten years. The mean age of patients was 55.5 years and mean follow up time was 7 years. Ten year data were available on forty patients (62 eyes) and of the remainder the majority had died. Of those eyes initially with good vision (defined as 6/12 or better), 60% maintained this level of acuity at ten years and of those which deteriorated 50% became blind (defined as 6/60 or worse). A significantly greater proportion of eyes with exudative maculopathy (48%) had good final vision compared to eyes with oedematous and ischaemic maculopathy (26%).

Although photocoagulation has been demonstrated to be effective in the treatment of diabetic maculopathy, the condition remains a major cause of visual loss.[1-4] The visual outcome following treatment has previously been determined in several clinical trials with mean durations of patient follow-up ranging from one to five years.[5-8] In order to assess whether or not the benefit of treatment is maintained in the long term we now report the results of a ten year follow-up on patients treated for diabetic maculopathy.

Patients and Methods

Ninety-five consecutive patients referred to the diabetic retinopathy clinic at the Hammersmith Hospital between 1 January 1974 and 31 December 1976 with diabetic maculopathy in at least one eye were entered into the study. Details of these patients are shown in Table I.

Maculopathy was defined as a corrected visual acuity of 6/12 or worse where the visual loss was due to macular oedema and/or hard exudates. Patients with visual acuities better than 6/12 were also included if hard exudates were seen to encroach onto the macula. The second eye of patients was eligible for the study if it had received photocoagulation treatment for diabetic maculopathy within one year of the first. Patients were excluded if there was a previous history of photocoagulation or the presence of concurrent proliferative retinopathy.

At the initial visit patients received a full ophthalmological examination with best corrected visual acuity measured. Retinal lesions were documented by stereo colour photographs and fluorescin angiography. These procedures were then repeated on an annual basis for each patient.

Photocoagulation was by Xenon arc until 1975 and thereafter by Argon laser. The centre of hard exudate rings was treated and where exudates were absent but macular oedema present, microvascular lesions (microaneurysms and intra-retinal microvascular abnormalities) between the inferior and

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Table I *General patient details*

Number	95 (57M, 38F)
Mean age (years)	55 (range 24–78)
Non-insulin dependent	66
Insulin dependent	29

superior temporal vascular arcades were treated. Where the macula was ischaemic, additional scatter treatment to the peripheral retina was also applied.

From the initial stereo colour photographs and fluorescein angiograms eyes were classified on the basis of their maculopathy into exudative, oedematous and ischaemic groups. These categories are comparable to the focal, cystoid and ischaemic groups described by Whitelocke *et al.*[9] Exudative maculopathy consisted of hard exudate deposits in the macula, usually associated with focal areas of leakage on fluorescein angiography. Eyes without hard exudate deposits were defined as oedematous as these eyes often had widespread oedema as demonstrated by diffuse leakage on fluorescein angiography. Ischaemic maculopthy was used to describe eyes with large confluent areas of capillary occlusion in the macula. Due to the relatively small number of eyes in this study the oedematous and ischaemic maculopathies were combined into a single non-exudative group for analysis.

Results

The number of patients and eyes remaining in the study during the ten years is shown in Table II. The mean (±SD) length of patient follow-up was 7.0±3.2 years. Of those 55 patients in whom ten year data was unavailable the majority had died (See Table III).

A total of 36 patients (55 eyes) developed proliferative retinopathy during the course of this study. This represented 37% of the exudative eyes and 47% of the non-exudative eyes. In only four of these eyes, which developed vitreous haemorrhages, was the proliferative disease the final cause for the reduced vision.

Table II *Number of patients and eyes followed-up during the ten years*

	Entry	*3yrs*	*5yrs*	*10yrs*
Patients	95	83	69	40
Eyes	128	115	97	62

In order to assess visual outcome, eyes were divided into those with good vision (6/6–6/12), fair vision (6/18–6/36) and poor vision (6/60 or worse).

The initial and final vision of the 62 eyes which achieved a ten year follow-up are shown in Table IV. Vision deteriorated in these eyes mainly within the first five years of the study with only three eyes deteriorating thereafter. Of the 47 eyes with good vision initially, 60% still maintained this level of vision at ten years. Only 14 eyes with initial fair vision had a ten year follow-up and of these 50% maintained the same level of vision. The single eye with poor vision initially which improved to good shown in Table IV, did so following cataract extraction rather than an improvement in maculopathy.

Figure 1, demonstrates the percentage of eyes initially with good vision which maintained good vision throughout the ten years. The greatest decline occurred in the first year and by five years the proportion of eyes maintaining good vision had stabilised and remained relatively constant over the next five years. Of the eyes with good vision initially which later deteriorated 50% became fair and 50% became poor.

The initial and final vision of the exudative and non-exudative eyes are compared in Table V. Although at entry no significant difference was present between the initial visions of the two groups a significantly greater number of eyes in the exudative group had final vision that was good (48%) compared to the non-exudative group (26%).

