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The outcome of Photocoagulation Treatment of Retinal Vascular Diseases

Fatin Abdulsalam Al–Qaysi[*1], Abdullah Ahmed Awheash[2], Khor Sirwan[3]

[1]Duhok Eye Teaching Hospital, Iraq.
[2]Tikrit Teaching Hospital, Iraq.
[3] Aso Eye Hospital in Sulaymaniyah, Iraq.
[*]Corresponding Author: Fatinabdulsalam@yahoo.com

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Abstract:

Due to the significance of macular edema in retinal vascular diseases, this study aims to determine whether laser photocoagulation is effective in the treatment of macular edema and in the improvement of visual acuity. This is a prospective data study considering 80 patients with 52 eyes, with a follow-up of 6 weeks, 3 months, and six months with macular edema treated with double frequency yag laser photocoagulation in Aso Eye Hospital in Sulaymaniyah City, Kurdistan, Iraq, from February 2010 to October 2010. With six months of follow-up, visual acuity was improved in 36.4% of eyes, unchanged in 61.3%, and worsened in 2.3%. After this period the macular edema was improved in 78.85% and not improved in 21.15%. According to this study, baseline visual acuity and retinopathy severity were two important intervening factors in response to laser therapy. Comparing the current results with other studies, it has been found that, in assessing visual outcomes, laser photocoagulation is an effective modality in the treatment of macular edema, and it improves visual acuity in retinal vascular diseases.

Keywords: Photocoagulation, Macular Edema, Visual Acuity.

دراسة سريرية حول تأثير التخثير الضوئي على الوذمة البقعية والحدة البصرية في أمراض الأوعية الدموية في شبكية العين

فاتن عبدالسلام القيسي [1*], عبدالله احمد الوحيش[2], سيروان خور [3]

[1]مستشفى دهوك التعليمي للعيون، العراق.
[2]مستشفى تكريت التعليمي، تكريت صلاح الدين ، العراق.
[3] مستشفى آسو للعيون، السليمانية، العراق.
*Fatinabdulsalam@yahoo.com

نظرًا لأهمية الوذمة البقعية في أمراض الأوعية الدموية في شبكية العين، تهدف هذه الدراسة إلى تحديد ما إذا كان التخثير الضوئي بالليزر فعال في علاج الوذمة البقعية وتحسين حدة البصر. هذه دراسة بيانات استباقية تناولت ٨٠ مريضاً ب ٥٢ عين ، مع متابعة لمدة ستة أسابيع و٣ أشهر وستة أشهر مع الوذمة البقعية، عولج المرضى بالتخثير الضوئي الليزري ياج ذو التردد المزدوج في مستشفى آسو للعيون في مدينة السليمانية، إقليم كردستان العراق، من فبراير ٢٠١٠ إلى أكتوبر ٢٠١٠. مع ستة أشهر من المتابعة، تحسنت حدة البصر في ٣٦,٤٪ من العيون ، دون تغيير في ٦١,٣٪ وتفاقمت في ٢,٣٪، وبعد هذه المدة تحسنت الوذمة البقعية بنسبة ٧٨,٨٥٪ ولم تتحسن في ٢١,١٥٪. وفقًا لهذه الدراسة، كانت حدة البصر الأساسية وشدة اعتلال الشبكية عاملين متداخلين مهمين في الاستجابة للعلاج بالليزر، وبمقارنة النتائج الراهنة مع الدراسات الأخرى، فقد وجد أنه التخثير الضوئي بالليزر هو طريقة فعالة في علاج الوذمة البقعية وتحسين الرؤية في تقييم النتيجة البصرية وانه يطور حدة البصر في أمراض الأوعية الدموية الشبكية.

الكلمات المفتاحية: التخثير الضوئي ، الوذمة البقعية، حدة البصر.

1. INTRODUCTION:

LASER technology has revolutionized many medical fields. In ophthalmology, lasers are used to photocoagulate, cut, remove, shrink and stretch ocular tissues. New types of lasers and novel applications continue to be developed. This article will focus on the role of photocoagulation in retinal vascular diseases [1]. Laser may work through the absorption of laser by melanin pigments in retinal pigment epithelium and choroid, and also by the haemoglobuline in the micro aneurysm or both. [2, 3]. The most commonly used modes of laser treatment for macular edema are focal, grid and modified grid. In focal treatment, microaneyrysms causing macular edema are treated directly; in grid treatment, the areas of diffuse capillary leakage and of capillary non perfusion are lasered in a grid pattern; a modified grid is a combination of focal and grid treatment [4-6]. The aim of this study is to determine the effect of laser photocoagulation on preventing vision loss and on the resolution of macula edema in retinal vascular diseases.

