

## CENTRAL CORNEAL THICKNESS (CCT) MEASUREMENT IN EACH TRIMESTER OF PREGNANCY: A SCREENING PARAMETER FOR A HEALTHY EYE DURING PREGNANCY : A PROSPECTIVE STUDY!

*Sruthi Swaminathan G<sup>1\*</sup>, Lalith Sundaram\*, Ranjakumar TC, Rahana Ashraf\*, Nimesha Alex\**

<sup>1\*</sup> Resident, Department of Ophthalmology, Kannur medical college, Kerala, INDIA, email: srutz27@gmail.com

\* Department of Ophthalmology, Kannur medical college, Kerala, INDIA

*Conflict of Interest – NIL, Received – 06/10/2015, Accepted – 06/11/2015, Published - 09/11/2015*

**AIM:** - To detect central corneal thickness (CCT) in each trimester of pregnancy.

**Purpose:** To evaluate difference in measurement of central corneal thickness due to corneal changes in each trimester of pregnancy.

**METHOD:** - 100 healthy pregnant women within age group ranging from 21 to 35 years were included in the study. Central corneal thickness (Ultrasound Pachymetry), Intra ocular pressure (Goldmann-Appplanation Tonometer) was done. Changes in central corneal thickness (CCT) were calculated at 3 time periods: First trimester, Second trimester, Third trimester. Informed consent was taken from all patients. Patients had no systemic or ocular co-morbidities.

All of the patients underwent comprehensive ophthalmologic examinations, including Refraction, Intraocular pressure (IOP), Anterior segment and Fundus examination.

**RESULTS:** - The mean age was 25 years in the study group. The mean CCT in the second trimester of pregnancy was measured to be higher than first trimester by 1.67% & 3.13% by third trimester in right eye & increase of 1.91% in second trimester & 3.03% in third trimester left eye.

The results are statistically significant confirmed by ANOVA.

**CONCLUSION:** - Changes during pregnancy causes corneal edema, which is observed in pregnant women resulting from increased water retention during pregnancy. Changes in corneal curvature, central, corneal thickness and steeping may also occur during pregnancy particularly during the second and third trimester. Most of the changes are reversible and resolved in the postpartum period or after cessation of breastfeeding. Awareness of the changes during pregnancy and routine screening during antenatal period should be improvised.

**KEYWORDS:** - – CCT, IOP, Pachymetry, Pregnancy

### INTRODUCTION:

Eye has an integral role during changes in pregnancy (1) Detailed follow up of the corneal changes and intraocular pressure in each trimester is very essential during antenatal care due to the prevalence of changes in corneal curvature, thickness and intra ocular pressure. Changes in

refraction of eye is also noted during pregnancy. It can even occur for the first time in pregnancy (2). Ocular changes can thus be a determining factor of pre-existing ocular disease or as a manifestation of systemic disease. (2). Need to assess development of a new ocular pathology during pregnancy is also

essential; hence the study of physiological changes in eye becomes important. (1)

Some of the major concerns are lack of awareness of routine ophthalmology checkup during pregnancy. Only a pregnant woman with a previous ocular pathology is usually found to do follow up during antenatal period. Interest in refractive surgery amongst women of reproductive age should also be emphasized that pregnancy causes changes in the eye making the results of any refractive surgery unpredictable (2). Refractive procedures in pregnant women be postponed till after delivery (2)

**Need And Significance Of Study:** - Awareness of an essential screening of eye during along with antenatal visits should be known to our population. Women of reproductive age must be aware of the possible consequences of refractive surgeries and its unpredictable results due to refractive surgery (2).

**Indications:** To find out the variation of ocular parameters during pregnancy and a study in detail about it has become important. Variation in the thickness of cornea and change intraocular pressure has been detailed in various studies. By understanding these parameters, we can try to do a screening, for the common changes and in turn take measures for corrections and thereby directly improve the quality of life of these patients.

Monitoring changes in pregnancy can immensely help in preventing further complications (ocular and systemic) and aid in regaining proper visual function, which in turn can lead to better patient satisfaction and self-confidence. It will be a significant step forward, in the comprehensive management of the patient as well as spreading awareness for a healthy eye in pregnancy.

The most common physiological changes are alterations of cornea and thickness, decreased intraocular pressure, refractive errors, hence a

pregnant woman requires ophthalmologic examination as routine screening and further management of ocular complaints.

**Scope Of The Study:** - Only very few studies have been conducted in India. Monitoring these ocular parameters during pregnancy is essential for early detection for changes in pregnancy and assessment of prevalence of ocular changes during pregnancy as well as management of certain conditions like glaucoma during pregnancy.