Discussion

As reported in previous studies, the majority of patients presenting with diabetic maculopathy were found to be non-insulin dependent.[10-11] Our study also confirms that patients with diabetic maculopathy have a reduced life expectancy compared to non-diabetics of a

Table III *Patients who did not have a ten year follow-up*

Dead	43
Moved away	5
Too ill to attend	3
Whereabouts unknown	4
	Total=55

Table IV *Comparison of vision at entry with vision at ten years*

		10 year vision			
		good	*fair*	*poor*	*Total*
Initial vision	good	28	10	9	47
	fair	1	7	6	14
	poor	1	0	0	1
	Total	30	17	15	62

similar age (expected mortality per year in the age range 45–64 = 1.3/100 patients).[12]

Thirty-six of our patients developed proliferative retinopathy which is considerably higher than that found in the British Multicentre Study of Maculopathy,[7] where the treated eyes of only nine patients out of 99 became proliferative during a five-year follow-up period. One factor which may have contributed to this difference is that in the latter study 44 patients received photocoagulation to the peripheral retina in addition to macular treatment whilst this was confined to only 15 of our patients with ischaemic maculopathy. It has been reported that even moderate peripheral photocoagulation may give prophylaxis against retinal neovascularisation.[9] A higher incidence of proliferative disease would also be expected from the longer duration of patient follow-up in our study. That in only four eyes was vision finally reduced due to the complications of the proliferative disease demonstrates the effectiveness of pan-retinal photocoagulation in preserving vision.

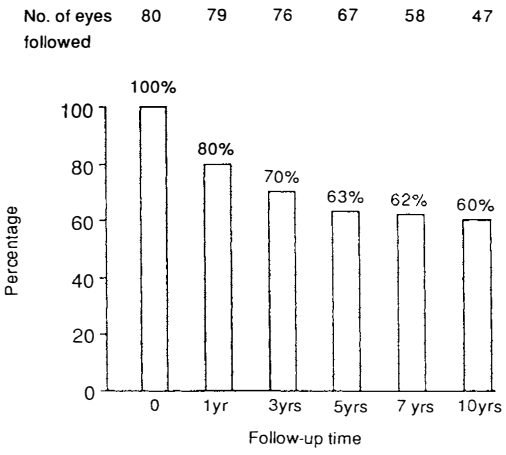

Fig. 1 *Percentage of eyes with initial good vision which maintained good vision*

Table V *Initial and final vision of Exudative and Non-exudative eyes*

	Exudative		*Non-exudative*	
	Initial	*Final*	*Initial*	*Final*
good	36	28	44	18
fair	20	16	18	28
poor	2	14	8	24

In the British Multicentre Study, photocoagulation was found to be effective in maintaining vision in treated eyes compared to control eyes over a five year period. It is notable from our study that most of the deterioration in vision occurred in the first five years after treatment, relatively little occurring thereafter. This suggests that the visual acuity five years after treatment is a good indicator of long term visual outcome (see Fig. 1). Photocoagulation for diabetic maculopathy is therefore effective in maintaining vision over the long term with 60% of eyes with good vision initially maintaining this level of vision at ten years.

In this study the benefit of treatment was greater for exudative maculopathy than for oedematous maculopathy. Since this study was started, grid photocoagulation has been shown to maintain vision in eyes with diffuse macular oedema.[13] The long-term difference in visual outcome between the exudative and non-exudative eyes may therefore be less when this mode of treatment is employed than that reported in this study.

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References

[1] Klein R, Klein BEK, Moss SE: Visual impairment in diabetes. *Ophthalmology,* 1984, **91:** 1–8.

[2] McMeel JW, Trempe CL, Franks EB: Diabetic maculopathy. *Trans Am Acad Ophtahlmol Otolaryngol* 1977, **83:** OP476–85.

[3] Patz A, Fine SL: Observations in diabetic macular edema. In symposium on retinal disease: *Trans New Orleans Acad Ophthalmol* St Louis: CV Mosby 1977, 112.

[4] Ferris F, Patz, A: Macular Edema. A complication of diabetic retinopathy. *Surv Ophthalmol* 1984, **28:** 452–61.

[5] Patz A, Shatz H, Berkow JW, *et al.*: Macular edema—An overlooked complication of diabetic retinopathy. *Trans Am Acad Ophthalmol Otolaryngol* 1973, **77:** 34–42.

[6] Blankenship GW: Diabetic macular edema and

laser photocoagulation. *Ophthalmology* 1979, **86:** 69–75.

[7] Photocoagulation for Diabetic Maculopathy. British Multicentre Study Group. *Diabetes* 1983, **32:** 1010–16.

[8] Early Treatment Diabetic Retinopathy Study Reseasrch Group: Photocoagulation for Diabetic Macular Edema. *Arch Ophthalmol* 1985, **103:** 1796–806.

[9] Whitelocke RAF, Kearns M, Blach RK, Hamilton AM: The diabetic maculopathies. *Trans Ophthalmol Soc UK* 1979, **99:** 314–20.

[10] Aiello LM, Rand LI, Briones JC: Diabetic retinopathy in Joslin Clinic Patients with adult onset diabetes. *Ophthalmology* 1981, **88:** 619–23.

[11] Bodansky HJ, Cudworth AG, Whitelocke RAF, Dobree C: Diabetic Retinopathy and its relation to type of diabetes: review of retinal clinic population. *Br J Ophthalmol* 1982, **66:** 496–9.

[12] Mortality Statistics. England and Wales. Office of Population, Census and Surveys, 1979.

[13] Olk RJ: Modified Grid Argon Laser Photocoagulation for Diffuse Diabetic Macular Edema. *Ophthalmology* 1986, **93:** 938–49.