2. Patients and Methods

This is a case series studies where 'treatment and follow up of the patients was up to 6 months after laser photocoagulation', involving 80 eyes of 52 patients with macular edema. The study was done in Aso Eye Hospital in Sulaymaniyah Province in Kurdistan Region of Iraq. The study extended from February 2010 to October 2010; each patient was carefully informed about the purpose of the research; they were given an explanation of the procedure prior to laser therapy. The reasons and steps were explained to the patients as well as the duration of the procedures to seek their cooperation. The painless nature of procedure was explained, and the importance of steady fixation was emphasized. Ophthalmological exclusion criteria include all the following preretinal or vitreous hemorrhage at the time of evaluation, history of retinal detachment or retinoschisis, significant media opacity and congenital ocular anomalies. Those who had cataract extraction before enrollment into the study were not excluded, and those who had ocular media opacity were illegible in the study. The process included a review of detailed medical and ocular history and ocular examination. Best corrected visual acuity "BCVA" by using the "illiterate E Snellen's chart" snellen's and pin hole test was noted prior to laser photocoagulation and on each follow-up visit. Detailed anterior segment examination was done by using slit lamp; intraocular pressure measurement was also done before laser photocoagulation and on each follow- up visit; posterior segment examination was examined after maximum pupillary dilatation using tropicamide 1% eye drop. The methods included a direct ophthalmoscope and binocular slit lamp examination with +78 or +90 or goldmann's 3 mirror contact lens. The indication of treatment was macular edema: the thickening that involves or threatens the center of macula "even when vision is not affected. The treatment was done by a coherent double frequency laser machine by using green light. A follow-up examination was done 6 weeks, 3 months, and 6 months of laser treatment and subsequently, the frequency of follow-up varied for individual cases depending on the resolution of macular edema. Retreatment for persistent macular edema was done when indicated. The laser used is grid laser and considering all laser treatment, spot size for all was 50 mics., duration was 0.1 sec., mean power was 210.77 =V. for numbers of laser shoots were 167.58/eye, as in **Table 1** below.

Table (1) Laser treatment summary

	Range	Minimum	Maximum	Mean	Standard Deviation
Numbers of shoots	190	110	300	167.58	46.201
Laser therapy power	160	120	280	210.77	33.872

Post laser Treatment

Once the procedure was completed, one tablet of acetazolamide 250 mg was also given. In all patients, intraocular pressure was measured immediately after laser photocoagulation and later on prednisolone eye drop 1%. 3 times a day at least for one week. Patients were scheduled to visit after 6 weeks, 3 months and six months subsequently. Data regarding type, duration, and mode of retinal vascular diseases were noted; the changes in visual acuity post laser treatment was recorded. Post laser visual acuity was taken as the best corrected visual acuity by using Snellen's visual acuity chart in each follow up visit. Any post laser stable vision or improvement at least one line was taken as a positive visual outcome while any significant visual loss was taken as decreased vision of more than two lines of Snellen's visual acuity chart.

3. Results:

During the period of study, there were 80 eyes for fifty-two patients, 31 female and 21 males, out of whom (67.31%) were between forty and sixty years old and (32.69%) were sixty-one to eighty years old. Among those patients (73.1%) patients had no insulin treatment & (126.9%) had insulin treatment with thirty-two patients only have controlled hyperglycemia with antidiabetic treatment. In this study, there were 16 patients with hypertension, eight with hyperlipidaemia, two with cardiovascular diseases, one with asthma, two with peptic ulcer, and one patient had cerebrovascular accident as in **Table 2**.

Table (2) Frequencies of Medical Illnesses

Variables	Frequency
Diabetic patients use insulin	9
Diabetic patients not use insulin	38
Hypertension	16
Hyperlipidaemia	8
Asthma	1
Ischemic Heart Disease	2
Cerebrovascular accident	1
Peptic ulcer	2

Note: Some patients have more than one disease at the same time.

