Indian Journal of Basic and Applied Medical Research; September 2020: Vol.-9, Issue- 4, P. 221 - 228
DOI: 10.36848/IJBAMR/2020/18215.56050

**Original article:**

# COMPARISON OF NEW ONSET VISUAL DISTURBANCES AFTER SUPERIOR VS TEMPORAL YAG LASER PERIPHERAL IRIDOTOMY- A PROSPECTIVE RANDOMIZED PAIRED EYE TRIAL

**Sutapa Roy[1], Kumkum Ghosh[2], Raka Chatterjee[3], Riddhiman Dutta Roy[4]**

[1] MBBS, DNB, Senior consultant, Glaucoma services, Susrut Eye Foundation & Research Centre, Salt Lake, Kolkata

[2]MBBS, DO, DNB, FRCS, Senior consultant, Susrut Eye Foundation & Research Centre, Salt Lake, Kolkata

[3] MBBS, MS, Senior consultant ,Susrut Eye Foundation & Research Centre, Salt Lake, Kolkata

[4] B.Sc , Dept of Mathematics & computing, Institute of Mathematics & Applications

Chief & corresponding author- Dr Sutapa Roy, MBBS, DNB , Senior consultant , Glaucoma services, Susrut Eye Foundation & Research Centre, Salt Lake, Kolkata , HB 36/A/1, Salt Lake, Sec 3, Kolkata-106 ; Email: drstproy@gmail.com

**Abstract:**

**Purpose-** To determine if the location of Nd- YAG laser peripheral iridotomy is related to the occurrence of post laser visual disturbances.

**Design-** Randomized, prospective, single masked, paired eye comparative clinical trial.

**Method-** Thirty five patients of 30 years of age or older diagnosed as primary angle closure suspect (PACS) or with primary angle closure (PAC) or primary angle closure glaucoma (PACG) in both eyes diagnosed by 4 mirror gonioscopy were included in this study. Participants were randomized to receive LPI temporally in one eye & superiorly in the other eye. Patients were masked to the location of LPI & LPI was done in both eyes at single sitting & by same surgeon in all patients .

Primary outcome measure-occurrence of new onset visual disturbances after LPI were evaluated after 1week & 1 month after LPI using a questionnaire based on 7 item dysphotopsia symptoms described by Spaeth et al.

Secondary outcome measure- whether eyelid position has in relation to LPI, laser parameters & any intraoperative complications.

**Results-** Total 35 patients were recruited in the study & received the laser treatment in both eyes. The mean number of shots used in superior group (9.8) was higher than temporal group ( 8.2 ) & this value was statistically significant. The initial & total laser energy used in superior group were 4.85±0.89 & 46.14±12.65 mj & the energy used were 5.17±0.92 & 41.54 mj in temporal group & there was no statistically significant difference between the groups. There was also no statistically significant difference the intraoperative hemorrhage or other complications between the superior & temporal groups. There was a statistically significant increase in new onset dysphotopsia symptoms in both the groups after LPI. Superior LPI group had 28.57% & temporal group had 31.43% change in frequency of new onset dysphotopsia symptoms, but there was no statistically significant difference between the groups. Total 37 eyes (52.85%) had dysphotopsia post laser & when the PI was partially exposed there was statistically significant increase in dysphotopsia symptoms. 20% patients had dysphotopsia symptoms when the LPIs were partially covered by lids, but there were no significant increase in dyphotopsia symptoms when the LPIs were fully covered or fully exposed by lids . At 1 month of the study only 3 patients (8.6%) in superior group & 4 patients (11.4%) continued to experience dysphotopsia , whereas the symptoms resolved in other patients .

**Conclusion-** New onset dysphotopia symptoms do not depend on the location of LPI. Both the locations superior & temporal are equally safe for PI, but they should not be partially covered by the eyelids.

**Keywords-** Dysphotopsia , Nd YAG laser peripheral iridotomy

**Introduction-**

Glaucoma is the leading cause of irreversible blindness both globally & in India. It is estimated that more than 15 million people suffer from primary angle closure disease (PACD) worldwide and that will increase to 21 million by 2020.[1,2]

According to International society for geographical & epidemiological ophthalmology(ISGEO) an eye with occludable angle in which the peripheral iris is in appositional contact with posterior trabecular meshwork in 180 degree of the angle or more with normal IOP, optic disc & visual field is termed as primary angle closure suspect(PACS) and PACS with additional peripheral anterior synechiae and/or elevated IOP is termed as primary angle closure(PAC). Nearly 1 in 4 patients with PACS (22%) are likely to progress to PAC over 5 years & a similar percentage are likely to progress from PAC to PACG (28.6%).[3] The risk of progression is higher in eyes with bilateral PAC, PAC with ocular hypertension, and if laser peripheral iridectomy (LPI) has not been performed.

