

## Manipulative Gonioscopy as a predictor of angle opening– post Nd-YAG laser Iridotomy in primary angle closure suspects (PACS) patients

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### Abstract

**Background:** PACS (primary angle closure suspects) continue to pose a diagnostic and therapeutic dilemma. PACS being converted to PACG as the disease evolves in the long run leads to irreversible blindness; hence the importance of screening with gonioscope to see which patients will improve with laser peripheral iridotomy (LPI).

**Objective:** To assess the effectiveness of routine manipulative gonioscopy as a tool in order to predict angle opening after Nd-YAG laser iridotomy in PACS patients.

**Methods:** Fifty patients having PACS were enrolled in the prospective observational interventional study. Main outcome measure were effect on IOP, effectiveness of manipulative gonioscopy with regard to angle opening and Van Herick's predicting angle changes. Manipulative gonioscopy and Peripheral laser iridotomy was done. Wilcoxon signed rank was used to find the significance of study parameters.

**Results:** Seventy four percent were females with males forming 26% of the study. Mean age was  $65 \pm 5.16$  years. Comparison of Shaffer's grading pre and post intervention in superior quadrant showed P value 0.020 (suggestive of significance), inferior quadrant showed  $p < 0.001$  which was significant. Van Herick's grading pre and post intervention in the temporal quadrant showed P value 0.005 and in the nasal quadrant showed P value of 0.001 which is strongly significant and correlates with gonioscopic findings.

**Conclusion:** Study confirms that laser peripheral iridotomy increases peripheral chamber angle as predicted by manipulative gonioscopy in majority of cases prior to the intervention which correlates with Shaffer/Van Herick's grading. Laser peripheral iridotomy to all patients with PACS requires proper evaluation as some cases have no effect on peripheral anterior chamber depth post LPI.

**Keywords:** Manipulative Gonioscopy, Glaucoma, Primary angle closure suspect (PACS), Dynamic Gonioscopy.

### Introduction

Primary angle closure glaucoma (PACG) is a leading cause of bilateral blindness worldwide. The disease is estimated to affect 16 million people, with 4 million bilaterally blind.<sup>(1)</sup> Not every case of occludable angles in PACS convert into primary angle closure glaucoma.<sup>(2)</sup> Thus most occludable eyes do not get glaucoma. So prophylactic laser Peripheral iridotomy in all such cases is debatable.<sup>(3)</sup> Most patients do not know they have the disease, there by justifying the need for glaucoma screening specially gonioscopy. Major cause of glaucoma blindness is angle closure glaucoma. PI remains to be the cornerstone of prophylactic management of angle closure especially in PACS. It also eliminates pupillary block thereby equalizing pressure in posterior and anterior chamber. This study was undertaken in patients with PACS undergoing Laser peripheral iridotomy with pre-laser manipulative gonioscopy and correlating it to angle opening after laser, confirmed by gonioscopy.

### Objectives

1. To correlate pre-operative manipulative gonioscopy findings and correlate it to final angle opening post PI.

2. To compare changes in central and peripheral anterior chamber depth pre and post procedure.
3. Correlate variables with Shaffer and Van Herick grading pre and post procedure.

### Materials and Methods

Fifty patients aged 50-75 years having PACS were enrolled from consecutive patients attending ophthalmology out-patient department. Informed consent was obtained. Institutional ethical clearance was approved. Rebound Tonometer was used to record IOP five from each eye and the average was taken. Slit lamp examination with single mirror gonioscope was performed by single investigator. A narrow vertical beam 1mm in length was used to evaluate superior, inferior, nasal and temporal quadrants. Manipulative gonioscopy in primary gaze and then in direction of the mirror was done in all 4 quadrants and angle width documented in degrees (tangent to TM and peripheral 1/3 iris) as 0, 10, 20, 30 degrees. Central anterior chamber depth was documented using slit beam in terms of central corneal thickness which is normally 3 times central corneal thickness. Attempt was also made to describe peripheral angle width with Shaffer/Van Herick's grading. Blumenthal iridotomy lens (Volk) was used with zeiss Nd-YAG visulas III.