In this study fifteen patients had only right eye involvement; 9 patients had only left eye involvement and 28 patients had both eyes involved. Besides, 23.1% of the eyes had background diabetic retinopathy, 34.6% had pre-proliferative diabetic retinopathy, 17.3% had proliferative diabetic retinopathy, and 1.9% had advanced diabetic retinopathy. Furthermore, 5.8% of the eyes had hypertensive retinopathy, 9.6% had central retinal vein occlusion,1.9% had branch retinal vein occlusion, and 5.8% had advanced diabetic retinopathy with hypertension retinopathy; all of them with clinically significant macular edema, as shown in

Figure (1). In each follow up visit, visual acuity was calculated and the changes in lines was recorded as shown in **Figure (3)** for right eye and **Figure (4)** for left eye.

CSME: Clinically Significant Macular Edema, BGDR: background diabetic retinopathy, DR: diabetic retinopathy, CRVO: Central Retinal Vein Occlusion, BRVO: branch retinal vein occlusion.

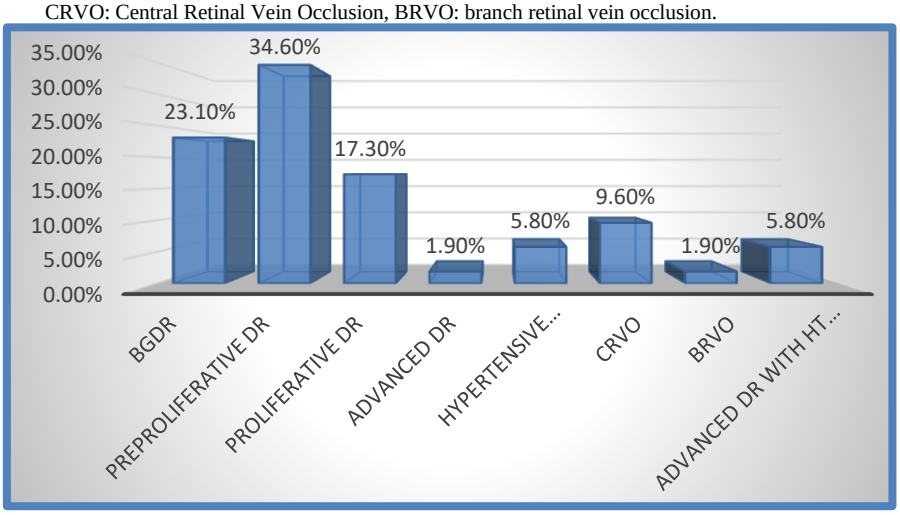

Figure 1: Distribution According to Type and Degree of Retinopathy

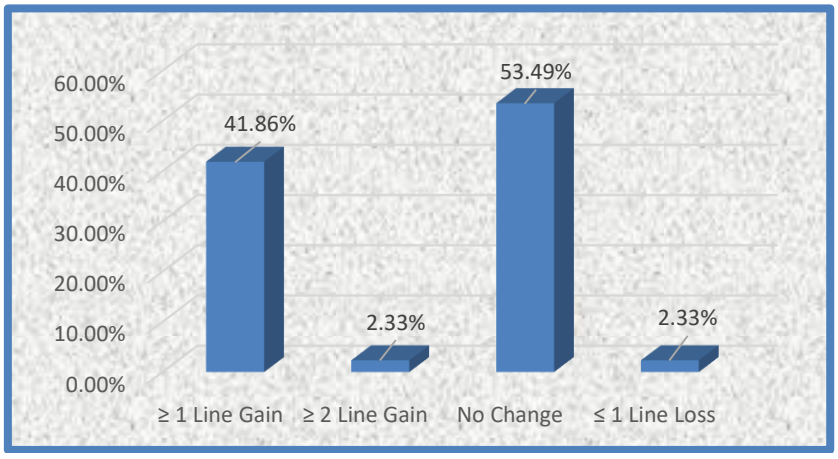

Figure 3.Changes in lines in the Right Eyes

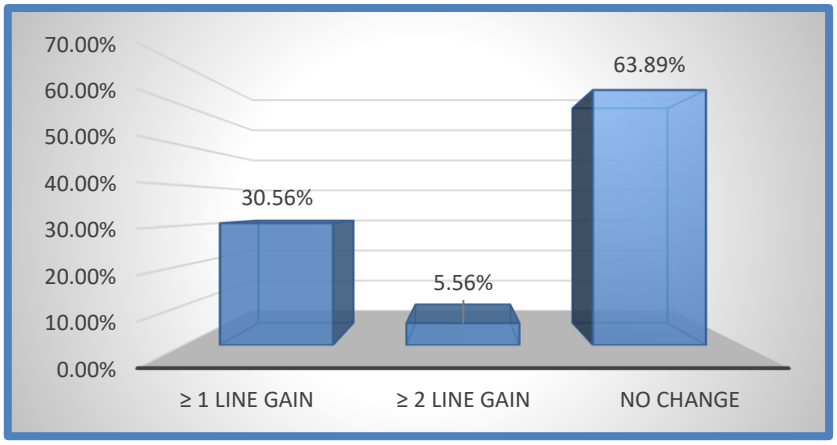

Figure 4. The Changes in lines in the Left Eyes

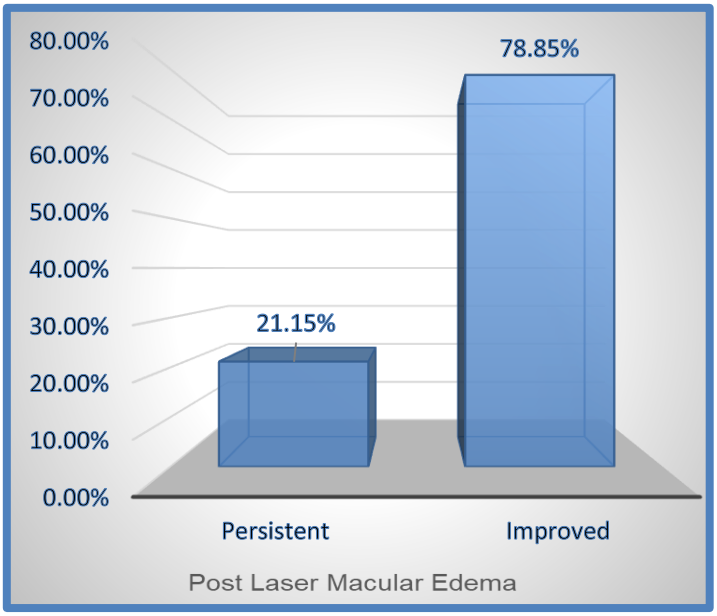

Figure 5. The state of macular edema after laser therapy

Table (3) type of retinal diseases in relation to change in vision.

Type of retinal disease	Changes in vision			Total	P value
	No change N (%)	Better N (%)	Worse N (%)		
Background Diabetic Retinopathy + CSME	6(50)	6(50)	0(0.0)	12(100%)	P-value = 0.003
Preproliferative Diabetic Retinopathy +CSME	12(75)	4(25)	0(0.0)	16(100%)	
Proliferative Diabetic Retinopathy + CSME	6(60)	3(30)	1(1.0)	10(100%)	