#### **MATERIALS AND METHODS:**

This is a one - year prospective study. Randomly selected patients (21-35years) who have given an informed consent for the study will be included.

A pre-structured proforma is used to collect the baseline data, which includes:

1. Questionnaire for screening the pregnant women.
2. Investigation findings
3. Follow up in each trimester

Pregnant women aged between 21-35 years coming for antenatal checkup in Obstetrics and Gynecology OPD, during a period of 1 year between year 2014 -2015.

**Study Design:** Pregnant women of 1<sup>st</sup> trimester are randomly chosen who come for antenatal check up to the center.

Each pregnant woman is then evaluated for complete eye examination using the Visual acuity, Retinoscopy, Pachymetry (SONOMED), and Auto refraction, Applanation tonometer.

**Sample Size:-** 100 Antenatal patients (200 eyes: 21-35yrs) diagnosed with pregnancy without any co-morbid conditions and ocular pathology.

All the pregnant women between 21 to 35 years who were consenting for the study were included.

Patients with other co – morbidity and age less than 21 years and more than 35 years were not included.

**Data Collection Process:** - All pregnant women between the age group of 21-35 years satisfying the above criteria are evaluated and taken for the study with consent. Subjects were then followed in subsequent trimester of that pregnancy and similar parameters were recorded.

Pregnant women undergoing routine antenatal screening at the Obstetrics and Gynecology Clinic of our institution were prospectively enrolled in this study. We examined 100 consecutive pregnant women (200 eyes) with uncomplicated singleton pregnancies and with no history of any ocular diseases or systemic diseases, and no history of past ocular surgeries. They underwent concurrent ophthalmic examinations. Informed consent was obtained from each participant.

Pregnant women of 1<sup>st</sup> trimester are randomly chosen who come for ANC to ophthalmology OPD. Each pregnant woman was then evaluated for Visual acuity testing using Snellen's chart for distant vision and Jaeger's chart for near vision, Dry Retinoscopy, Auto-refraction, Corneal thickness using Pachymetry & IOP with Applanation tonometry & Fundus evaluation using 90D lens. Patients with any ocular pathology during the course of study was dropped from the study.

The participants were called prior to their scheduled appointment. Complete ophthalmologic examinations, including the recording of best-corrected visual acuity, refraction, anterior segment and fundus examinations (mydriatics), IOP and CCT measurements were repeated & performed every 3 months during pregnancy (beginning at the first 10 weeks of pregnancy) and in their subsequently one visit any time in each trimester. The right and left eyes were measured separately. All measurements were performed by the principal investigator in the following order: visual acuity,

auto refraction, ultrasound pachymetry, applanation tonometry and anterior segment, fundus evaluation. IOP was measured using the Carl Zeiss Goldman Applanation tonometer. The average of 3 consecutive readings in auto mode was used for the data analysis. Ultrasound pachymetry (sonomed, japan) was used for the CCT measurements. Repeated sets of 5 readings were taken at the center of the cornea after a drop of anesthetic was administered, until the standard deviation for the 5 readings was 5  $\mu\text{m}$  or less.

**Statistical Methods:** - Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean, SD and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance.

The following assumptions on data is made,

Assumptions: (1) Dependent variables should be normally distributed (2) Samples drawn from the population should be random.

**Statistical software:** - The Statistical software namely SPSS 17 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

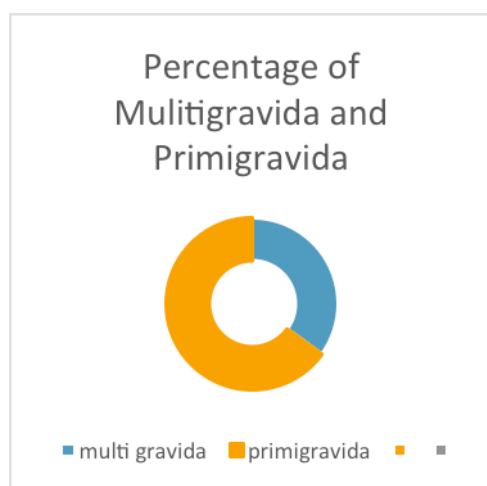
**Data analysis:** - Descriptive table was generated and appropriate statistical analysis was done using SPSS 17.0 ANOVA (Analysis of Variance) was applied to compare the CCT in different phases of pregnancy. A significance level of p value < 0.05 was considered for the ANOVA. The data were expressed as mean  $\pm$  standard deviation.

