Contact trans-scleral diode laser cyclophotocoagulation for treatment of refractory glaucoma, a prospective study

DR MOHAMED EL-MALAH
MD, PHD
ASSIST. PROF. OF OPHTHALMOLOGY
AL-AZHAR UNIV., CAIRO, EGYPT

Disclaimer:

No financial interest in any aspect of this study.

Introduction

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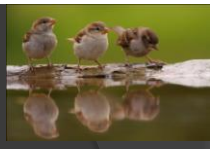
Introduction:



- Coagulation or destruction of the CB to reduce the rate of AH production has been advocated in the ttt of gl since 1930s, when penetrating cyclodiathermy was introduced[1].
- Trans-scleral cyclodestruction by light energy was developed by Weekers in 1961[2].

1- Scott AP, Kuldev S, David AL, et al: Cyclophotocoagulation: A report by the American Academy of Ophthalmology. Ophthalmology: 2001;108:2130-2138.
2-Weekers R, Lavergne G, Watillon M et al: Effects of photocoagulation of the ciliary body upon ocular tension. Am J Ophthalmol. 1961;51:156.

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Introduction:

- When all med. & surg. therapies fail to control IOP, it may be necessary to ablate a part of the CB.
- Cyclodiath. and cyclocryo. belong to the past because of the severe side effects.
- These methods are being replaced by contact transscleral infrared 810nm diode laser cycloph. (TDLC) [2,3].

2-Weekers R, Lavergne G, Watillon M et al: Effects of photocoagulation of the ciliary body upon ocular tension. Am J Ophthalmol 1961;5:156.
3- Ahti T, Paivi P and Tero K: Cyclodestruction in glaucoma. Atlas of glaucoma surgery. Editors: Tarek S and Andre M. Jaypee, 1st ed. 2006;34-44.

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Introduction:

- The energy of this wave length is excellently absorbed by melanin pig. epith. of the CB.
- Diode laser equipment is not costly; it is mostly portable and easy to use.
- TDLC is simple, safe and easy to learn[3].

3- Ahti T, Paivi P and Tero K: Cyclodestruction in glaucoma. Atlas of glaucoma surgery. Editors: Tarek S and Andre M. Jaypee, 1st ed. 2006;34-44.

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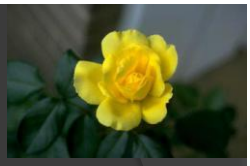
Introduction:



- TDLC has been evaluated for years as 1ry surg. ttt in developing countries as one of gl. therapies[4].
- Histopathological studies have shown its coagulative effect on the CB stroma[5].

4- Egbert PR, Fiadoyor S, Budenz DL et al: Diode laser transscleral cyclophotocoagulation as a primary surgical treatment for primary open angle glaucoma. Arch Ophthalmol 2001;119:345-350.
5- Subrata M, Ritu G and Jatin A: Diode laser transscleral cyclophotocoagulation. J Curr Glaucoma Practice 2009;3:47-59.

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Introduction:

- Many studies believed that IOP lowered by disruption of pars plicata stroma, subsequently decreasing AH production[6,7].
- Some studies have suggested that cyclopho. also lowers IOP by causing an increase in outflow through the uveoscleral therapy[8,9].

6- Schubert HD and Federman JL: A comparison of CW Nd:YAG contact transscleral with cyclocryopexy. IOVS 1989;30:536-542.
7- Mckelvie PA and Walland MJ: Pathology of cyclodiode laser: a case of nine enucleated eyes. Br J Ophthalmol 2002;86:381-386.
8- Schlote T, Beck J, Rohrbach JM et al: Alternation of the vascular supply in the rabbit ciliary body by TDLC. Graefes Arch Clin Exp Ophthalmol 2001;259:53-58.
9- Liu GJ, Mizukawa A and Okisaka S: Mechanism of IOP decrease after contact transscleral continuous-wave Nd:YAG laser cyclophotocoagulation. Ophthalmic Res 1994;26:65-79.

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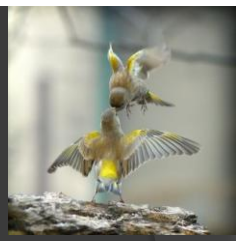
Introduction:

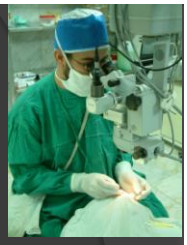
- TDLC using typical gl. probe is the cyclo-destructive procedure of choice because of the reduced incidence of compls. compared to the other cyclo-destructive procedures[10].
- It is now currently used and efficacy of contact method has been well established[11].