Advanced Diabetic Retinopathy + CSME	1(100)	0(0.0)	0(0.0)	1(100%)	
Hypertensive Retinopathy + CSME	1(20)	4(80)	0(0.0)	5(100%)	
CRVO+CSME	2(50)	2(50)	0(0.0)	4(100%)	
BRVO+ CSME	1(100)	0(0.0)	0(0.0)	1(100%)	
Advanced Diabetic Retinopathy +Hypertension+CSME	3(100)	0(0.0)	0(0.0)	3(100%)	
Total	32(61.3)	19(36.4)	1(2.3)	52(100%)	

CSME: Clinically Significant Macular Edema, CRVO: Central Retinal Vein Occlusion, BRVO: Branch Retinal Vein Occlusion

In this table, there are 12 patients with background diabetic retinopathy, 6 of them developed no change in vision and six of them developed a better vision and no one of them had a worse vision.

In addition, in pre-proliferation diabetic retinopathy, there are 16 patients, 12 developed no change in vision and 4 patients had better vision with no one of them had worse vision. In proliferative diabetic retinopathy, there are 10 patients, 6 of them developed no change in vision and 3 patients had better vision and 1 patient had worse vision. In advanced diabetic

retinopathy, there is one patient only; he developed no change in vision. In hypertensive retinopathy, there are 5 patients,1 patient developed no change in vision and 4 patients had better patients while in central retinal vein occlusion there are 4 patients, 2 of them had no change in vision and 2 patients had better vision. In branch retinal vein occlusion, there is one patient only who had no change in vision, and finally in advanced diabetic retinopathy & hypertensive retinopathy there were 3 patients, all of them had no change in vision. The final result was that among those 52 patients, 32 (61.3%) patients had no change in vision and 19 (36%) patients had better patients, and only 1 (2.3%) patient had worse vision after laser treatment.