**Significant figures:**

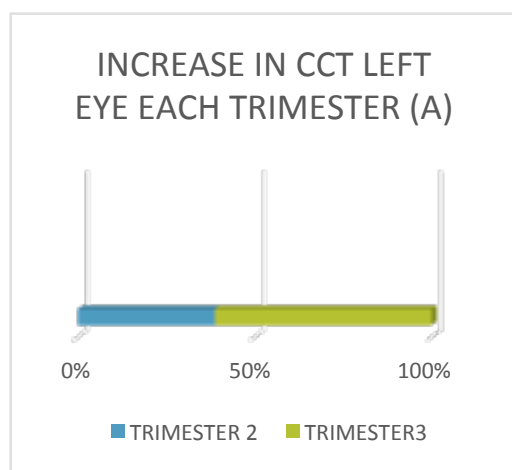
+ Suggestive significance (P value: 0.05 < P < 0.10)

\* Moderately significant (P value: < 0.01)

\*\* Strongly significant (P value: < 0.001)



**FIGURE LEGEND 1:** Percentage of multigravida and primigravida in the study



**Figure Legend 2: (A)** – [Increase in central corneal thickness (CCT) left eye in each trimester]

## RESULTS AND DISCUSSION:

The mean age was 25 years in the study group. (SD: 3.928) .65% were primigravida and 35% multigravida. The data collected were entered in the MS excel spread sheet. Descriptive table was generated and appropriate statistical analysis was done using SPSS17.0 ANOVA (Analysis of Variance) was applied to compare the CCT in different phases of pregnancy. A significance level of p value < 0.05 was considered for the ANOVA. The data were expressed as mean  $\pm$  standard deviation. Also IOP decreased in each trimester significantly.

Results suggests that a hormonal influence may be acting in corneal thickness changes .In our study we found that there was a significant increase in CCT in advanced pregnancy especially in the third trimester.

Atlas M,Duru N et al found that there is an increase in the anterior chamber parameters, corneal volume, corneal thickness, and corneal curvature and a decrease in intraocular pressure in the third trimester. A significant increase of 3.13% by third trimester in right eye & trimester & 3.03% in third trimester left eye in our study.

“The eye and visual system in pregnant eye. What to expect?” Khwala Abu Samra, also support that statistically significant increase in corneal changes is seen during second and third trimester which resolves with time.(1) . As per D. Pizzarello Louis et al, a significant change in the central corneal thickness and intraocular pressure was noted in pregnant women during their 2nd and 3d trimesters. (3, 4) Our study mean CCT in the second trimester of pregnancy was measured to be higher than first trimester by 1.67% & increase of 1.91% in second trimester left eye.

Similar findings supporting our study were noted by Efe, Yasemin Kozluca et al in which both IOP and CCT returned to first-trimester levels following delivery. In this study, third trimester, a increase in CCT was associated with a decrease in IOP. (5)

In our study , the mean IOPs in the second and third trimesters of pregnancy right eye were found to be lower than first trimester by 9.33% & 20.33% respectively & 14.2% & 28.84% left eye along with the above stated CCT parameters.

However in a study by Sen, Emine et al. The mean CCT value had no statistically significant differences were found between the 2 groups : pregnant and non-pregnant women, stating

hormonal changes during pregnancy may not affect corneal biomechanics. This may be due to the balanced effect of the various hormones on the cornea during pregnancy. (6)

An increase in CCT in advanced pregnancy should be routinely checked for all pregnant patients. Pregnancy induced changes can occur either first time during pregnancy or can be due to a preexisting co morbid condition, screening is essential to assess the physiological as well as pathological changes, which can also can worsen pre-existing conditions.”(7)

INCREASE IN CENTRAL CORNEAL THICKNESS IN RIGHT EYE IN EACH TRIMESTER

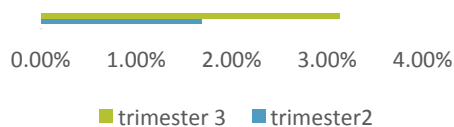


Figure Legend 2: (B) - [Increase in central corneal thickness (CCT) right eye in each trimester.

Trimester	Increase in CCT (%) Right eye	Increase in CCT (%)Left eye	Decrease in IOP (%) Right eye	Decrease in IOP (%) Left eye
Trimester 2	1.67%	1.91%	9.33%	14.2%
Trimester 3	3.13%	3.03%	20.33%	28.84%

Abbreviations: CCT: CENTRAL CORNEAL THICKNESS, IOP: INTRAOCULAR PRESSURE  
Table 1: Changes in Central Corneal Thickness and Intraocular pressure in each Trimester