10- Leiv ME and Gerber S: Long-term outcome of TDLC in refractory glaucoma. Br J Ophthalmology 2007;91:1631-1635.
11- Hennis HL and Stewart EC: Semiconductor diode laser cyclophotocoagulation in patients with glaucoma. Am J Ophthalmol 1992;81:113.

Aim of the work:



The aim of this study is to evaluate the results of TDLC in term of efficacy on IOP control, pain relief and safety on eyes affected by refractory glaucoma in a prospective manner.



Patient and Method

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Patient and Method:

- **25** pts (**32** eyes) were included in this study.
- **14** males (56%) and **11** females (44%).
- TDLC **810nm** for ablation of the CB was used for ttt of pts presented by refractory glaucomas (*neovascular, pseudophakic, aphakic, uveitic, and post-keratoplasty glaucoma*).

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Patient and Method:

Glaucoma type	Number of eyes	%
Neovascular glaucoma	14	43.8%
Pseudophakic glaucoma	9	28.1%
Angle closure glaucoma	5	15.6%
Uveitic glaucoma	3	9.4%
Post-keratoplasty glaucoma	1	3.1%

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Patient and Method:

- The preop IOP was ranged from 46 to 64 mmHg, mean **(52±4.36mmHg),** in spite of max. med. ttt.
- BCVA were assisted for all pts, it was ranged between **LP and 0.1.**
- It was explained for all pts that VA may be same postop, decreased or rarely improved.

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Patient and Method:

- All pts were received peribulbar LA e or s sedation.
- Diode laser was used with the classic probe, with fixed parameters of **25 pulses** with power of **1400-1800mW** for **2000ms.**
- For *repeated ttts* only **15 pulses** were given with the same parameters.

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Patient and Method:

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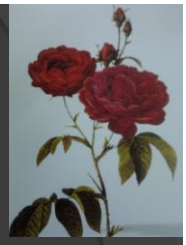
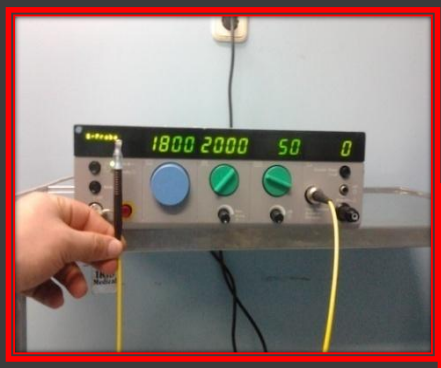
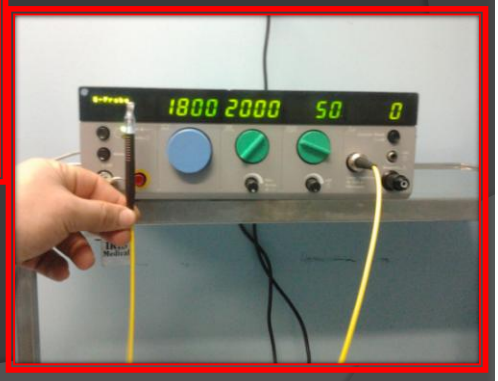
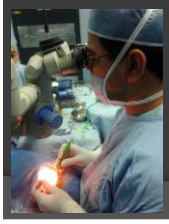
Patient and Method