4. Discussion

The current study has revealed that laser treatment indicated a prevention of visual loss rather than visual improvement in patients with retinal vascular diseases. It should be offered before the vision loss when the risk of visual loss justifies the adverse effect of laser treatment. Dowler JG in 2003 found that all of the cases with stable or one line improvement in visual acuity as positive outcome[7]. Fu DJ et al in 2022 found that visual outcome for sight threatening retinopathy can be excellent; a key factor, especially in maculopathy, is early commencement of laser therapy before visual acuity has dropped[8].

Zafar A. Zaidii in 2009 found that the visual outcome as a whole can be: 29.7% of the patients maintained their visual acuity; 35.6% showed improvement in vision; and 34.7% showed a decrease within 16 to 24 months, it was found visual acuity. Visual improvement in terms of visual acuity was as follows: 27.6% improved by up to one line of Snellen's visual acuity chart, 7% by one to two lines, and 1% by more than two lines. Further, 34.7% patients showed a decrease in the visual acuity, 23.8% had a decrease by one line, 9.9% by one to two lines, and 1% by more than two lines. A significant visual loss (decrease in visual acuity of two or more lines) was observed in 4%, and this agreed with the present study. [9]

The current study agrees with Kayhan et al (2021) who found that the best corrected visual acuity demonstrated the increase of 2 lines or more in 20.7% of the eyes, stabilization within 2 lines in 60.7% of the eyes, and loss of 2 lines or more in 18.3% of eyes. The eyes with baseline best corrected visual acuity lower than or equal to 0.50 showed a statistically significant increase (p=0.001) whereas the eyes with baseline best corrected visual acuity of more than 0.50 did not show a statistically significant change (p=0.070) after laser photocoagulation

treatment. This indicates that conventional laser photocoagulation is an effective treatment in diabetic macular edema including center-involved type and stabilizes visual in the majority of the patients. Improvement in the best corrected visual acuity is significant in the group with lower baseline best corrected visual acuity[10].

In the current study, more than one line gain has been found in 41.86% of the patients and more than two lines gain 2.33% and no change has been found in 53.49%. this was higher than what found by Alvi R in 2016 who found that after a follow up of 12 to 45 months patients had Grid laser done in (99%) and focal laser in (1%) and that best corrected visual acuity had declined in 2.4% of eyes, stabilized in 67% of eyes and improved in 30.7% eyes. They also found that one line improvement on Snellen's chart was fond in 21.3% eyes, 2 lines in 8% eyes, 3 lines in 1.2% eyes and 4 lines in one (0.1%) eye with p-value of 0.000[11].

The current study has revealed that 78.85% of macular edema improved and 21.15% in those whom their macular edema is persistent after laser therapy. This agreed with Jorge EC study in 2018 who found that at one year, people with diabetes macular edema receiving laser were less likely to lose best corrected visual acuity compared with no intervention (risk ratio (RR) 0.42, 95% confidence interval (CI) 0.20 to 0.90; 3703 eyes; 4 studies; I2 = 71%; moderate-certainty evidence). There were also favorable effects observed at two and three years.

In addition, Jorge EC reported on partial or complete resolution of clinically significant diabetes macular edema and found moderate-certainty evidence of a benefit at three years with photocoagulation (RR 1.55, 95% CI 1.30 to 1.86)[12]. Zas M found that there is a resolution of lipid exudates upon treatment with xenon photocoagulation and that the likelihood of visual improvement was greater in eyes that had undergone macular laser photocoagulation compared to those eyes that did not undergo macular laser photocoagulation[13]. Zur et al in 2022 found that macular laser treatment has its place as an efficient and safe treatment, that judicious evaluation of the edema, disease dynamics and patient compliance need to be taken into consideration. And that the macular laser treatment reduces the risk of moderate vision loss by 50% by 3 years.[14]

Fong et al in 2007 studied a modified early treatment diabetic study research laser protocol or mild macular grid laser photocoagulation in previously untreated diabetic macular edema. In patients who had 12-month follow-up, they found that the reduction in macular thickness was significantly greater in the group treated with the modified early treatment diabetic study

research laser protocol, but no difference was noticed in terms of the mean change in best-corrected visual acuity, suggesting that modified early treatment diabetic study researches focal photocoagulation should continue to be the standard treatment for diabetic macular edema[15]. Recently, a randomized controlled trial conducted by diabetic retinopathy clinical research network (DRCR.net) protocol B found that focal/grid photocoagulation was more effective and was associated with fewer side effects than Intravitreal injection of triamcinolone acetonide in diabetic macular edema patients at both 2 and 3 years of follow-up [16, 17]. The researchers suggested that focal/grid laser treatment should remain to be the standard against which other diabetic macular edema treatments are compared. However, Elman et al in 2011 found that some laser-treated patients (10%) in the DRCR.net protocol I study lost 15 letters or more in visual acuity at 2 years of follow-up. Although it is obviously essential to prevent further loss of vision, the need to restore visual acuity via a laser therapy has, until recently, been unmet in diabetic macular edema patients[18].

