ORIGINAL ARTICLE

Patient comfort levels and treatment parameters in laser photocoagulation: comparison of patterned scanning versus single spot laser machines

Andrew C. T. Fok,[1] FRCS, Fiona O. J. Luk,[1] MRCS, Victoria W. Y. Wong,[1] MRCS, Poemen P. M. Chan,[1] MRCS, Timothy Y. Y. Lai,[2] MD, FRCS, FRCOphth

[1]*Hospital Authority Ophthalmic Service, Hong Kong Eye Hospital, Hong Kong SAR, China.*

[2]*Department of Ophthalmology & Visual Sciences, The Chinese University of Hong Kong, Hong Kong SAR, China.*

Correspondence and reprint requests:

Dr. Andrew C. T. Fok, Hong Kong Eye Hospital, 147K Argyle Street, Kowloon, Hong Kong SAR, China. Email: afok@alumni.cuhk.net

Abstract

Aims: To compare the treatment parameters, outcomes, and patient comfort levels following patterned scanning laser photocoagulation versus single spot laser photocoagulation.

Methods: This prospective randomized controlled trial involved 18 eyes of 16 patients. Patients with retinal diseases requiring laser photocoagulation to the retina were recruited and randomized to undergo laser photocoagulation using patterned scanning laser or single spot laser machines. Treatment parameters were recorded. Comfort levels and cooperation were evaluated by visual analog scales by both the patients and treating ophthalmologists.

Results: There was no statistically significant difference between treatment parameters in the two groups except that the patterned scanning laser group had a shorter laser shot duration ($p < 0.001$). Regarding the patient comfort levels and cooperation, there were no significant differences with respect to the two machines used ($p = 0.95$ and 0.45, respectively).

Conclusions: Patterned scanning and single spot laser photocoagulation appeared to result in similar patient comfort. The use of patterned scanning laser machine did not appear to reduce the time required for the procedure.

Key words: Laser coagulation; Retinal diseases; Treatment outcome

Introduction

Thermal laser photocoagulation is one of the main treatment options for ocular diseases. Commonly performed laser photocoagulation procedures include panretinal photocoagulation (PRP) to treat proliferative retinopathies such as neovascularization in proliferative diabetic retinopathy and retinal vein occlusions, barrier laser photocoagulation for treating retinal breaks or peripheral retinal degenerations, and focal and grid laser photocoagulation for management of macular edema. In PRP, laser photocoagulation usually requires more than 2000 to 3000 laser burns to cover the entire retina and might be very time-consuming since most conventional laser systems only allow the delivery of one laser spot to the retina at a time. Due to the long duration of the laser procedure, it could result in patient discomfort.

More recently, ophthalmic laser with a semi-automated patterned scan delivery system has become commercially available.[1,2] These systems can deliver up to 50 individual laser shots in various patterns to the retina on each occasion over a very short period of time. This procedure is reputed to reduce the duration of laser, and improve the patient comfort. Moreover, the time required for laser therapy using the patterned scan laser was found to be significantly reduced and therefore more patients might be able to undergo

the procedure in one session and thus reduce the waiting times.[3,4] To evaluate whether the patterned scanning laser system might be useful in our local setting, we performed a pilot study to compare the treatment parameters, visual and anatomical outcomes, and patient comfort levels following laser photocoagulation with the single spot laser system and patterned laser scanning.

Patients and methods

This was a prospective randomized controlled trial. Patients were recruited and enrolled in the ophthalmology clinic at the Hong Kong Eye Hospital. The study protocol conformed to the Declaration of Helsinki and was approved by an institutional review board. All patients gave written informed consent to participate in the study and consented to laser photocoagulation. The study inclusion criteria were: indication for laser photocoagulation procedures such as PRP or retinal barrier laser, and age of 18 years or above. Exclusion criteria included: inability to cooperate with laser procedures, eyes with significant media opacity (preventing fundal examination or effective laser delivery).

Patients were randomized to undergo laser photocoagulation using either single spot laser (Lumenis, Santa Clara, CA, USA) or the patterned scanning laser delivery (Quantel Medical, Paris, France) using a computer-generated table kept centrally and concealed from the investigators until the time of the first treatment. If a patient had both eyes included in the study, their second eye was randomized and analyzed separately. Patients and investigators were not masked to the treatment group allocated but assessors performing visual acuity examination were. Patients could withdraw from the study at any time. The primary study outcomes included the patient's level of comfort during the laser treatment and the parameters of the laser treatment settings (time, duration, power, size, and number of laser spots). Other treatment outcomes included the patient's level of cooperation as perceived by the treating investigator.