GROUP	TRIMESTER	MEAN CCT VALUE (µm)	STANDARD DEVIATION	P VALUE*
RIGHT EYE	First trimester	535.59	41.59	P= 0.013
	Second trimester	544.69	39.92	P= 0.013
	Third trimester	552.82	41.29	P=0.013
LEFT EYE	First trimester	537.18	32.05	P<0.001
	Second trimester	547.66	29.57	P< 0.001
	Third trimester	553.99	31.57	P< 0.001

Table 2: CCT measurement in each Trimester

It has been reported that the number of pregnant women undergoing regular eye examinations is low. The majority of pregnant women referred to ophthalmologist are those with previously diagnosed high myopia. Ocular changes during pregnancy are specifically, rare to disturb the normal visual function and are transient in nature

(8) In our study the no significant refractive changes were noted. Most ocular changes in pregnancy are physiological and reversible. Nevertheless, it is advised that such changes should be registered and followed-up at least during pregnancy and in the post-partum period.

	Presentation	N	Mean	Std. Deviation	Std. Error Mean
CCTR1	Primigravida	65	531.8615	42.87113	5.31751
	Multigravida	35	542.5143	39.88319	6.74149
CCTR2	Primigravida	65	541.1692	40.49636	5.02296
	Multigravida	35	551.2286	38.56933	6.51941
CCTR3	Primigravida	65	549.1231	41.66290	5.16765
	Multigravida	35	559.6857	40.27974	6.80852
CCTL1	Primigravida	65	536.5077	31.69588	3.93139
	Multigravida	35	538.4286	33.13101	5.60016
CCTL2	Primigravida	65	547.5231	27.35936	3.39351
	Multigravida	35	547.9143	33.73458	5.70218
CCTL3	Primigravida	65	552.9385	30.51633	3.78508
	Multigravida	35	555.9429	33.81258	5.71537

*CCTR1: Central corneal thickness in right eye first trimester*

**Abbreviations**

*CCTR2: Central corneal thickness in right eye second trimester*

*CCTR3: Central corneal thickness in right eye third trimester*

*CCTL1: Central corneal thickness in left eye first trimester*

*CCTL2: Central corneal thickness in left eye second trimester*

*CCTL3: Central corneal thickness in left eye third trimester*

**TABLE 3: COMPARISON OF CCT BETWEEN MULTI PARA AND PRIMIGRAVIDA**

**Limitations:** Central corneal thickness & intraocular pressure for the post-partum period could not be checked due to difficulty of follow up of patients. However literature supports the resolution of the same after pregnancy. (2)

**CONCLUSION:**

Increase in corneal thickness observed in pregnant women may be the consequence of corneal edema resulting from increased water retention. Indication for refractive surgery in reproductive age group should be considered owing to the changes pregnancy causes in the eye. These changes are

usually reversible and resolved in the postpartum period or after cessation of breastfeeding

Also a reciprocal relation of reduction in IOP is also noted. Routine monitoring of these parameters will be helpful to manage glaucoma patients during pregnancy. Antenatal checkup & must involve ophthalmic examination as a part of screening tool for detecting the changes in eye during pregnancy.

**REFERENCES**

1. Khwala Abu Samra, The eye and visual system in pregnant eye. What to expect? An in-depth review, Oman J Ophthalmol 2013; 6:87-91

2. M. Gotovac et al.: Eye and Pregnancy, Coll. Antropol. 37 (2013) Suppl. 1: 189–193
3. D. Pizzarello Louis, Refractive changes in pregnancy, Graefe's Arch Clin Exp Ophthalmology.2003; 241:484-48
4. Ebeigbe. J.A, Ocular changes in pregnant Nigerian women, Niger J ClinPract\_ 2012: 298- 301
5. Efe, Yasemin Kozluca et al. "The course of corneal and intraocular pressure changes during pregnancy." Canadian journal of ophthalmology. Journal canadien d'ophtalmologie 47.2 (2012) : 150-4.
6. Sen, Emine et al. "Corneal biomechanical parameters during pregnancy."European Journal of Ophthalmology 24.3 (2013) : 314-319. Print.
7. Weinreb RN, Lu A, Beeson C.Maternal corneal thickness during pregnancy , - Am. J. Ophthalmol. - Mar 1988; 105(3); 258-60
8. Pilas-Pomykalska, Magdalena, Janusz Czajkowskii, and Przemyslaw Oszukowski. "Ocular changes during pregnancy." Ginekologia polska 76.8 (2005) : 655-660. Print.

**How to cite this article** – Swaminathan G.S, Sundaram L et al, Ranjakumar TC, Central Corneal Thickness (CCT) Measurement In Each Trimester Of Pregnancy: A Screening Parameter For A Healthy Eye During Pregnancy: A Prospective Study, IJRSMS, 2015;01(1): 19 - 25