



Comparison of Optic Disc on Machine (OCT) Versus Manual Assessment on Slit Lamp

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Abstract

Background and Objectives: OCT is an evolving tool of diagnosing various anatomical anomalies of eye specially for retinal parameters and also gaining a strong role in other structures like cornea, angle, optic disc. But its cost and incorporation of newer technology with time becomes a dilemma for its purchase. The subjective assessment of optic nerve head (ONH) with the help of 90 dioptre, or 78 dioptre lens on slit lamp, or direct ophthalmoscope are methods in common clinical practice in most ophthalmic settings. Such manual assessment forms the core of the strategic approach to diagnose optic disc variations. This study aimed to learn if objective tool like OCT could do away the subjective method. **Material and Method:** All eyes underwent comprehensive ophthalmic evaluation including visual acuity, slit lamp biomicroscopy, tonometry, and OCT. The optic disc was assessed on slit lamp by 78 D as the morphology appeared close to natural dimensions. Disc size, NRR, C:D ratio noted on OCT were compared with the readings of manual method. **Study Design:** A cross sectional, hospital based, prospective study involving 200 eyes of 100 patients. **Result:** In our study, we found that the size was significantly more on OCT than manual assessment on slit lamp with 78 dioptre lens. Glaucoma Suspect eyes on slit lamp were found to have suspicious discs even on OCT in almost 90% eyes. **Interpretation & Conclusion:** Subjective assessment is mandatory for diagnostic purposes as it is vivid, and is easily available on account of low cost. OCT is additive of information of structures not visible to human eye directly. A proper

combination of OCT and SLB brings specificity and clarity to both the patient and clinician.

Keywords: Optic disc, Glaucoma, OCT, Glaucoma Suspect

INTRODUCTION

Optical Coherence Tomography (OCT) is a noninvasive technology that works by passing a beam of laser-generated light, with a wavelength in the infrared range, through a tissue and analyzing the reflected fraction. Already indispensable for retinal analysis, OCT is now becoming essential for glaucoma and other optic neuropathies, to evaluate axonal integrity, to assess disease progression in the afferent visual pathway and to predict visual recovery after surgery in compressive optic neuropathies. Also, OCT testing is considered a powerful biomarker of neurodegeneration and a promising outcome measure for neuroprotective trials.^[1,2] Even when the progression of the glaucomatous damage has been known to be subtle, nevertheless, the OCT scans have been shown to differentiate between healthy and glaucomatous eyes using Retinal Nerve Fibre Layer (RNFL) measurements.^[3,4] The use of the clinically invisible Bruch's Membrane Opening (BMO) to define the border of the optic disc margin, accurately and repeatedly with OCT, has also made the measurements more diagnostic.^[5] The improvement in the resolution of the device has resulted in better segmentation of the retinal layers and better test-retest repeatability.^[6] The drawbacks of the device lie in over or under estimation of rim tissue, which depends on the orientation of the machine.^[7,8] The manual assessment of the disc with the help of ophthalmoscope is indispensable as it is vivid, economical, and feasible in most circumstances. Through this study, we try to draw comparisons in the measurement of disc parameters taken manually versus those noted on OCT.

OBJECTIVES

1. To document Cup Disc ratio (C:D) by Slit Lamp Biomicroscopy (SLB) and OCT
2. To record the Glaucoma Suspect discs by SLB and OCT and compare.
3. To note the width of Neuro Retinal Rim (NRR) on OCT

MATERIAL AND METHOD

It is a prospective, cross- sectional, hospital-based study. Ethics Committee approval was obtained for the study that was conducted in a tertiary care hospital of northern India from August 2021 to December 2021. All patients more than 18 years of age visiting the Out Patient Department (OPD) and willing to participate were enrolled in the study. Eyes with history of trauma, surgery, laser, or retinal pathology were excluded from the study.

All eyes underwent comprehensive ophthalmic examination including visual acuity testing, SLB, indirect ophthalmoscopy, intra ocular pressure on non-Contact tonometry (NIDEK NT-530P) and OCT(RS-3000) examinations. The optic disc was seen on slit lamp by 78 D as the morphology appeared close to natural dimensions. The disc was then assessed on OCT after proper dilation. Disc size, NRR, C:D ratio was noted and compared with the readings of manual method.

STATISTICAL ANALYSIS

The data was analyzed using Student t test and Chi square test. p-Value less than 0.5 was considered significant.