Nd-YAG LPI is the preferred modality to create an alternate pathway for aqueous to flow from posterior to anterior chamber & allowing the iris to fall back, thus reducing iridotrabecular contact in all PACG & PAC eyes & in high risk PACS patients.

Though Nd YAG LPI is a relatively safe procedure with very less complication rate, one of the serious problem after LPI is development of dysphotopsias. While this complaint is found infrequently, but patients can feel severe discomfort from the symptoms. Rate of this symptoms vary between 2.7% to 16% according to different studies.[4,5,8,9] It is thought that these symptoms are caused by the light entering through the LPI & it is suggested to place the LPI superiorly so that the eyelid fully covers the LPI not allowing the light to enter through it. But incidence of visual disturbances even in fully covered LPI suggests that even when LPIs are fully covered by eyelids light can still enter through LPI by a base up prism created by the tear meniscus at the lid margin. This placement of LPI, fully covered, partially or totally uncovered by eyelid can potentially lead to similarly significant symptoms.

Dysphotosias can be positive or negative. Positive dysphotopsias (eg haloes, arc) are related to the bright artifacts of light on the retina. Negative dysphotopsias are manifested by a dark crescent or a curved shadow. Classically these dysphotopsias after PIs are described by a patient as a horizontal line that is present in the lower visual field. Diffraction of light resulting in the horizontally oriented linear shape to the positive dysphotopsia & this image being projected to the superior peripheral retina causing the image to manifest in the inferior visual field.

In OPD nature of dysphotopsia, as well as assessment of the change of the change in dysphotopsia can be evaluated with a careful history taking & examination of the eyelids positions in different gazes.

**Materials & method-**

The study was conducted in a tertiary eye hospital of Kolkata from June 2019 to August 2020.

Thirty five patients of 30 years of age or older diagnosed as primary angle closure suspect (PACS) or with primary angle closure (PAC) or primary angle closure glaucoma (PACG) in both eyes diagnosed by 4 mirror

gonioscopy were included in this study. Participants were randomized to receive LPI temporally in one eye & superiorly in the other eye. Patients were masked to the location of PI in each eye. All patients underwent LPI by same surgeon & LPI in both eyes are done in same sitting.

All participants provided informed consent and the study was done & adhered to the tenets of the Declaration of Helsinki.

**Primary outcome measure**- occurrence of new onset visual disturbances after LPI were evaluated after 1week & 1 month after LPI using a questionnaire based on 7 item dysphotopsia symptoms described by Spaeth et al.[4]

**Secondary outcome measure**- eyelid position in relation to LPI, laser parameters & any intraoperative complications were also noted & analysed.

**Inclusion criteria**- Patients with indication of LPI in both eyes, who were older than 30 years of age, who were able to give consent & able to understand study instructions & willing to come for follow up visit were included in this study.

**Exclusion criteria**- Patients with history of intraocular surgery in either eye or pseudophakia in either eye, asymmetrical ptosis of more than 2 mm, any history or any sign or symptom of acute attack of angle closure, presence of active intraocular inflammation were excluded from the study.

**Clinical evaluation**- Participants underwent proper baseline interview regarding past ocular history, any history of antiglaucoma medication, systemic medication history etc. On the day before LPI detailed ocular examination was done starting from noting down the BCVA. Then slit lamp examination of anterior segment and undilated fundus examination was done. Goldman applanation tonometry was used to measure the IOP, 4 mirror gonioscopy was done in all patients. After filling up the consent forms 2% Pilocarpine drops were administered in the eyes of all patients at least 1 hour before LPI to constrict the pupils.