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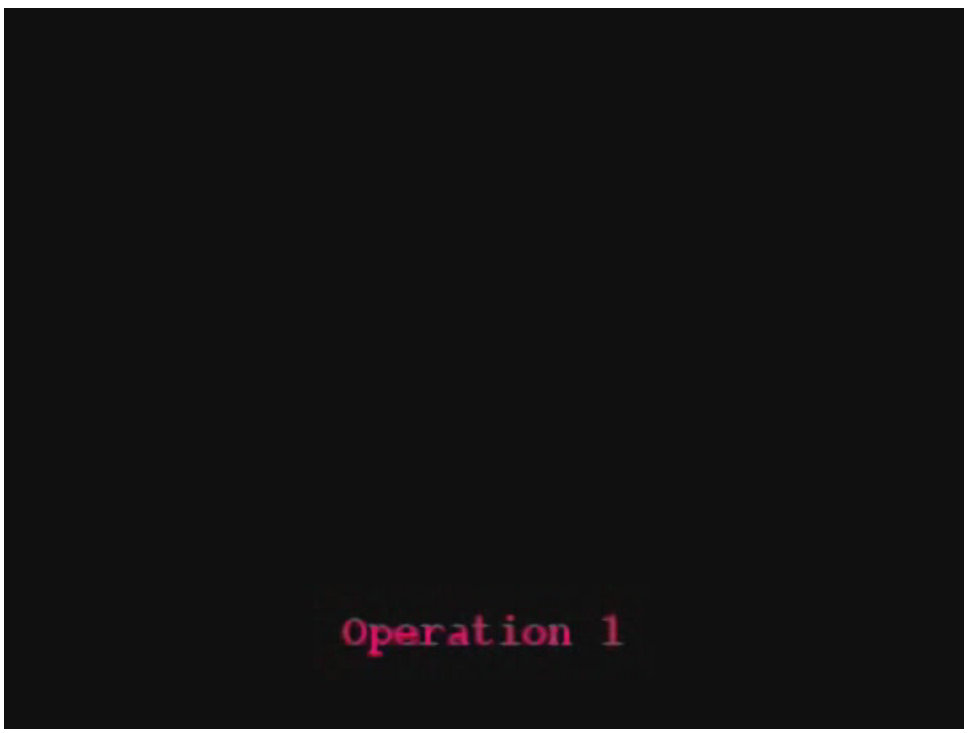

Patient and Method:

- The machine that used in this study is ***Oculight SLx "Iris Medical Instrument",*** contact delivery mode laser with **810nm** wavelength max. power output of **1.0-3.0W**, and a max. duration of **9.9sec**.
- The probe "G-probe" consists of 600µ quartz fiber-optic, producing 0.7mm from a hand-piece, w is fabricated to center the fiber-optic *1.2mm behind the surg limbus and parallel to the visual axis*

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Patient and Method:

- Preop. exam. of BCVA, IOP, gonioscopy, glaucoma type, cor and conj state.
- Technique was previously cleared, but **3 & 9** o'clock meridians were not treated to avoid lesions of long post. ciliary nerves.

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Patient and Method:

- Postop. ttt in the form of topical steroids, antibiotics and cycloplegic ED for 2-3 wks.
- Systemic antiinflamm and analgesics were given for all pts. Also, antigl. drugs were given postop and decreased gradually according to IOP level.

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Patient and Method:

- Success was defined as postop IOP less than or equal **22mmHg** e or s antigl. drugs.
- Follow up were done in the first postop day, 1 wk, 4 wks, 6, and 12 ms, follow up for 1 year was attempted for 27 eyes and only 5 eyes for 6 ms.

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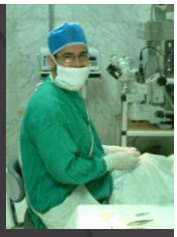

Results

Results:

- ***Mean*** follow up of ***(12±2.36),*** (27/32 eyes, (84.4%), and 6 ms only for 5/32 eyes (15.6%) after TDLC.
- IOP, antigl. meds, BCVA and postop compl. were analyzed as seen in table (2).

