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Efficacy of TTT (Transpupillary Thermotherapy) in Treatment of Myopic Subretinal Choroidal Neovascular Membranes (SNVMs)

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The purpose of present study is to evaluate the efficacy of TTT in treatment of myopic choroidal nonvascular membranes (SNVMs). The study included 25 eyes of 25 different patients all suffering from myopic SNVMs. Another 10 eyes of 10 patients were not treated by TTT and were used as control. Marked improvement in the visual acuity of patients suffering from myopic SNVMs in 80% of cases. In the control group, 70% of cases showed deterioration in their VA, whereas the rest 30% remained unchanged. TTT is an effective method in treating myopic SNVMs, as well as an adjuvant therapy for other treatment modalities as PDT. (Photodynamic therapy).

Key words: Transpupillary thermotherapy (TTT), myopic subretinal neovascular membrane (SNVMs), Visual Acuity(VA)

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INTRODUCTION

Transpupillary thermotherapy (TTT) is a low irradiance, large spot size, prolonged exposure (long-pulse), infrared laser photocoagulation protocol. TTT has emerged as method of treatment for selected cases of choroidal malignant melanoma (Stoffels, 2002)

Transpapillary thermotherapy (TTT) is currently also being used as a treatment modality for choroidal neovascularization in Age-related Macular Degeneration (ARMD). It is also being used in the management of choroidal metastasis, choroidal hemangioma and in the management of choroidal melanoma (Reichel *et al*., 1999)

In present study, we used TTT in managing patients suffering from myopic subertinal choroidal neovascular membranes (SNVMs).

MATERIALS AND METHODS

Our study included 25 eyes of 25 different patients all suffering from myopic SNVMs. Another 10 eyes of 10 patients also suffering from myopic SNVMs, but were not treated by TTT and were used as control.

We retrospectively divided our 25 patients receiving treatment by TTT into 3 groups according to their response to treatment: Visual Acuity (VA) after treatment correlated to the patient myopic spherical equivalent

Group (I): Included 15 eyes of 15 patients, where their VA ranged between 6/36 and 5/60, their myopic spherical equivalent ranged between-6 and 12 D, with a mean of -9 D.

This group included 10 females and 5 males of age ranged between 30-50 years with a mean age of 40 years.

Group (II): Included another 5 patients, where their VA ranged between 6/36 and 3/60. Their myopic spherical equivalent ranged between-8.0 and 14 D, with a mean of -11.0 D.

This group included 3 females and 2 males of age ranged between 35 years to 55 years with a mean aged of 45 years.

Group (III): Included 5 patients, 2 females and 3 males. Their myopic spherical equivalent ranged between -7.0 D to -15.0 D, with a mean of -11.0 D. their mean age was 42 years.

In these 3 groups, the myopic SNVMs did not exceed 3.0 mm in diameter as measured by fundus biomicroscopy and fluorescein angiograms.

In the control group, our 10 patients included 6 females and 4 males, their age ranged between 35-55 years with a mean age of 45 years. Their myopic spherical equivalent ranged between -8.0 to -15.0 D, with a mean of -11.5 D, their membranes also did not exceed 3mm in diameter as measured by fundus biomicroscopy and fluorescein angiograms.

All our patients had deterioration in their V.A. in the last 6months before treatment.

Our exclusion criteria included submacular haemorrhage, hypofluoresence of other origin, serous Pigment Epithelial Detachment (PED) and submacular fibrosis.

All had full clinical ophthalmological examination including fundus biomicroscopy and fundus fluorescein angiography before and after treatment up to 6 months.

Eyes with other retinal disorders previous laser photocoagulation or photodynamic therapy (PDT), glaucoma and other conditions affecting VA were also excluded.

All our lesions were treated using the 810 nm diode laser (3000 micron spot, duration of 60 sec).

The lesion size and the amount of subretinal fluid were determined by results of examination and review of fluorescien angiograms.

It is clear from the results of patients of group 1 that they have responded well to treatment and achieved better BCVA than before treatment to reach up to 6/9. (Table 1) These results were confirmed by funds biomicroscopy and by fluorescein frames that showed a reduction of the neovascular complex and regression of the fluorescein leakage (Fig. 1). In most cases minute hges were absorbed, leaving subretinal fibrous tissue and window defects in Retinal Pigment Epithelium (RPE).