**Plan for Data Analysis:** Percentages, Ratio, P value and Wilcoxon signed rank t-test were used.

#### Inclusion Criteria

1. ITC > 270 degrees (irido-trabecular contact)
2. Normal IOP
3. Normal optic disc
4. Normal visual fields

#### Exclusion Criteria

1. Primary angle closure(PAC)
2. Primary angle closure glaucoma(PACG)
3. History of angle closure
4. Age > 75 years
5. Hypertension, diabetes mellitus, thyroid disorders
6. Corneal disease
7. Pterygium
8. Intra and extra ocular surgery
9. Laser trabeculoplasty.

**Procedure:** Gonioscopy was performed using a coupling agent (methyl cellulose) under topical anaesthetic drops. Superior, inferior, nasal and temporal quadrants were graded using Shaffer's grades in primary gaze and then angle was reassessed by looking towards the mirror away from the quadrant to be assessed and angle opening re-graded. Additionally the temporal and nasal quadrants were also assessed by Van Herick's method to show correlation between the two. When TM cannot be seen because of marked iris convexity and over the hill view was obtained a manipulative dynamic gonioscopic examination was performed. Angle was evaluated in primary gaze and then the patient was asked to look towards the mirror. LPI using Nd-YAG laser was performed and gonioscopy was repeated to confirm the pre-operative manipulative gonioscopy findings to predict and confirm the opening.



#### Blumenthal laser iridotomy lens



Zeiss Nd-YAG visulas III

#### Results

A prospective interventional study was done to assess the predictability of manipulative gonioscopy in determining angle opening in patients attending OPD pre and post laser peripheral iridotomy. Wilcoxon signed rank was used to find the significance of study parameters.

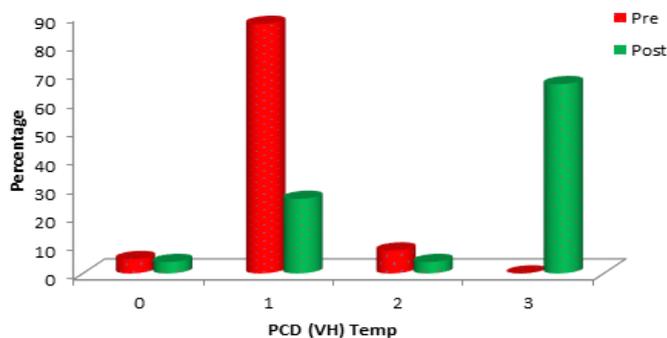
In the present study 72% of the patients were in the age group 61-70 years and 26% in age group 50-60 years and 2% in age group greater than 70 yrs. Mean age  $\pm$  SD was  $65.48 \pm 5.16$ . Male to female ratio was 1:3(74% females and 26% males).

**Table 1: IOP distribution of eyes**

IOP	Min-Max	Mean $\pm$ SD	difference	t value	P value
Pre	12.00-18.00	14.90 $\pm$ 1.49	1.280	4.759	<0.001**
Post	10.00-20.00	13.62 $\pm$ 2.82			

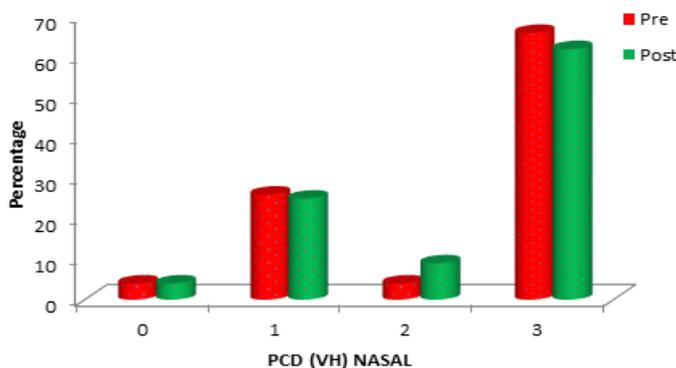
**Table 2: Assessment of Peripheral anterior chamber depth (Van Herrick grading) pre and post procedure**

PCD (VH)	Pre	Post	% change
0	5(5%)	4(4%)	1.0%
1	87(87%)	26(26%)	61.0%
2	8(8%)	4(4%)	4.0%
3	0(0%)	66(66%)	66.0%
Total	100(100%)	100(100%)	



