

ANALYSIS OF CORNEAL THICKNESS ALTERATIONS DURING MENSTRUAL CYCLE IN REPRODUCTIVE AGE WOMEN: AN INSTITUTIONAL BASED STUDY

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Abstract

Background: Changes in corneal curvature, thickness, and sensitivity during the woman's menstrual cycle have been co-related to endocrine influences. The present study was conducted to evaluate corneal thickness alterations during menstrual cycle in reproductive age women. **Materials & Methods:** Ultrasonic pachymeter was used to determine the corneal thickness. Three measurements were made at each examination for both eyes, and the mean value recorded. The central corneal thickness was determined at the beginning of the cycle, within 24 h after the LH peak and at the end of the cycle. Paired t-test was used to compare the corneal thickness between different times. Probability values of less than 0.05 were considered statistically significant. **Results:** The mean values of the central corneal thickness at days 1 to 3 was 541.85 ± 11.72 and 542.41 ± 11.30 microns respectively for left and right eyes. At ovulation, the corneal thickness was 556.97 ± 7.25 and 557.02 ± 7.10 for left and right eyes. The mean values on days 27 to 32 were 536.46 ± 13.06 and 537.39 ± 12.85 microns for left and right eyes. **Conclusion:** The study concluded that the thickness of the cornea was maximum at the time of ovulation time and the thinnest at the end of the cycle and this helps at the time of corneal refractive surgery.

INTRODUCTION

Menstruation is governed by changes in the levels of ovarian estrogen and progesterone, which produce varying responses in diverse tissues and organs. The cyclic hormonal changes have a significant biological influence on the female body, both physical and emotional.¹ Gonadal hormone receptors have been observed in human ocular tissues such as the cornea, iris, ciliary body, lens, conjunctiva, and lacrimal and meibomian glands.² Physiological changes in the hormone milieu, oral contraceptive use, or hormonal replacement therapy³ can influence the management of glaucoma⁴ and dry eyes⁵ and are important in contact lens users as well.⁶ Corneal thickness consideration is an important aspect for lasik surgery and any change pre/post lasik will greatly affect the visual outcome of the surgery. As the thickness of cornea changes in the menstrual cycle, it becomes important factor in pre /post lasik surgery. These corneal changes may result in miscorrections and further ectasia. Corneal ectasia is the most dreaded potential side effect in corneal refractive surgery and results from predisposed factors such as irregular corneal thickness, different ablation rates, and ultrasound pachymetry errors. The analysis of a

pachymetry map and its relationship to corneal curvature patterns is critical to identify and provide additional data to alert the surgeon of a risk for ectasia.⁷ The present study was conducted to evaluate corneal thickness alterations during menstrual cycle in reproductive age women.

MATERIALS AND METHODS

The present study was conducted in Department of Ophthalmology, Sri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh (India) among 80 women of reproductive age i.e. between 21 to 43 years. Before the commencement of the study, ethical clearance was taken from the Ethical committee of the institute and informed consent was taken from the patients after explaining the study. All subjects had regular menstrual cycles of about 24 to 32 days; they had no refractive errors, no ophthalmic or hormonal diseases and diabetes were included in the study. In addition, the subjects who are using oral or parenteral contraceptive drugs excluded from study. Self-reported history of menstrual cycle by participants was documented. Participants were asked to contact us 3 times, on days 1 to 3 of the cycle and at ovulation time and on days 27 to 32 of the

cycle. For determining the time of ovulation, Luteinizing hormone (LH) ovulation prediction urine test was utilized. This test was done on days 11 to 15 of subjects' menstrual cycles. When the test became positive, (it meant that the LH peak occurred and it was ovulation time), patients underwent pachymetry within 24 h. To avoid the diurnal variation of the corneal thickness participants were checked at 10 am. Ultrasonic pachymeter was used to determine the corneal thickness (Echoscan US-4000, Nidek). Three measurements were made at each examination for both eyes, and the mean value recorded. The central corneal thickness was determined at the beginning of the cycle, within 24 h after the LH peak (ovulation) and at the end of the cycle. Paired t-test was used to compare the corneal thickness between different times. Independent-samples t-test utilized to compare

left and right eyes. Probability values of less than 0.05 were considered statistically significant. In processing the data, the difference among corneal thicknesses should also be evaluated by measures analysis of variance (ANOVA).