It is clear from the results of patients of group 2that they have responded well to treatment but slightly less than in group 1 and that their BCVA reached up to 6/12 after treatment (Table 2).

Their fluorescein frames showed the same results as in group 1.

Table 1: Pre and post treatment visual acuity for each patient in group 1 with their corresponding spherical equivalent

Serial No. of patient	VA before TTT	Myopic sph. Equiv.	BCVA after TTT
1	6/36	-6.0D	6/9
2	6/36	-7.5D	6/12
3	5/60	-12.0D	6/12
4	6/60	-8.0D	6/12
5	6/60	-8.5D	6/9
6	6/36	-11.0D	6/12
7	6/36	-10.0D	6/12
8	6/60	-11.5D	6/18
9	6/60	-11.0D	6/18
10	5/60	-9.0D	6/9
11	6/60	-7.0D	6/12
12	6/36	-10.5D	6/12
13	6/36	-11.0D	6/12
14	6/60	-8.5D	6/12
15	6/60	-10.0D	6/9

Significant results ($p<0.0001$)

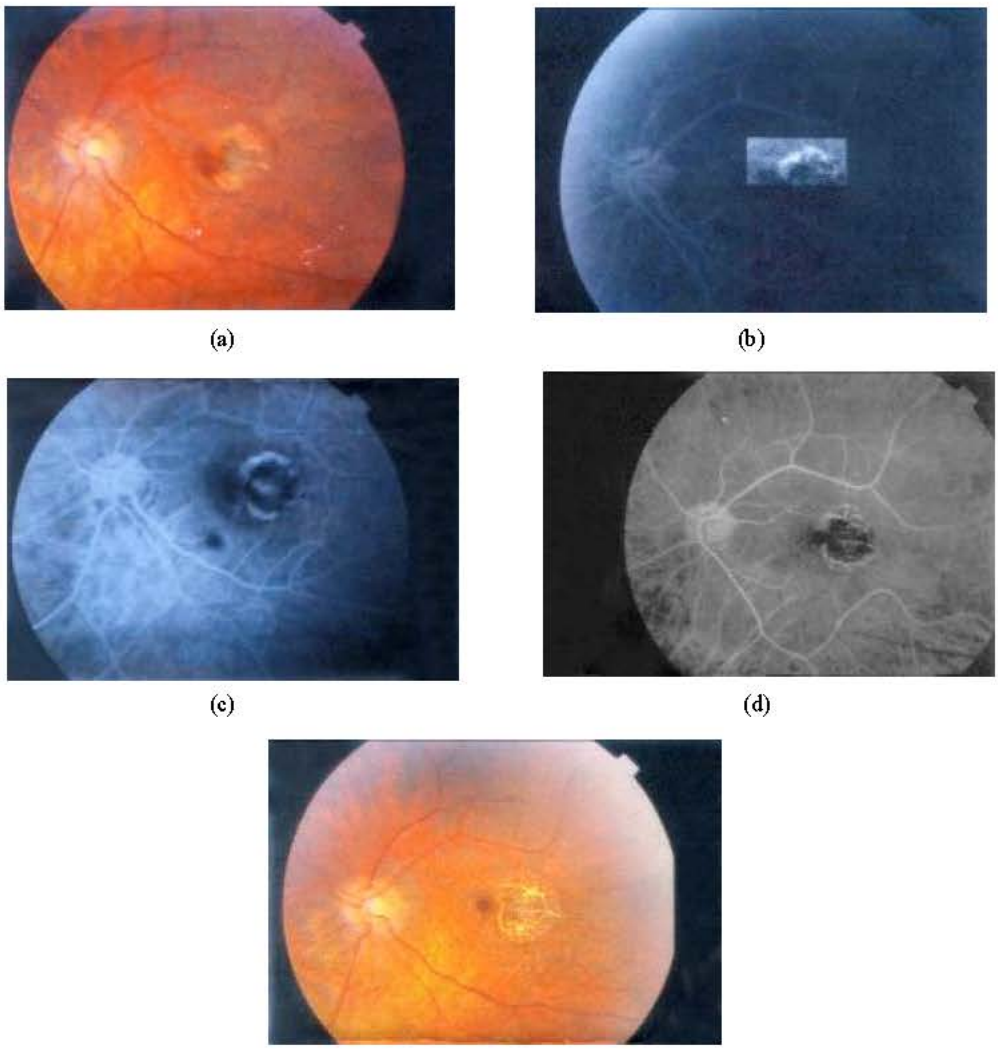

Fig. 1: The myopic, SNVMs before TTT and after treatment TTT, (a) Coloured photograph showing the myopic subretinal vascular complex, (b) Fundus flourescein angiography showing the vascular membrane complex.,(c) The same lesion by flourescein frames, (d) Regression of the vascular membrane complex after treatment by TTT and (e) Coloured photograph showing regression of the same lesion after treatment by TTT

Table 2: Pre and post treatment visual acuity for each patient in group 2 with their corresponding spherical equivalent

