



ORIGINAL RESEARCH PAPER

Ophthalmology

MODIFICATION IN SMITH'S METHOD FOR CLINICAL ASSESSMENT OF ANTERIOR CHAMBER DEPTH (ACDS) BY USING AS-OCT

KEY WORDS:

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INTRODUCTION

Anterior chamber is between posterior surface of cornea and anterior surface of lens. Anterior chamber depth (ACDs) estimates have assumed importance as a major factor for development of angle-closure glaucoma^{1,2}. The relationship between shallow anterior chamber and increased risk of developing acute glaucoma is well established and especially relevant in the 30 year (and above) age group³. Generally, eyes with axial ACDs of 2.5 mm or less are more likely to develop primary angle-closure glaucoma (PACG)^{4,5}. Several factors are known to influence the anterior chamber depth, including race^{7,8}, refractive error⁹ and gender¹⁰⁻¹². Generally, men and myopes have deeper axial ACDs than women and hyperopes, respectively. Furthermore, Caucasians have deeper axial ACDs than Asians.

There are multiple methods to measuring AC depth clinically¹³,

1) Subjective Method's :-

- a) **Qualitative Method:-** Pen torch method, Split limbal technique, Von herick's method.
- b) **Quantitative Method :-** Smith's method.

2) Objective Method's :- UBM, AS-OCT, Topography.

As, UBM, AS-OCT and Topography technique are accurate but they are costly, So for cost effective clinical and mass population screening purpose quantitative assessment is done by Smith's method.

Purpose of our study is to refine smith's method for better and accurate assessment of ACDs by cross checking with AS-OCT in normal subjects of age group 30 to 50 year.

MATERIALS AND METHODS

Measurement of ACD is done first by smith's method and then by AS-OCT. Value for same person is compared. 20 eye's of normal subject out of which 12 eye's of male and 8 eye's of female, age group between 30 to 50 year are examined in MBS Hospital & Govt. Medical Collage, Kota.

Smith's Method :-

The method of ACD assessment suggested by Jacobs¹⁴ and modified by smith¹⁵.

Slit lamp illumination is placed 60° temporally and rotate slit beam horizontally with 1 mm width. For right eye examination see through right eyepiece and vice versa for opposite eye. In this position, 2 horizontal streaks of light are seen, one on cornea and other on lens and on increase length of slit until inner ends of corneal and lenticular reflection are meet. At this position slit length is noted and ACD is calculated by multiply measured slit length with correction factor 1.34¹³.

$$ACD = \text{MEASURED SLIT LENGTH} \times 1.34$$

AS-OCT :- ACD assessment is done by using Zeiss Spectral domain OCT (SD-OCT) and depth between posterior surface

of cornea and anterior surface of lens measured.

Comparison of ACDs value measured by both above techniques and results are statistically compared by using www.medcalc.org. Snellen's visual acuity, IOP and Fundus examination is done to rule out other ocular disease.

RESULTS :-

Anterior chamber depth (ACD) value measured by smith's method and by AS-OCT of same eye and values are shown in Table no. 1

Table No. 1 Showing Estimated ACD Value In Study Group

S.N.	Name	Age	Sex	ACD by Smith's method (In mm)		ACD by AS-OCT (In mm)	
				Right Eye	Left Eye	Right Eye	Left Eye
1	Sharukh	30	M	3.5×1.34 =4.690	3.5×1.34 =4.690	3.560	3.357
2	Shamim	40	F	3×1.34 =4.020	3×1.34 =4.020	3.127	3.120
3	Rinku	30	M	2.8×1.34 =3.752	2.5×1.34 =3.350	2.703	2.826
4	Mahendra	38	M	3.1×1.34 =4.154	3.5×1.34 =4.690	3.300	3.276
5	Devkishan	40	M	3.1×1.34 =4.154	3.5×1.34 =4.690	3.315	3.207
6	Meena	42	F	2.5×1.34 =3.350	2.5×1.34 =3.350	2.486	2.454
7	Aruna	49	F	2×1.34 =2.680	2.1×1.34 =2.814	2.027	2.067
8	Yashwant	30	M	3.1×1.34 =4.440	3×1.34 =4.020	2.917	2.976
9	Nikita	30	F	2.6×1.34 =3.484	2.6×1.34 =3.484	2.440	2.447
10	Anand	30	M	3.5×1.34 =4.690	3.7×1.34 =4.958	3.191	3.136