Eye	Preop IOP	Postop IOP	Preop med.	Postop med.	Preop VA	Postop VA	Follow up	Complications
1	54	18	4	1	CF	3/60	12	No significant compl.
2	48	21	4	1	3/60	3/60	12	Severe pain
3	64	21	3	1	CF	3/60	12	No significant compl.
4	60	32	4	2	HM	LP	6	↓ visual acuity
5	51	18	4	1	0.16	0.1	6	No significant compl.
6	50	19	3	1	0.1	0.2	12	No significant compl.
7	56	22	4	1	HM	HM	12	Hyphaema
8	52	18	4	1	0.05	0.2	12	No significant compl.
9	56	26	4	2	CF	LP	12	↓ visual acuity
10	56	19	3	1	CF	2/60	6	No significant compl.
11	49	20	4	1	0.1	0.1	12	Hyphaema
12	53	18	3	1	0.05	0.1	12	No significant compl.
13	56	17	4	1	0.05	0.2	11	No significant compl.
14	54	22	4	2	3/60	3/60	6	Hyphaema
15	48	18	4	1	0.1	0.3	12	No significant compl.
16	62	17	3	1	CF	CF	6	Hyphaema
17	58	29	4	2	3/60	CF	12	↓ visual acuity
18	48	16	4	1	0.1	0.1	12	Severe uveitis
19	47	22	3	1	0.16	0.1	12	No significant compl.
20	52	18	4	1	LP	LP	6	Hyphaema
21	46	19	4	2	CF	CF	12	Hyphaema
22	48	16	3	1	0.05	0.1	12	No significant compl.
23	53	27	4	2	2/60	HM	11	↓ visual acuity
24	48	21	3	1	0.05	0.05	12	No significant compl.
25	56	18	4	2	0.05	0.1	12	No significant compl.
26	52	18	3	1	CF	2/60	12	No significant compl.
27	50	15	4	1	CF	3/60	12	No significant compl.
28	54	16	4	2	2/60	2/60	12	Severe pain
29	55	20	3	1	0.05	0.05	12	No significant compl.
30	51	21	4	1	CF	CF	11	No significant compl.
31	54	16	3	1	HM	HM	12	Hyphaema
32	48	19	3	1	0.16	0.2	12	No significant compl.
Mean	52±4.36	19±3.83	4±0.48	1±0.43			12±2.36	

Results:

- *IOP control:* as shown in table (2),
- **IOP** were decreased from mean **(52±4.36mmHg)** to **(19±3.83mmHg).**
- After first ttt, 26 eyes (81.2%) were achieved control of IOP to less than 22 mmHg e or s antigl. ttt.
- While 5 eyes (15.6%) were treated twice after 6-12 wks of its 1st ttt.
- One eye (3.2%) were treated for 3 times after 8 ms from the 1st ttt.

Results:

- IOP were controlled in 28 of 32 eyes (87.5%), and failed to be controlled in 4 eyes (12.5%).
- Repeated ttt for these 6 eyes, 3 of them were neovascular, one eye uveitic, one eye angle closure and one eye pseudophakic siliconised glaucoma.

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Results:

- *Regarding to antiglaucoma medications:*
- Mean preop drugs were decreased from (mean: 4±0.48 to 1±0.43) at the last visit of follow up.
- The good thing in this study is the stoppage of systemic CAIs postop for all pts.

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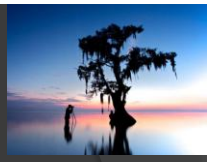
Results:



- *Visual acuity:*
- BCVA preop were ranged between LP to 0.1.
- **Postop, BCVA** were improved in 15 eyes (46.8%), mostly due to IOP reduction, stable in 13 eyes (40.6%) and decreased in 4 eyes (12.6%).

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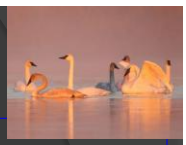
Results:



- ***Complications:***
- Major compls. as phthisis bulbi, hypotony or vitreous hage were not happened.
- Only 1 eye (3.2%) that treated for 3 times, were presented by severe uveitis after third ttt and improved e meds. within 2 ms and VA improved again to the same level like preop.
- Two eyes (6.4%) were presented by severe pain for 3 wks postop.

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Results:

- ***Complications:***
- Four eyes (12.8%) shows reduction of VA.
- Hyphaema reported in 7 eyes (21.8%).
- The remaining 18 eyes (55.2%) showed no significant compls, just conj congestion and mild cor edema for few days.

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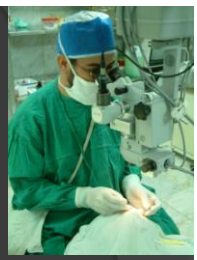

Discussion

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Discussion:

- CB ablation has been used as a method of controlling IOP in refractory gls for many years.[12,13]
- It has now replaced other more traumatic or invasive cycloablative procedures as cyclocryo.[14]
- TDLC has exhibited better efficacy, safety, reliability and convenience compared to previous methods of CB ablation for the ttt of the different gls.[15]

12- Mistlberger A, Liebman J, Tschiderer H, et al: Diode laser transscleral cyclophotocoagulation for refractory glaucoma. J Glaucoma 2001;10:288-293.
13- Vincenzo P, Federica T, Stefano B and Roberto B: Long-term follow up TDLC in refractory glaucoma. Ophthalmologica 2003;217:279-283.
14- Edmund YM, Paul TK, Caroline KL and Jun SW: Diode laser contact transscleral cyclophotocoagulation for refractory glaucoma in Asian patients. Am J Ophthalmol 1997;124:797-804.
15- B N Noureddin, W Zein, C Haddad, R Maluf and Z Bashashur: Diode laser transscleral cyclophotocoagulation for refractory glaucoma a one year follow up of patients treated using an aggressive protocol. Eye 2006;20:329-335.