Nd- YAG Laser PI was performed under topical anaesthesia in both eyes in the same sitting using Abraham's PI lens. Superior PIs were performed between 11 to 1 o clock position and temporal PIs were done between 8 to 10 o clock position . Data regarding laser energy used per shot in mJ , no of shots required, total energy used in the LPI in mJ were collected. Patients were given topical Loteprednol (.5%)/ Gatifloxacin combination drops for 1 week. Slit lamp examination was done & IOP was checked after 1 hour of LPI and antiglaucoma medications were added if needed. Patients were examined thoroughly under slit lamp and IOP was checked in all patients in their 1 week follow up visit. Dysphotopsia questionnaire was also filled up by all patients in 1 week and 1 month follow up visits.

**Dysphotopsia questionnaire**

| **Symptoms** | **Right eye** | **Left eye** |
|---|---|---|
| Halo | | |
| Lines | | |
| Crescent | | |
| Ghost images | | |
| Glare | | |
| Shadows | | |
| Blurry vision | | |
| Other | | |

Scale-

0 = none existing

1 = mild barely noticed

2 = mild not interfering with vision

3 = moderate, interfering with vision but tolerated

4 = severe, interfering with vision, not tolerated

**Statistical analysis**- baseline characteristics of the 2 groups were analysed by unpaired t test & P values obtained. Different visual symptoms frequencies between the superior & temporal PI groups & dysphotopsia frequency in relation to the lid positions were analysed using z score proportionate test. P values of less than 0.05 were considered statistically significant.

**Results-**

Total 35 patients were recruited in the study & received the laser treatment in both eyes. All of them completed the dysphotopsia questionnaire and clinical evaluation was also done before & after the laser treatment & the follow up visits. Demographic characteristics of the study patients are listed in Table1.The mean of number of shots used in superior group (9.8) was higher than temporal group ( 8.2 ) & this value was statistically significant. The initial & total laser energy used in superior group were 4.85±0.89 & 46.14±12.65 mj & the energy used were 5.17±0.92 & 41.54 mj in temporal group & there was no statistically significant difference between the groups. There was also no statistically significant difference the intraoperative hemorrhage or other complications between the superior & temporal groups (Table1).

Number of patients reported dysphotopsias ( eg. halo, glare, crescent)before LPI was 8 in both the groups, whereas the number increased to 18(51.4%) in superior & 19(54.28%) in temporal group after LPI. There was a statistically significant increase in new onset dysphotopsia symptoms in both the groups after LPI & among them most common were lines, haloes, blurry vision, crescent (Table2). In our study superior LPI group had 28.57% & temporal group had 31.43% change in frequency of new onset dysphotopsia symptoms, but there was no statistically significant difference between the groups (Table 3). At 1 month of the study only 3 patients (8.6%) in superior group & 4 patients (11.4%) continued to experience dysphotopsia , whereas the symptoms resolved in other patient.( Table 3).

In our study of total 70 eyes, 37 eyes (52.85%) had dysphotopsia post laser & when the PI was partially exposed there was statistically significant increase in dysphotopsia symptoms, but most of them resolved after 2 weeks, only 7 eyes (10%) continued to complaint even after end of 1 week. 20% patients had dysphotopsia symptoms when the LPIs were partially covered by lids, but there were no significant increase in dyphotopsia symptoms when the LPIs were fully covered or fully exposed by lids (Table 4).

**TABLE 1. Demographic characteristics & procedural details of patients undergoing superior vs temporal laser peripheral iridotomy**

| VARIABLES | SUPERIOR LPI (n=35) | TEMPORAL LPI (n =35) | P -value |
|---|---|---|---|
| Age(years)mean | 60 | 60 | 0.5 |
| Male:Female | 15:20 | 15:20 | |
| BCVA(logMAR) mean | 0.19±0.12 | 0.19±0.24 | 0.5 |
| PACS:PAC:PACG | 25:6: 4 | 25: 7: 3 | |
| Initial laser energy(mJ) mean | 4.85±0.89 | 5.17±0.92 | 0.75 |
| No of shots mean | 9.83.27 | 8.2±2.02 | 0.008 |
| Total laser energy(mJ) mean | 46.14±12.65 | 41.54±11.68 | 0.62 |
| Intra op hemorrhage | 11 | 10 | 0.79 |
| Other complications during laser | 3 | 3 | 0.5 |