Serial No. of patient	VA before TTT	Myopic sph. equiv.	VA after TTT
1	4/60	-8.0	6/12
2	5/60	-12.0	6/18
3	3/60	-14.0	6/18
4	6/60	-10.0	6/12
5	3/60	-11.0	6/12

p-value ($p<0.001$)

Table 3: Pre and post treatment visual acuity for each patient in group 3 with their corresponding spherical equivalent

Serial No. of patient	VA before TTT	Myopic sph. Equiv.	V aafter TTT
1	6/36	-7.0	6/36
2	6/60	-12.0	6/60
3	6/36	-10.0	6/36
4	3/60	-15.0	3/60
5	3/60	-11.0	3/60

It is clear from the results of patients of group 3 that they have not responded well to treatment, but their BCVA did not deteriorate more as seen from the Table 3.

Their fluorescein frames showed minimal changes than before treatment but they were not more deteriorated than before treatment (Fig. 2).

Our control group that included 10 patients, were strictly observed throughout the study with no other alternative treatment, showed deterioration of their VA in 7 patients suffering from increased subretinal fibrosis, haemorrahgic PED, vitreous hge and massive exudation as observed by fundus biomicroscopy and fluorescein angiograms.

The rest 3 patients showed stability in their V.A. and in their fluorescein frames throughout the study up to 6 months.

DISCUSSION

Transpupillary thermotherapy TTT is a subthreshold, low irradiance, long exposure duration, large spot size,