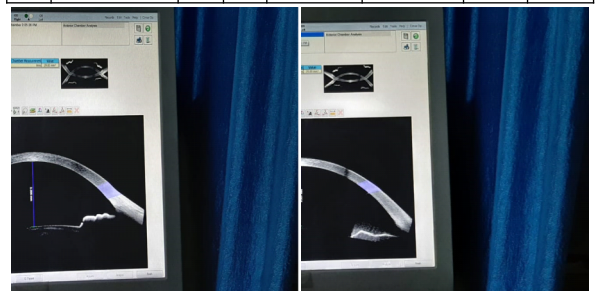


Figure showing ACD measure by AS-OCT

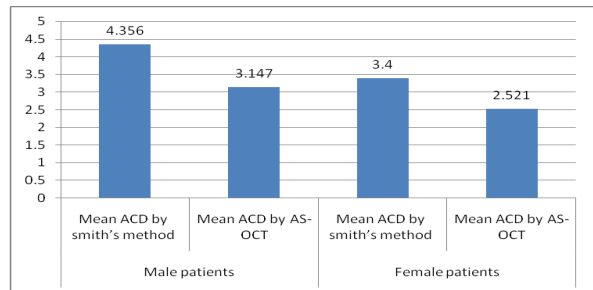
Mean and standard deviation (S.D.) of ACD value by both method's are calculated and compared statistically in male and female patients group as shown in table no.2 and 3

Table no.2 showing ACD value compared in male patients group

Age group	ACD by smith's method		ACD by AS-OCT		p value
	Mean	S.D.	Mean	S.D.	
30 to 50 year	4.356	0.456	3.147	0.246	<0.0001

Table No.3 Showing ACD Value Compared In Female Patients Group

Age group	ACD by smith's method		ACD by AS-OCT		p value
	Mean	S.D.	Mean	S.D.	
30 to 50 year	3.400	0.485	2.521	0.412	0.0016



Graph Comparing Mean ACD Value In Study Group's

So, Table no.1 & 2 shown that ACDs value measured by smith's method are different from that measured by AS-OCT and this difference is statistically significant as calculated p value are <0.0001 and 0.0016 (as value <0.001 is considered statistically highly significant), respectively in male and female patients group. And if correction factor in smith's method is changed, there are chances to achieve ACDs value near the ACDs value measured by AS-OCT.

Measurement Of New Correction Factor:-

To measure new correction factor mean ACDs value without correction factor by smith's method are compared with mean ACDs by AS-OCT in male and female patients group as shown in table no.4

Table No.4 Showing Mean ACD Value In Both Group

In Male patients		In Female patients	
Mean ACD value without correction factor by smith's method (a)	Mean ACD by AS-OCT (b)	Mean ACD value without correction factor by smith's method (a)	Mean ACD by AS-OCT (b)
3.233	3.147	2.537	2.521

Correction Factor = $\frac{b}{a}$

In Male Patients :-

Correction Factor = $\frac{3.147}{3.233} = 0.973$

In Female Patients :-

Correction Factor = $\frac{2.521}{2.537} = 0.993$

If new correction factor is used in table no.1, resulting Anterior chamber depth value (ACDs) become more near to value measured by AS-OCT shown in Table no.5

Table No.5 Showing Estimated ACDs Value Using New Correction Factor

S.N.	Name	Age	Sex	ACD by Smith's method (In mm)		A C D b y AS-OCT (In mm)	
				Right Eye	Left Eye	Right Eye	Left Eye
1	Sharukh	30	M	3.5×0.973 =3.405	3.5×0.973 =3.405	3.560	3.357
2	Shamim	40	F	3×0.993 =2.979	3×0.993 =2.979	3.127	3.120
3	Rinku	30	M	2.8×0.973 =2.724	2.5×0.973 =2.432	2.703	2.826
4	Mahendra	38	M	3.1×0.973 =3.016	3.5×0.973 =3.405	3.300	3.276
5	Devkishan	40	M	3.1×0.973 =3.016	3.5×0.973 =3.405	3.315	3.207
6	Meena	42	F	2.5×0.993 =2.482	2.5×0.993 =2.482	2.486	2.454
7	Aruna	49	F	2×0.993 =1.986	2.1×0.993 =2.085	2.027	2.067
8	Yashwant	30	M	3.1×0.973 =3.016	3×0.973 =2.919	2.917	2.976
9	Nikita	30	F	2.6×0.993 =2.581	2.6×0.993 =2.581	2.440	2.447
10	Anand	30	M	3.5×0.973 =3.405	3.7×0.973 =3.6	3.191	3.136

DISCUSSION

PACG is associated more with visual disability and vision loss compared to POAG and eyes with PACG have shallower anterior chamber depths (1.8 mm) than normal eyes (2.8 mm)¹⁶. The significance of ACDs assessment is to isolate the population at risk of developing angle closure glaucoma so that timely intervention are applied but it is crucial to estimate ACDs value accurately. Objective method's that available are eg. UBM, AS-OCT, Topography measure ACDs accurately but also very costly. So, Smith's method used for quantitative assessment which is cost effective is refine by cross checking with AS-OCT and a new correction factor 0.973 in male and 0.993 in female is evolved and when these correction factor are used estimated ACDs value are closure to ACDs value measured by AS-OCT.

CONCLUSION

We propose new correction factor in smith's method so that the Smith-method can be used as a non-invasive, quantifiable, rapid screening, reliable, cost effective and more accurate technique to identify patients at risk of developing angle-closure, during routine examination of patients in the ophthalmology clinic, especially in primary eye-care clinics, where sophisticated equipment may be unavailable to properly assess the risks of glaucoma.

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