Discussion:

- In the present study, an **audible pop sound** was a priority in machine settings; in other study this pop sound was not mandatory to be audible.[16]
- **Success rate** in this study were achieved in high number of treated eyes **28/32 eyes (87.5%),** mostly due to fixed moderate parameters and number of diode laser applications.
- This high success rate very comparable to a recent study that reported **87%** success rate,[15] also, Murphy et al[19] reported a higher success rate **89%** but in a retrospective study. Also, Spencer and Vernon[22] reported **81%** success rate, other previous studies reported variable success rates as **77.3%** with nearly same parameters and follow up period.

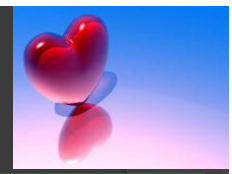
15- B N Noureddin, W Zein, C Haddad, R Maluf and Z Bashashur: Diode laser transscleral cyclophotocoagulation for refractory glaucoma a one year follow up of patients treated using an aggressive protocol. Eye 2006;20:329-335.
16- Rebolleda G, Munoz F and Murube J: Audible pops during cyclodiode procedures. J Glaucoma 1999;8:177-183.
19- C C Murphy, C A M Burnett, P G D Spry, D C Broadway and J P Diamond: A two-centre study of the dose-response relation for TDLC in refractory glaucoma. Br J Ophthalmol 2003;87:1252-1257.
22- Anne F Spencer and Stephen A Vernon: Cyclodiode: results of a standard protocol. Br J Ophthalmol 1999;83:

Discussion:

- In the present study, 6 eyes **(18.8%)** needed **re-ttt** for a second time and 1 eye only **(3.2%)** were treated for 3 times.
- In comparison to other studies, re-ttt was done in **16%** in one study,[12] **25%** in another recent study,[15]
- Branacato et al[20] and Bock et al[21] reported a higher rate of re-ttt up **65% and 70%** respectively. Lastly, Spencer and Vernon[22] were reported **45% re-ttt** rate, most probably due to different parameters of laser machine and number of laser shots.

12- Mistlberger A, Liebman J, Tschiderer H, et al: Diode laser transscleral cyclophotocoagulation for refractory glaucoma. J Glaucoma 2001;10:288-293.
15- B N Noureddin, W Zein, C Haddad, R Maluf and Z Bashashur: Diode laser transscleral cyclophotocoagulation for refractory glaucoma a one year follow up of patients treated using an aggressive protocol. Eye 2006;20:329-335.
20- Broncato R, Carrasa R G, Bettin R, et al: Contact diode laser cyclophotocoag with diode laser in ref gla. Er J Ophthalmol 1995;5:235-239.
21- Bock C J, Freedman S F, Buckley E G, et al: TDLC for refractory pediatric glaucoma J Pediatr Ophthalmol Strabismus 1997;34:235-239.
22- Anne F Spencer and Stephen A Vernon: Cyclodiode: results of a standard protocol. Br J Ophthalmol 1999;83:3[illegible]

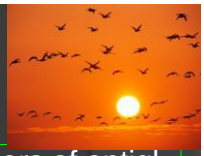
Discussion:



- Regarding to **visual acuity,** in the present study, it was improved in **15 eyes (46.9%),** stable in **13 eyes (40.6%)** and worsen in **4 eyes (12.8%).**
- In comparison to other studies, one previous study[17] reported **18 eyes (30%)** getting better VA, **5 eyes (8%)** getting decreased.
- Another study[23] reported nearly same percent for vision reduction after ttt in **5.8%,**
- In a third study[14], remained stable **in 55%,** improved in 20.8% and worsen in **24.2%.**

17- Virpi E R, Paivi M P and Ilkka J R: Cyclophotocoagu with the transscl contact red 670-nm diode laser in the treatment of glaucoma. Acta Ophthalmologica 2008;86:558-564.
23- R Autrata and J Rehurek: Long-term results of TDLC in refractory pediatric glaucoma patients. Ophthalmologica 2003;217:393-400.
14- Edmund YM, Paul TK, Caroline KL and Jun SW: Diode laser contact transscleral cyclophotocoagulation for refractory glaucoma in Asian patients. Am J Ophthalmol 1997;124:797-804.