**TABLE 2. Dysphotopsia occurrence in patients before & after superior & temporal Laser peripheral iridotomy**

| Variables | Superior LPI | | | | Temporal LPI | | | |
|---|---|---|---|---|---|---|---|---|
| | Before | After 2weeks | After 1 month | P value | Before | After 2 weeks | After 1 month | P value |
| Halo | 3 | 5 | 1 | 0.23 | 3 | 4 | 2 | 0.34 |
| Lines | - | 4 | 1 | 0.02 | - | 6 | 1 | 0.005 |
| Crescent | 1 | 1 | - | 0.5 | 1 | 1 | - | 0.5 |
| Glare | 4 | 5 | 1 | 0.36 | 4 | 4 | 1 | 0.5 |
| Ghost image | - | - | - | - | - | - | - | - |
| Shadows | - | - | - | - | - | - | - | - |
| Blurry vision | - | 3 | - | 0.04 | - | 4 | - | 0.02 |
| Total | 8 (22.8%) | 18(51.4%) | 3(8.6%) | 0.007 | 8(22.8%) | 19(54.3%) | 4(11.4%) | 0.003 |

**TABLE 3. Comparison of frequency changes of new dysphotopsia symptoms after superior vs temporal PI**

| Variables | Superior LPI | Temporal PI | P value |
|---|---|---|---|
| Halo | 5.71 | 2.86 | 0.28 |
| Lines | 11.43 | 17.14 | 0.25 |
| Crescent | 0 | 0 | 0.5 |
| Glare | 2.86 | 0 | 0.16 |
| Ghost images | 0 | 0 | 0.5 |
| Shadows | 0 | 0 | 0.5 |
| Blurry vision | 8.57 | 11.43 | 0.34 |
| Total | 28.57 | 31.43 | 0.39 |

**TABLE 4. Occurrence of visual symptoms based on lid coverage of LPI in all study patients**

| Lid coverage | No dysphotopsia | Dysphotopsia | P value |
|---|---|---|---|
| LPI exposed | 12 (17.14%) | 13 (18.57%) | 0.41 |
| LPI partially exposed | 5 (7.14%) | 14 (20%) | 0.01 |
| LPI covered | 16 (22.85%) | 10 (14.28%) | 0.09 |
| Total | 33 (47.14%) | 37 (52.85%) | 0.25 |

**Discussion-**

Approximately 1 in 11 patients undergoing LPI experienced 1 or more new dysphotopsia symptom after LPI. This rate is in accordance with that previously reported by others: 8% by Congdon et al,6.8% linear dysphotopsias by Vera et al, 2% by Murphy and Trope, and 16% by Spaeth et al.[ 4,5,8,9]

Historically LPI & surgical iridectomies have been performed superiorly with the hope that the upper lid would prevent stray light from passing to retina& causing dysphtopsia. [4,7]

Recent prospective studies have debated the benefit of temporal vs superior placement & effect on their reported symptoms. The results do contrast & the optimal clock hour location remain debatable. Many studies have showed the possibility of dysphotopsia even placed superiorly.[10]

All studies show that a partially covered LPI poses the greatest risk to potentially disturbing dysphotopsia post laser. A superior or temporal placement can equally be selected depending upon anatomy & surgeon preference but partial exposure of the LPI in relation to the eyelid should be avoided.[10]

In a study done in Canada on PACD patients, no significant differences were found with other visual disturbances between temporal & superior LPI groups. There was more pain associated with temporal LPI despite no difference in laser energy & number of shots. Intraoperative hemorrhage were also similar.[9]

In a study on south Indian patients with PACD, they found superior PI require more shots & greater energy in total. No significant difference in anterior chamber reaction or any significant dysphotopsia symptoms were noted between 2 groups. Neither LPI location nor LPI area or total laser energy used predicted higher odds of new postoperative dysphotopsias.[12]

There are mixed literature reviews regarding LPI placement. Two large prospective trials have been conducted in recent years. In the study by Vanessa vera et al eyes randomized to superior LPI experience more significant linear dysphotopsias than eyes with temporal LPI, whether in the study by K. Srinivasan et al nasal or temporal PIs had slightly more incidences of linear dysphotopsia than superior location. This difference may be due to the difference in study population & study design. In the study of V. Vera et al one eye received superior PI & other received temporal PI, whereas in the other study patients received bilaterally similar treatment to document the binocular symptoms more well. [9,11, 12]

Authors have suggested that by allowing complete exposure of the LPI, light entering through the opening gets scattered without coalescing into a discrete linear phenomenon & theoretically this should reduce the risk of positive linear dysphotopsias.[9]