RESULTS

The mean values of the central corneal thickness at days 1 to 3 was 541.85 ± 11.72 and 542.41 ± 11.30 microns respectively for left and right eyes. At ovulation, the corneal thickness was 556.97 ± 7.25 and 557.02 ± 7.10 for left and right eyes. The mean values on days 27 to 32 were 536.46 ± 13.06 and 537.39 ± 12.85 microns for left and right eyes.

Table 1: Corneal thickness distribution for right and left eyes at different phases of menstrual cycle

	Right Eye Mean± SD microns	Left Eye Mean± SD microns
Days 1-3	541.85±11.72	542.41±11.30
Ovulation	557.02±7.10	556.97±7.25
Days 27-32	537.39±12.85	536.46±13.06

DISCUSSION

The effect of the menstrual cycle and fluctuating levels of hormones on the eye are multifold. They can affect the corneal hydration and tear film and thence, the corneal thickness.⁸ It is also associated with variations in the corneal biomechanics.⁹

The mean values of the central corneal thickness at days 1 to 3 was 541.85 ± 11.72 and 542.41 ± 11.30 microns respectively for left and right eyes. At ovulation, the corneal thickness was 556.97 ± 7.25 and 557.02 ± 7.10 for left and right eyes. The mean values on days 27 to 32 were 536.46 ± 13.06 and 537.39 ± 12.85 microns for left and right eyes.

Giuffre et al, in a study on 16 healthy women of reproductive age assessed central corneal thickness at 3 points, on days 1 to 3 and again at ovulation and at the end of the cycle (days 27-32). They found that the central cornea was thinnest at the beginning of the cycle (mean = 536 micron). Corneal thickness increased at ovulation (mean = 549 micron) and at the end of the cycle (mean = 559 micron). The difference in corneal thickness was statistically significant at ovulation ($P = 0.003$) and the end of cycle ($P = 0.001$) compared with values at the beginning of the cycle.¹⁰

Ghahfarokhi NA et al determine the change in corneal thickness through different phases of menstrual cycle in women who are in their productive age and found that in days 1 to 3 of menstruation, mean corneal thickness was 541.40 ± 11.36 and 540.82 ± 11.70 microns for left and right eyes respectively. At ovulation time the mean thickness changed to 556.50 ± 7.11 and 555.98 ± 7.26 microns for left and right eyes respectively, and at the end of the cycle, the corneal thickness turned in to 536.38 ± 12.83 and 535.48 ± 13.08 microns for left and

right eyes respectively. The difference of corneal thickness was statistically significant relating to the different stages of menstrual cycle.¹¹

Mishra D et al determine the changes in central corneal thickness (CCT) during the menstrual cycle in Indian women. The mean CCT of both eyes was $541.76 \pm 4.21 \mu\text{m}$, $559.21 \pm 4.50 \mu\text{m}$, and $544.52 \pm 8.06 \mu\text{m}$ at the beginning, mid, and end of cycle, respectively. The mean CCT of the right eye was $541.68 \pm 4.15 \mu\text{m}$, $559.08 \pm 4.50 \mu\text{m}$, and $544.44 \pm 8.06 \mu\text{m}$ and of the left eye was $541.84 \pm 4.27 \mu\text{m}$, $559.35 \pm 4.50 \mu\text{m}$, and $544.61 \pm 8.06 \mu\text{m}$ at the beginning, mid, and end of cycle, respectively. The study concluded that the CCT value was significantly ($P < 0.001$) higher during ovulation compared to the beginning and end of the menstrual cycle.¹²

CONCLUSION

The study concluded that the thickness of the cornea was maximum at the time of ovulation time and the thinnest at the end of the cycle and this helps at the time of corneal refractive surgery.

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