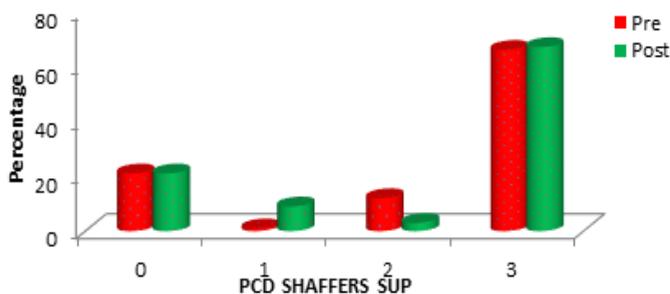
**Table 3: PACD (VH) nasal quadrant number of eyes pre and post assessments**

PCD (VH) NASAL	Pre	Post	% change
0	4(4.0%)	4(4.0%)	0.0
1	26(26.0%)	25(25.0%)	-1.0
2	4(4.0%)	9(9.0%)	+5.0
3	66(66.0%)	62(62.0%)	-4.0
Total	100(100.0%)	100(100.0%)	0.0



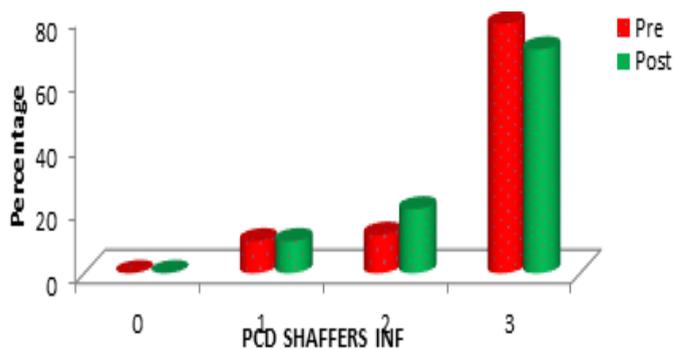
**Table 4: PACD SHAFFERS superior pre and post assessment**

PCD SHAFFERS SUP	Pre	Post	% change
0	21(21.0%)	21(21.0%)	0.0
1	1(1.0%)	9(9.0%)	+8.0
2	12(12.0%)	3(3.0%)	-9.0
3	66(66.0%)	67(67.0%)	+1.0
Total	100	100	-

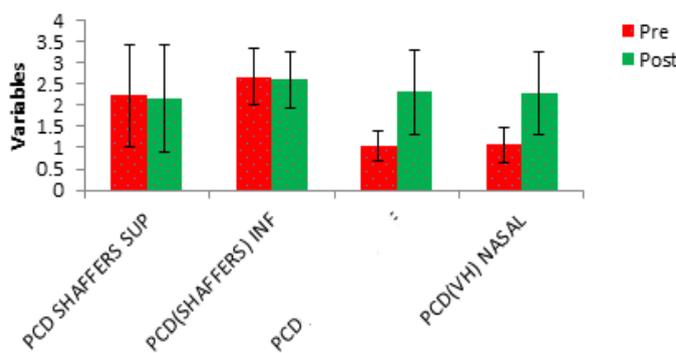


**Table 5: PACD Shaffers Inferior pre and post assessment**

PCD Shaffers INF	Pre	Post	% change
0	0	0	0.0
1	10(10.0%)	10(10.0%)	0.0
2	12(12.0%)	20(20.0%)	+8.0
3	78(78.0%)	70(70.0%)	-8.0
Total	100	100	-

**Table 6: Comparison of study variables pre and post procedure**

Variables	Pre	Post	difference	Z score	P value
PCD SHAFFERS SUP	2.23±1.21	2.16±1.26	0.070	2.333	0.020*
PCD (SHAFFERS) INF	2.68±0.65	2.60±0.67	0.080	7.811	<0.001**
PCD (VH) TEMP	1.03±0.36	2.32±0.99	1.29	2.828	0.005**
PCD (VH) NASAL	1.07±0.41	2.29±0.98	1.22	7.600	<0.001**