In the study of Srinivasan et al ,although new dysphotopsia symptoms occurred after LPI in a sizable portion of study population, the overall frequency of dysphotopsias did not increase, and LPI location was not associated with statistically significant differences in new visual disturbances suggesting that both superior and temporal LPIs are equally safe with regard to dysphotopsia symptoms[12]. Other considerations should be consided during choosing LPI location based on the lid anatomy & individual patient characteristics, like presence of iris crypt, arcus senilis etc. In this study we found, the concept of dysphotopsia is difficult to convey in a questionnaire to all patients and that changes observed represent inconsistency in how patients respond to the questions designed to capture these hard-to-define symptoms, making it difficult to observe true laser-related symptoms with these questionnaires. Our sample size was smaller & preoperative lens status was not graded properly in undilated pupil. A longer follow up with a larger sample size may be able to understand more clearly the outcomes of LPI & throw light on the attenuation of the symptoms, due to neuroadaptation in log run .

**Conclusion**

In our study dysphotopsia symptoms increased after LPI, but this symptoms did not depend on superior or temporal location. Though superior PI s needed more number of shots in our study, but there was no significant difference in total energy required to perform the LPIs or other complications were also equal in superior & temporal PI groups & both locations are equally safe. However when the LPI s were partially covered by the lids there was significant increase of dysphotopsia. It emphasizes the need of proper examination of eyelid position before PI & selection of the PI location properly so that it does not get partially covered by eyelids.

**REFERENCES-**

1)Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. Br J Ophthalmol. 2006;90: 262-267.

2)Yih- Chung Tham, Xiang Li, Tien Y, Harry A. Quigley, Tin Aung, Ching – Yu Cheng. Global prevalence of glaucoma & projections of glaucoma burden through 2040, Am J Ophthalmol, 2014

3)Ramanjit Sihota, Aparna Rao,Viney Gupta, Geetha Srinivasan, Ajay Sharma. Progression in primary angle closure eyes, Journal of glaucoma 19(9), 632-636, 2010

4) George L Spaeth et al. The effects of iridotomy size & position on symptoms following laser peripheral iridotomy, J Glaucoma 2005 Oct.

5) Paul H. Murphy, Graham E. Trope. Monoocular blurring A complication of YAG Laser iridotomy. Ophthalmology,1991;98:1539-1542

6) Weintraub J, Berke SJ. Blurring after iridotomy. Ophthalmology. 1992;99: 479-480.

7) Quigley HA. Long-term follow-up of laser iridotomy. Ophthalmology 1981;88(3):218–224.

8) Congdon N, Yan X, Friedman DS, et al. Visual symptoms and retinal straylight after laser peripheral iridotomy: the Zhongshan Angle Closure Prevention Trial. Ophthalmology. 2012;119(7):1375-1382.

9) Vera V, Abdulla N, Graham W, et al. Dysphotopsia after temporal versus superior laser peripheral iridotomy: a prospective randomized paired eye trial. Am J Ophthalmol.2014;157:929-935.

10)Manjool Sah. Dogma vs data: Placement of Laser Peripheral Iridotomy, www. Glaucomaphysician.net, Dec 2019

11) Chung RS, Guan AE. Unusual visual disturbance following laser peripheral iridotomy for intermittent angle closure glaucoma (letter). Graefes Arch Clin Exp Ophthalmol. 2006;244:532-533

12) Kavitha Srinivasan, MD, Nazlee Zebardast, MD, MS, Palaniswamy Krishnamurthy, MD, Mohideen Abdul Kader, MD, Ganesh V. Raman, MD, Sharmila Rajendrababu, MD, Rengaraj Venkatesh, MD,Pradeep Y. Ramulu, MD, PhD. Comparison of New Visual Disturbances after Superior versus Nasal / Temporal Laser Peripheral Iridotomy. Am J Ophthalmol , October 2017 , 22-26

Date of Submission: 28 August 2020 Date of Publishing: 30 September 2020
Author Declaration: Source of support: Nil, Conflict of interest: Nil
Ethics Committee Approval obtained for this study? YES
Was informed consent obtained from the subjects involved in the study? YES
For any images presented appropriate consent has been obtained from the subjects: YES
Plagiarism Checked: YES


DOI: 10.36848/IJBAMR/2020/18215.56050