Discussion:



- **For antiglaucoma ttts,** in the present study, numbers of antigl drugs were reduced from **4±0.48 to 1±0.43** and all pts stopped systemic use of CAIs.
- By comparison to other studies, one study[14] reported **48.8%** reduction in daily medication postop.
- Another study[15] reported significant reduction of the number of antigl ttts from **2.81 to 0.89** and only 3 pts required oral CAIs.
- In a third study[17], they reported a limited reduction of systemic use of CAIs from **47% to 37% only**.

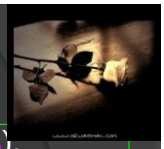
14- Edmund YM, Paul TK, Caroline KL and Jun SW: Diode laser contact transscleral cyclophotocoagulation for refractory glaucoma in Asian patients. Am J Ophthalmol 1997;124:797-804.
15- B N Noureddin, W Zein, C Haddad, R Maluf and Z Bashashur: Diode laser transscleral cyclophotocoagulation for refractory glaucoma a one year follow up of patients treated using an aggressive protocol. Eye 2006;20:329-335
17- Virpi E R, Paivi M P and Ilkka J R: Cyclophotocoagulation with the transscleral contact red 670-nm diode laser in the treatment of glaucoma. Acta Ophthalmologica 2008;86:558-564.

Discussion:

- For **postop complication**, in this study, **one eye (3.2%)** compl by severe uveitis, **4 eyes (12.8%)** with VA reduction and **7 eyes (21.8%)** by hyphema but no major compls were reported as phthisis, hypotony or vit hage
- In comparison to other studies, Edmund et al[13] reported only low incidence of transient relatively minor side effects.
- In contrast, James et al[24] reported visual loss in **3 of 77 eyes (4%)** and uveitis in **8/77 eyes (10%),** may be due to high number of applications (40 laser applications).

13- Vincenzo P, Federica T, Stefano B and Roberto B: Long-term follow up TDLC in refractory glaucoma. Ophthalmologica 2003;217:279-283.
24- James F Kirwan, Peter Shah and Peng T Khaw: Diode laser cyclophotocoagulation, Role in the management of pediatric glaucoma. Ophthalmology 2002;109:319-323.

Discussion:



- Vincenzo et al[14] reported phthisis in **1.6% (2/120eyes)**,
- Murphy et al[19] reported a relatively high percent of hypotony **9.5%,**
- Spencer and Vernon[22] reported **3.4%** but in another study[15] only mild to severe conj inj and cor edema were reported.
- In a recent study[17] more or less like the present study, they reported only mild uveitis in **21/83 eyes (25%)** and moderate anterior uveitis only **in (1%)** and no conj burns were seen.

14- Edmund YM, Paul TK, Caroline KL and Jun SW: DLCC for refractory glaucoma in Asian patients. Am J Ophthalmol 1997;124:797-804.
15- B N Noureddin, W Zein, C Haddad, R Maluf and Z Bashashur: DLCC for refractory glaucoma a one year follow up of patients treated using an aggressive protocol. Eye 2006;20:329-335
17- Virpi E R, Paivi M P and Ilkka J R: Cyclophotocoagulation with the transscleral contact red 670-nm diode laser in the treatment of glaucoma. Acta Ophthalmologica 2008;86:558-564.
19- C C Murphy, C A M Burnett, P G D Spry, D C Broadway and J P Diamond: A two-centre study of the dose-response relation for TDLC in refractory glaucoma. Br J Ophthalmol 2003;87:1252-1257
22- Anne F Spencer and Stephen A Vernon: Cyclodiode: results of a standard protocol. Br J Ophthalmol 1999;83:311-316.

Conclusion

- TDLC is very effective and less traumatic for the eye especially for eyes that are not suitable for filtering surgery.
- Even with higher power settings, it is still safe and reliable method for treating advanced gls with lesser need for antigl. meds postop.
- Also, minimal compls. were reported and VA still preserved to a good extent.

THANK YOU

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