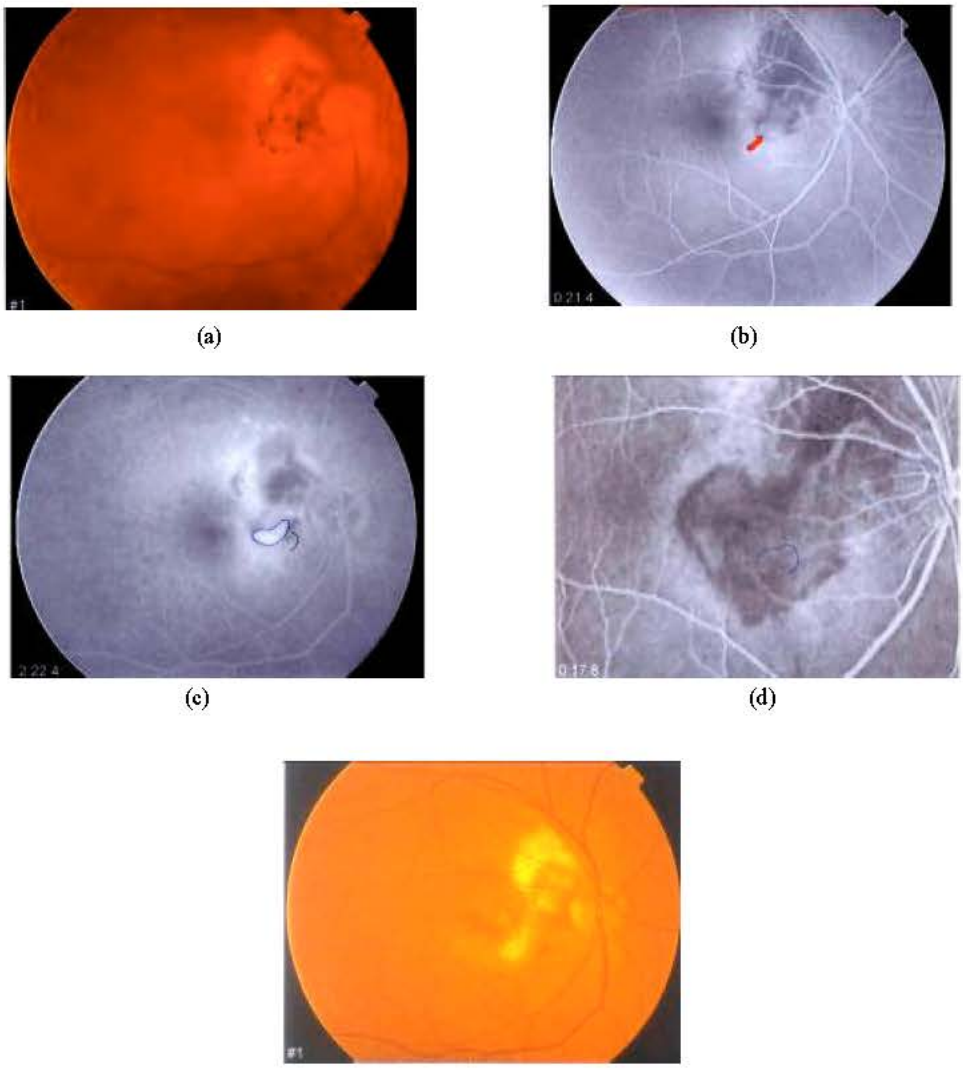

Fig. 2: The myopic SNVMs before TTT and after treatment TTT, (a) Coloured photograph showing the myopic subretinal vascular complex (marked), (b) Fundus flourescein angiography showing the vascular membrane complex, (c) The same lesion by fundus flourescein angiography, (d) The same lesion (zooming) showing regression of the vascular complex as identified by fundus fluorescein frames after treatment by TTT and (e) Coloured photograph of the same lesion after treatment by TTT showing regression of the lesion

infrared diode laser protocol. Retinal temperature increases in TTT to treat SNVMs are substantially lower than those in conventional short pulse photocoagulation by they maintained for 60 sec to achieve therapeutic results (Mehugh, 2001).

Retinal temperature rise in laser therapy is proportional to retinal irradiance (laser power/area) for a particular spot size, exposure duration and wave length.

Treatment power is adjusted for retinal lesion size, chorioretinal pigmentation, macular elevation and medium clarity. To achieve a preselected temperature rise, TTT laser power must be increased or decreased in proportion to the diameter rather than the area of the spot light, (Algvere *et al*., 2001).

TTT uses infrared radiation that has a deeper chorioretinal tissue penetration than visible light, decreased photoreceptor pigment bleaching, less potential Henel fiber optic transmission and negligible risk of retinal phototoxicity, which could be significant in prolonged exposures to blue or green laser sources. (Thomas *et al*., 2001).

The mode of action of TTT is far from clear. It may cause a sequence of vascular changes presumably mediated by heat shock proteins, apoptosis of endothelial cells and vascular thrombosis resulting in vascular occlusion. It is likely that a reduction in blood flow to the choroidal neovasular complex is associated with a retirement or inhibition of angiogenic growth that affect the choroidal neovascular membranae complex (Lanzetta *et al*., 2002).

The chorioretinal temperature elevation is calculated to be roughly 10°C significantly lower than 20°C temperature elevation short-pulse retinal photocoagulation.

In this study we showed that TTT has the capacity to improve vision in patients suffering from myopic SRNM and good results and improvement in their Best Corrected Visual Acuity (BCVA) was achieved in 80% of patients.

These results may be because we have strictly chosen our cases, in which the membranes present, included no other complications and the size of the lesion is less than 3 mm.