RESULT

200 eyes of 100 patients ranging from 18 to more than 65 years were analyzed. There were 71 females, and 29 males. 29% of the patients belonged to the age group of 36 to 45 years. The vision recorded was better than 6/18 in 70% right and 73% and only 3 right (3%) and 3 left (3%) eyes had vision less than 6/60.

Variable	Minimum	Maximum	Mean	Std. Deviation	t-test (‘p’ value)
VC:D Right eye SLB	0.20	0.70	0.4141	0.11293	-5.671 (0.000)
VC:D Right eye OCT	0.20	0.89	0.5149	0.13726	
VC:D Left eye SLB	0.20	0.70	0.4266	0.12649	-5.301 (0.000)
VC:D Left eye OCT	0.29	0.97	0.5336	0.15730	
Table 1: Vertical Cup Disc ratio (C:D) with IDO and OCT					
VC:D = vertical cup disc ratio; SLB= slit lamp biomicroscopy; OCT=optical coherence tomography, IDO= Indirect ophthalmoscopy					

The minimum vertical C:D found on SLB was 0.20, equal to the minimum vertical C:D ratio recorded on OCT. However, the maximum vertical C:D on SLB was noted to be 0.7 with respect to 0.89 recorded on OCT. The mean Vertical C:D was 0.41 on SLB while the value was 0.52 on OCT. The difference was statistically significant with a p-Value 0.000. Similarly, the mean vertical C:D ratio in left eyes was found to be 0.43, compared to 0.53 on OCT and the difference was significant with a p-Value of 0.000. (Table 1)

The minimum and maximum C:D on SLB was found to be similar to vertical C:D as 0.20, and 0.70 respectively. However, the mean of horizontal C:D in right eyes was 0.42 as compared 0.57 to mean horizontal C:D on OCT and the difference was significant with a p-Value less than 0.000. Even among left eyes, the mean C:D on SLB was 0.43, while 0.58 on OCT and the difference was significant. (Table 2)

Variable	Minimum	Maximum	Mean	Std. Deviation	t-test (‘p’ value)
HC:D Right eye SLB	0.20	0.70	0.4210	0.11393	-7.867 (0.000)
HC:D Right eye OCT	0.30	0.97	0.5731	0.15622	
HC:D Left eye SLB	0.20	0.70	0.4326	0.12904	-7.044 (0.000)
HC:D Left eye OCT	0.30	0.96	0.5805	0.16562	
Table 2: Horizontal Cup Disc ratio (C:D) with SLB and OCT					
HC:D = horizontal cup disc ratio; SLB= slit lamp biomicroscopy; OCT=optical coherence tomography					

On SLB, 34 right and 38 left eyes were glaucoma suspect. On OCT, 63 right, and 58 left eyes had a vertical C:D suspicious of glaucoma. (Table 3)

	VC:D<0.5	VC:D≥0.5
VC:D RE SLB	66	34
HC:D RE SLB	63	37
VC:D RE OCT	37	63
HC:D RE OCT	33	67
VC:D LE SLB	62	38
HC:D LE SLB	61	39
VC:D LE OCT	42	58
HC:D LE OCT	34	66
Table 3: Glaucoma Suspect Eyes		
HC:D = horizontal cup disc ratio; VC:D = vertical cup disc ratio; SLB= slit lamp biomicroscopy; OCT=optical coherence tomography; RE=right eye; LE= left eye		

Table 4: Comparison between SLB and OCT of Glaucoma Suspect Eyes

Among 34 glaucoma suspect right eyes SLB, 31(91.2%) showed similar findings on OCT (Table 4 and Table 5). Likewise, among 38 glaucoma suspect left eyes, 35(92.1%) showed similar findings on OCT (Table 6 and Table 7). Conversely, among 63 glaucoma suspect eyes on OCT, only 31(49.2%) had similar findings on SLB. Among 58 glaucoma suspect left eyes on OCT, just 35(60.3%) eyes had similar findings.

