

Abstract**Purpose**

To compare the pain response of patients with proliferative diabetic retinopathy (PDR) or severe nonproliferative diabetic retinopathy (NPDR) underwent panretinal photocoagulation (PRP) using both yellow and green laser photocoagulation treatment.

Method

Patients diagnosed with PDR or severe NPDR were assigned to undergo both yellow and green laser photocoagulation treatment in both eyes. PRP was performed using spot size of 500 μm and a pulse duration of 0.02 second to obtain a white-greyish spot (grade 2 laser burn) on the retina. Parameters were identical in both procedures. Patients were asked to verbally describe their pain perception using visual analogue scale (VAS) by indicating a score from "0" to "10," representing the severity of pain from "no pain" to "severe pain" immediately after the procedure. The second eye was treated the following day with different kind of laser photocoagulation and analyzed immediately.

Result

Eight patients were participated in this study. Five patients had PDR and three patients had severe NPDR. The mean number of laser spots delivered during was $680 \pm 189,4$ for green laser and $723 \pm 230,1$ for yellow laser. The mean number of power delivered was $502 \pm 276\text{mW}$ for the green laser and $568 \pm 151\text{mW}$ for the yellow laser. The mean number of VAS was $1,75(\pm 1)$ for green laser and $1,25(\pm 1)$ for yellow laser.

Conclusion

The results suggest that there is a tendency less pain in patients underwent PRP with yellow laser than green laser.

Keywords

Diabetic retinopathy, laser photocoagulation, pain response.

Introduction

Diabetic retinopathy has been and remains a leading cause of blindness in working-age adults. However, for patients with severe nonproliferative diabetic retinopathy (NPDR) or proliferative diabetic retinopathy (PDR), prompt intervention with photocoagulation can reduce the 5-year risk of severe visual loss by 90%. Numerous trials have demonstrated the benefits of photocoagulation in high-risk patient's diabetic retinopathy PDR.¹⁻³

One of the side effects experienced by patients during undergoing panretinal photocoagulation (PRP) is the pain caused by the laser. Various researches have been conducted to overcome the discomfort. Compared with the widely used conventional green laser photocoagulation, new technologies such as yellow laser photocoagulation believed to provide more comfortable, less harmful and time-saving treatments.^{4,5}

This study intent to compare the pain responses of patients with PDR or NPDR undergoing PRP uses either yellow laser or green laser photocoagulation treatment.

Subject and Method

Consecutive case series was used in this study. The subjects in this study are patients, who came to Vitreoretinal Unit of Cicendo Eye Hospital between 10 to 20 October 2016. The study population included a total of 16 eyes of 8 patients (4 males and 4 females) were treated. There were 5 patients diagnosed with bilateral PDR and 3 patients with bilateral severe NPDR. None of the patients had undergone previous laser therapy. Patients in this study were treated by the same operator who has laser photocoagulation competency

Pre-laser anaesthesia used topical 0.5% tetracaine applied over 5 minutes. Photocoagulation was applied using techniques with 0,02 second and spot size 500 µm with a Mainster 165 PRP lens (OMRA-PRP 165 Ocular) that has given methylcellulose. Two laser systems were used in this study. Green laser system (Carl Zeiss Meditec, Visulas 532s) provided optical radiation from a diode-pumped solid-state continuous wave laser coupled into a scanning system integrated with a slit lamp. In this system, the laser beam is projected onto the retina and a graphic user interface is used to control laser parameters including the spot size, laser power, and pulse duration. Once the treatment parameters are selected, a foot pedal is used to activate the laser. The yellow laser system (Nidek, Multicolor Scan Laser Photocoagulator MC-500 Vixi) operated in the same manner as the green laser system. Threshold laser burn intensity was standardized grade 2 for all eyes.

Observation of pain response was done right after every session of each laser treatment using Visual Analogue Scale (VAS). Participants were asked to rate the level of pain related to the treatment session using the VAS. The VAS allows the patient to rate the pain intensity on a numbered scale, from 0 to 10. Zero is absence of pain, 1-3 is mild pain, 4-6 is moderate pain, and 7-10 is

designated severe pain. The second eye was treated the following day with different kind of laser photocoagulation and assessed immediately.

Result

Table 1 showed the characteristics of laser spot delivered and power delivery during PRP. The mean number of laser spots delivered during was $680 \pm 189,4$ for green laser and $723 \pm 230,1$ for yellow laser. The mean number of power delivered was 502 ± 276 mW for the green laser and 568 ± 151 mW for the yellow laser.

Table 1. Laser photocoagulation laser spot delivered and power delivery

Characteristic	Green	Yellow
Laser spots delivered		
- Median	663	639
- Range	410-950	490-1200
- Mean (\pm SD)	$680 (\pm 189,4)$	$723 (\pm 230,1)$
Power (mW)		
- Median	425	600
- Range	220-950	400-700
- Mean (\pm SD)	$502 (\pm 276)$	$568 (\pm 151)$

Table 2 showed the pain scores associated with green laser and yellow laser treatments after PRP. The mean number of VAS was $1,75 \pm 1$ for green laser and $1,25 \pm 1$ for yellow laser.

Table 2. Pain scores associated with green laser and yellow laser treatments

VAS score	Laser Treatment	
	Green	Yellow
Median	2	1
Range	0-3	0-3
Mean(\pm SD)	$1,75 (\pm 1)$	$1,25 (\pm 1)$

Discussion

Green (532-nm) lasers are used due to the high absorption by melanin and haemoglobin at green wavelengths, but 577-nm (yellow) wavelength has been suggested as a preferable alternative. Yellow laser has attributes similar to green laser, with a few extra advantages. This longer wavelength scatters less than green and therefore has a reduced energy requirement. Its application has been limited by the costliness. In this study, the total power delivered higher in yellow laser system. It is most likely due to the use of different laser photocoagulation machine. Ideally, yellow and green laser should come from the same machine.⁶⁻⁸

Laser PRP can be an unpleasant experience for the patient, which may be so uncomfortable that there is a risk of inadequate treatment being applied or perhaps the patient may even default from attendance. Numerous of pre-laser injection strategies have been investigated. Oral acetaminophen, diazepam, diclofenac, mefenamic acid, and paracetamol have all been studied. Recently, clinicians have undertaken PRP using modified short duration-high power laser setting compare to ETDRS laser setting. The result is lower pain response experienced by patient in modified short duration-high power laser setting.⁹⁻¹²

Pain experienced by patients during laser retinal photocoagulation is very variable and dependent on a number of factors including pigmentation of the fundus, laser re-treatment, and patient anxiety. Ocular pain and photophobia are frequently reported post-laser. It is thought in many cases to result from photocoagulation of the ciliary nerves running in the suprachoroidal space and generally patients experience more pain when treated anteriorly and in the horizontal meridians.¹²⁻¹³

Pain is a difficult outcome to measure due to its multifaceted and subjective nature. The need for selecting proper outcome measures is high because of the increasing demand for scientifically valid demonstrations of treatment efficacy. This research used the VAS, which has been found to be correlative and reproducible.¹⁴⁻¹⁵

Small sample size, limited time and use of different laser machines become limitation of this study. Therefore, prior to drawing conclusive results, a

similar study should be performed in a larger study sample, longer time and use a single laser machine.

By comparing between yellow and green laser, it may be possible to improve comfort and reduce pain. This study found that patients undergoing PRP treatment with the yellow laser photocoagulation suggest slight less pain than those treated with the green laser, despite the total spot delivered and total power delivered higher in yellow laser than green laser.

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