At baseline examination, all patients were given a full ophthalmologic examination in order to confirm eligibility. The examinations included: slit lamp and dilated fundal examination, best-corrected visual acuity, and intraocular pressure measured by non-contact tonometry. Laser photocoagulation was performed under topical anesthesia. After installation of topical anesthesia with 0.4% oxybuprocaine (Novesin; Novartis, Basel, Switzerland), a contact lens was placed on the cornea for laser photocoagulation. For PRP, we aimed to perform about 1000 to 1500 laser shots per session. The appropriate number of laser applications was performed for barrier laser photocoagulation. At the end of the laser session, the patient's level of discomfort was assessed using a 10-cm visual analog scale (VAS), with 0 being no pain and 10 being the most pain ever experienced. The patient's cooperation as perceived by the treating investigator was also assessed using a VAS.

Demographic characteristics of the patients were summarized by descriptive statistics using statistical software (SPSS for Windows version 16.0, SPSS Inc, Chicago, IL, USA). Comparisons of continuous variables were performed using the two-tailed *t*-test and Mann-Whitney *U* test. Comparisons of categorical variables were performed using the chi-square test. A p value of less than 0.05 was considered statically significant.

Results

Eighteen eyes of 16 patients were enrolled into the study. The baseline characteristics including age, gender, spherical equivalent, best-corrected visual acuity and lens status in the two groups were comparable (**Table 1**). The patient diagnoses included: proliferative diabetic retinopathy, neovascular glaucoma, retinal break, and peripheral retinal degeneration. One patient with bilateral retinitis had both eyes enrolled and randomized into the two different groups. All of the enrolled patients completed the study.

Table 1. Baseline characteristics of the two groups of patients.*

Characteristic	Patterned scan (n = 8)	Single spot (n = 10)	p Value
Age (years)	52.6 ± 13.5	57.2 ± 13.5	0.49
Gender (male : female)	4 : 4	6 : 4	0.68
Diagnosis			
Proliferative diabetic retinopathy	3 (38%)	4 (40%)	
Neovascular glaucoma	0 (0%)	1 (10%)	
Retinitis	1 (13%)	1 (10%)	
Retinal break	2 (25%)	3 (30%)	
Retinal degeneration	2 (25%)	1 (10%)	
Spherical equivalent (diopters)	-3.18 ± 5.38	-1.14 ± 2.13	0.29
Visual acuity (logMAR unit)	0.41 ± 0.45	0.56 ± 0.80	0.70
No. of pseudophakic eyes	1 (13%)	2 (20%)	

** Data are shown in No. of eyes, No. (%) of eyes, or mean ± standard deviation.*

Regarding the treatment parameters, the patterned scan group had a significantly shorter individual laser shot duration than the single spot laser group (0.02 s versus 0.10 s; $p < 0.001$). However, there was no statistically significant difference between the two groups with respect to the other treatment parameters (**Table 2**).

Table 2. Treatment parameters in the two groups.

Treatment parameter	Patterned scan	Single spot	p Value
Session duration (mins)	12	13	0.86
Mean number of shots	946	851	0.72
Mean shots per minute	74	62	0.93
Mean spot size (microns)	200	200	1.00
Mean power (mW)	400	316	0.66
Mean laser duration (s)	0.02	0.10	<0.001

Table 3. Visual analog scale (VAS) scores of comfort levels and cooperation in the two groups.

VAS parameter	Patterned scan	Single spot	p Value
Patients' comfort level (mean VAS score)	5.89	5.79	0.95
Patients' cooperativeness (mean VAS score)	9.16	8.27	0.45

Regarding the comfort level of patients, the mean VAS scores were 5.89 and 5.79 for the patterned scan and single spot groups, respectively. The mean VAS scores for patient cooperation were 9.16 and 8.27 for the patterned scan and single spot groups, respectively. There was no statistically significant difference in the mean VAS scores between the two groups for both parameters (**Table 3**).

Discussion

In our current study, patterned scan and single spot laser photocoagulation appeared to result in similar patient comfort. The use of the patterned scan machine did not appear to reduce the total time required for the procedure. These results contrast with those reported in the literature, in which it was reported to achieve better patient comfort and shorter session durations.[5,6] This might have been influenced by the use of a different brand of patterned scan laser machine, as brands might differ in terms of patient comfort and ease of use. Another possibility was that some of our patients had media opacities (cataracts and vitreous hemorrhages) that could make the application and focusing of the patterned scan lasers more difficult, thus prolonging the time required. Limitations in our study included the relatively small sample size, and the lack of visual field data. Inclusion of visual field examination into the study might have been beneficial as it has been suggested that patterned scan lasers might lead to better preservation of visual fields after PRP. Further studies to compare the use of different brands of patterned scan laser machines might also be useful.

References

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