## Discussion

This study was done on fifty consecutive PACS patients who attended out-patient department of ophthalmology with the objective of assessing the predictability of pre laser angle opening by manipulative gonioscopy using schaffer's grading and van herricks, comparing any changes in central and peripheral chamber depth pre and post procedure. In our study PACS was more common in females than males. Our study confirms the findings of Vijaya et al.(2008) that the angle width is narrow in females than

males and becomes narrow with increasing age.<sup>(4)</sup> In the study 87% of eyes with less than 25% or less than ¼ corneal thickness showed 61% change with final opening correlating(Wilcoxon signed rank test) with 66% of the eyes post PI using van herrick's grading in the temporal quadrant[Table 2]. Of the total eyes 62% had ¼ to ½ corneal thicknesses PACD according to van herrick's grading in the nasal quadrant.[Table 3]. On using schaffer's grading in the superior quadrant ,Grade 0 was seen in 21% eyes compared to 21% post laser procedure representing 0% change. Grade1 pre

assessment 1% was seen compared to 9% post laser procedure representing percentage change of +8. Grade 2 seen in 12 (12%) pre procedure compared to 3 (3%) post procedure representing percentage change of -9. Grade 3 pre procedure 66 (66%) compared favorably with post laser procedure 67(67%) representing percentage change of -1.[Table 4]. On using schaffers grading in the inferior quadrant Grade 1 pre procedure 10 eyes (10%) compared to 10(10%) post laser procedure. Grade 2 pre procedure 12 (12%) compared to 20(20%) post laser representing change of +8 Grade 3 pre procedure 78(78%) compared with post laser procedure 70 (70%) [Table 5] comparison of study variables pre and post procedure showed PACD SHAFFERS superior quadrant P value (0.020) to be moderately significant, as normally superior quadrant is narrow to start with inferior quadrant P value was < 0.001. PACD Van Herick temporal quadrant P value was 0.005. PACD Van Herrick nasal quadrant was P value < 0.001 being strongly significant.[Table 6].

In our study, mean range of the IOP pre and post laser peripheral iridotomy were  $14.9 \pm 1.49$  mm Hg and  $13.62 \pm 2.82$  mm Hg respectively with t value of 4.759, P value <0.001% which was strongly significant. No changes in central anterior chamber depth was recorded. In this study 87% of the angles had chamber depth less than  $1/4^{\text{th}}$  corneal thickness in the temporal quadrant, among which 66% of angles improved post laser PI as determined by van herrick grading.

Anterior insertion of the iris can be a factor that predisposes to peripheral anterior synenchia. The anatomic configuration of the anterior chamber angle can predispose to glaucoma in the long run. LPI allows free flow of aqueous through iridotomy and eliminates risk of attack in eyes. There is a visible change of iris configuration from steep to regular contour. Few angles do not change even after LPI. LPI is insufficient for PACS in whom non-pupillary block mechanisms is present. Anterior rotation of ciliary process, ciliary body thickening, lens thickening may be mechanism in failure of angle to change post LPI.<sup>(5)</sup>

Manipulative dynamic gonioscopy helps to predict which eyes will and will not respond to LPI. Gonioscopy predicts poor outcome after LPI in whom there was no or minimal angle opening. Gonioscopy is a subjective technique but when meticulously done has benefit in predicting in which eye LPI is required. Gonioscopy is indispensable in a management of PACS. Some eyes may have additional plateau iris configuration and plateau iris syndrome which explains residual narrow angle. None of the PACS suffered symptomatic angle closure or glaucomatous optic neuropathy. Reduced effectiveness of iridotomy may be related to small initial hole.<sup>(7)</sup>

Despite the subjective nature of gonioscopy we have demonstrated good predictability as an investigational tool in angle assessment prior to Nd: YAG laser iridotomy and correlate it to final angle

opening after LPI. We need to investigate strategies for prevention of PACG. Gonioscopy done meticulously provides low cost procedure in screening PACS patients in whom ultimately LPI may benefit.

### Conclusion

Comparison of study variables pre and post procedure showed good statistical significance. Thus we found that careful grading of the angles by manipulative gonioscopy in all the cases of PACS shows good predictability and help to determine which eyes will benefit from LPI.

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