5. Conclusions

As a conclusion, the present study demonstrates that a good visual outcome is achievable in sight threatening retinopathy especially in case of early detection and treatment. These results emphasize the importance of early detection of sight threatening retinopathy through the implementation of high-quality screening services; since patients are usually asymptomatic when their eye disease is in its early stages.

6. References

[1] Everett, L.A., Paulus, Y.M. Laser Therapy in the Treatment of Diabetic Retinopathy and Diabetic Macular Edema. Curr Diab Rep 2021; 21(9):35 .

[2] Young Jung Roh. Laser-Based Strategies to Treat Diabetic Macular Edema: History and New Promising Therapies. Journal of Ophthalmology 2014:1-9.

[3] Nailul Authoriyah, & Amin, R.. Laser Photocoagulation : Literature Review. Sriwijaya Journal of Ophthalmology2018, 1(2), 54-62.

[4] Jorge EC, Jorge EN, Botelho M, et al. Monotherapy laser photocoagulation for diabetic macular oedema. Cochrane Database Syst Rev. 2018 Oct 15;10(10):CD010859.

[5] Vasilijević JB, Kovačević IM, Bukumirić ZM, et al. Vision-Related Quality of Life and Treatment Satisfaction Following Panretinal Photocoagulation in Diabetic Retinopathy-A Panel Study. Medicina (Kaunas). 2022 Nov 28;58(12):1741.

[6] Subash M, Comyn O, Samy A, et al. The Effect of Multispot Laser Panretinal Photocoagulation on Retinal Sensitivity and Driving Eligibility in Patients With Diabetic Retinopathy. JAMA Ophthalmol. 2016;134(6):666–72.

[7] Dowler JG. Laser management of diabetic retinopathy. J R Soc Med. 2003;96(6):277-9.

[8] Fu DJ, Thottarath S, Faes L, et al. Visual acuity outcome of stable proliferative diabetic retinopathy following initial complete panretinal photocoagulation. BMJ Open Ophthalmol. 2022;7(1):e001068.

[9] Zafar A Zaidii, Many K. Jackob. Oman Journal of ophthalmology, 2009;2(2):62-.6.

[10] Kayhan B, Burumcek E. Does conventional laser photocoagulation still have a place in the treatment of diabetic macular edema?. Rom J Ophthalmol. 2021;65(2):130-5.

[11] Alvi R, Memon MS, Shera S, et al. Visual outcome of laser treatment in diabetic macular edema: Study from an Urban Diabetes Care Center. Pak J Med Sci. 2016;32(5):1229-33.

[12] Jorge EC, Jorge EN, Botelho M, Farat JG, Virgili G, El Dib R. Monotherapy laser photocoagulation for diabetic macular oedema. Cochrane Database Syst Rev. 2018 Oct 15;10(10):CD010859.

[13] Zas M, Cotic M, Wu M, Wu A, Wu L. Macular laser photocoagulation in the management of diabetic macular edema: Still relevant in 2020?. Taiwan J Ophthalmol. 2020;10(2):87-94.

[14] Zur, D., Loewenstein, A. Should we still be performing macular laser for non-centre involving diabetic macular oedema? Yes. Eye 2022; 36:483–4.

[15] Writing Committee for the Diabetic Retinopathy Clinical Research Network; Fong DS, Strauber SF, Aiello LP, et al. Comparison of the modified Early Treatment Diabetic Retinopathy Study and mild macular grid laser photocoagulation strategies for diabetic macular edema. Arch Ophthalmol. 2007 Apr;125(4):469-80.

[16] Diabetic Retinopathy Clinical Research Network, "A randomized trial comparing intravitreal triamcinolone acetonide and focal/grid photocoagulation for diabetic macular edema," *Ophthalmology*2008; 115(9):1447–59.e10.