We have achieved according to our statistical analysis highly significant results. In group 1, The p-value was <0.0001 with a mean of -0.3973, std. = 0.1, std. err. = 0.0298 and t-value-13.33 (Table 4).

In group 2, The p-value was < 0.001 with a mean of -0.354, std 0.1, std. err. = 0.038026 and t-value-9.3093 (Table 4).

We have compared our results in using TTT in treatment of myopic SNVMs with other studies that used the same tool in treating SNVMs but of other causes as in treatment of occult and minimal classic SNVMs.

These studies showed that TTT have improved BCVA in about 55% in occult membranes versus 44% in minimally classic membranes. The other portion of patients showed continuous decay and deterioration in their BCVA after 6 months (Martin *et al*., 2000).

In comparing our results with other modalities of treatment as photodynamic therapy (PDT) in treating SNVMs of age-related macular degeneration, the reports showed improvement in the BCVA occurred in only 34% of the verteporfin treated eyes. The rest of the patients showed deterioration in their BCVA by the end of 6 months following treatment (Treatment of Age-related Macular Degeneration with Photodynamic Therapy Study Group, 2001).

Recently, the effect of TTT on the normal human macula (VA 20/25) was reported with reference to an eye that was scheduled for enucleation of a malignant melanoma. Three minutes after TTT (800 mw, 3.0 mm spot), VA was 20/100. (Fig. 3 and 4) Five days later, VA had recovered to the pretreatment level (20/25). The Retinal Pigment Epithelium (RPE) and neural retina were preserved as confirmed by electron microscopy. (Robertson and Salamao, 2002).

Table 4: Statistical analysis

Paired samples statistics		Mean	N	Std. Dev.	Std. Err.
Pair 1	Group 1 (before TTT)	0.12533	15	0.038334	0.0099
	Group 1 (after TTT)	0.52267	15	0.10879	0.02809
Pair 2	Group 2 (before TTT)	0.078	5	0.027749	0.01241
	Group 2 (after TTT)	0.432	5	0.093113	0.04164
Pair 3	Group 3 (before TTT)	0.108	5	0.060166	0.02691
	Group 3 (after TTT)	0.108	5	0.060166	0.02691

		Paired differences					
Paired samples test		Mean	Std.	Std. Err.	t	df	Sig. (p-value)
Pair 1	Group 1 (before TTT) - Group 1 (after TTT)	-0.3973	0.1	0.0298	-13.333	14	<0.0001
Pair 2	Group 2 (before TTT) - Group 2 (after TTT)	-0.354	0.1	0.038026	-9.3093	4	<0.001

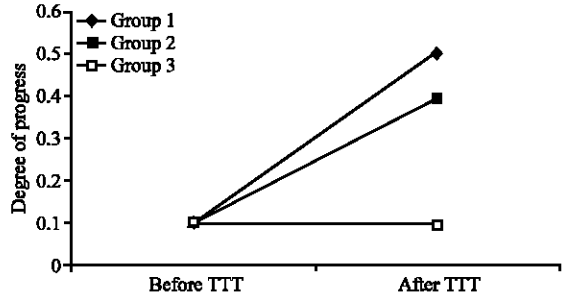

Fig. 3: Evaluation of progress before and after TTT

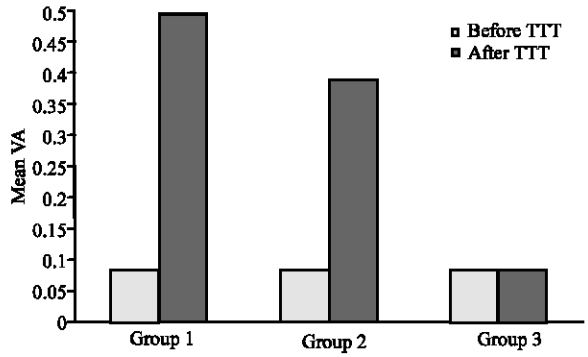

Fig. 4: Differences in VA before and after TTT

In conclusion, it is apparent from the present study, that TTT is an effective method in treating myopic SNVMs and can be also used as an adjuvant therapy for other modalities as PDT.

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