VC:D RE * VOCT RE Crosstabulation					
		VOCT RE			Chi-square (‘p’ Value)
		<0.5	≥0.5	Total	
VC:D RE SLB	<0.5	34 51.5%	32 48.5%	66 100.0%	17.546 (0.000)
	≥0.5	3 8.8%	31 91.2%	34 100.0%	
Total		37 37.0%	63 63.0%	100 100.0%	

Table 4: Comparison between SLB and OCT of Glaucoma Suspect right Eyes

VC:D = vertical cup disc ratio; VOCT=vertical cup disc ratio on OCT;
RE= right eye; SLB= slit lamp biomicroscopy; OCT=optical coherence topography

HC:D RE * HOCT RE Crosstabulation					
		HOCT RE			Chi-square (‘p’ Value)
		<0.5	≥0.5	Total	
HC:D RE SLB	<0.5	32 50.8%	31 49.2%	63 100.0%	24.383 (0.000)
	≥0.5	1 2.7%	36 97.3%	37 100.0%	
Total		33 33.0%	67 67.0%	100 100.0%	

Table 5: Comparison between SLB and OCT of Glaucoma Suspect right Eyes

HC:D = horizontal cup disc ratio ON SLB; HOCT=horizontal cup disc ratio on OCT;
RE= right eye; SLB= slit lamp biomicroscopy; OCT=optical coherence topography

VC:D LE * VOCT LE Crosstabulation					
		VOCT LE			Chi-square (‘p’ Value)
		<0.5	≥0.5	Total	
VC:D LE SLB	<0.5	39 (62.9%)	23 (37.1%)	62	29.266 (0.000)
	≥0.5	3 (7.9%)	35 (92.1%)	38	
Total		42 (42%)	58 (58%)	100 (100)	

Table 6: Comparison between SLB and OCT of Glaucoma Suspect left Eyes

VC:D = vertical cup disc ratio on SLB; VOCT=vertical cup disc ratio on OCT; LE= left eye; SLB= slit lamp biomicroscopy; OCT=optical coherence topography

HC:D LE * HOCT LE Crosstabulation					
		HOCT LE			Chi-square (‘p’ Value)
		<0.5	≥0.5	Total	
HC:D LE SLB	<0.5	33 54.1%	28 45.9%	61 100.0%	28.156 (0.000)
	≥0.5	1 2.6%	36 97.4%	37 100.0%	
Total		34 34.0%	66 66.0%	100 100.0%	

Table 7: Comparison between SLB and OCT of Glaucoma Suspect left Eyes

HC:D = horizontal cup disc ratio on SLB; HOCT=horizontal cup disc ratio on OCT;

LE= left eye; SLB= slit lamp biomicroscopy; OCT=optical coherence topography

DISCUSSION

The present study is one of its kind in the hilly region of northern India, to have compared the fundus noted on a machine (objective) versus manually (subjective). We found that the size of optic disc was significantly more on OCT, than when seen on slit lamp with 78D. Vessani et al found that stereophoto evaluated by a glaucoma expert showed better agreement with best parameter of each quantitative imaging technique in classifying eyes either as glaucomatous or normal. Also, the combination of subjective assessment of the optic disc by general ophthalmologists with objective parameters improved the identification of glaucoma patients.^[9] In another study from Alabama, similar diagnostic ability was found for all imaging techniques which included confocal scanning laser ophthalmoscope, scanning laser polarimeter, optical coherence tomographer, and stereographs. None of the imaging technique was found to be superior than subjective assessment of optic nerve head (ONH). Also, the disease classification by subjective methods was greater with techniques that evaluated ONH rather than RNFL.^[3]

In our study, there were almost double number of eyes, and subsequently more patients under the category of glaucoma suspects due to depiction of increased size of optic disc on OCT. On SLB, the eyes having suspicion of glaucoma, nearly 90% matched with OCT, while the reverse was not the same. Mwanza et al. in their study demonstrated that using all OCT structural parameters in combination with one another was more effective at detecting early glaucomatous damage compared with analyses done with individual parameters. [6]

Michelessi et al. have concluded that the accuracy of imaging tests for detecting manifest glaucoma was variable across studies, but overall similar for different devices.^[10] Banister et al. have asserted that the imaging technologies could aid clinicians in diagnosing glaucoma, but might not replace the current strategies as they could miss cases of severe glaucoma.^[11]

Our study only focused on the disc morphology, especially size and cup disc ratio in eyes and comparison of these morphological changes of optic disc, manually versus a machine, as both have a learning process. It does not discuss the changes in disc associated in glaucoma per se or glaucomatous damage noted on OCT, hence the comparison is limited. This study holds

relevance specially for post graduate students who are developing their concept of visualizing the optic disc manually and also analyzing the disc on machine like OCT.

Also, only one type of OCT machine was used for reference, that is suggestive of one kind of software and technology.

CONCLUSION

OCT technology is evolving at a quick pace with faster, mobile or hand-held functional imaging modalities, affordable technology and additive diagnostic applications. However, subjective assessment and the strategic approach still hold relevance as diagnostic tools. A proper combination of OCT and SLB is additive of information and clarity to both the patient and clinician.

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