

## Original Research Article

# Evaluation of difference in central corneal thickness between premenopausal and postmenopausal women

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## ABSTRACT

**Background:** Menopause is defined as permanent cessation of menses. By convention the diagnosis of menopause is not made until the individual has had 12 months of amenorrhoea. It is a physiological condition, and associated with changes in levels of sex hormones. Certain changes occur in the corneal tissue due to change in these hormones. The current study intended to study any change in central corneal thickness among women after menopause. CCT can cause false readings in IOP measurements and affect the diagnosis and monitoring of glaucoma.

**Methods:** It is a prospective, cross sectional, observational, case control study conducted in Department of Ophthalmology, GMC, Jammu for a period of 6 months from October 2022 to March 2023. 54 eyes of 27 patients each for pre and postmenopausal women were taken. Central corneal thickness was measured using specular biomicroscopy.

**Results:** The mean age of post-menopausal women was found to be  $52 \pm 2$  years and pre-menopausal women was found to be  $48 \pm 3$ . The mean of group 1 was found to be  $524 \pm 18.67$  microns and the mean of group 2 was found to be  $558 \pm 20.83$  microns

**Conclusions:** The data presented in this study suggest that menopause cause decrease in central corneal thickness.

**Keywords:** Post menopausal women, Central corneal thickness, Pre menopausal women

## INTRODUCTION

Menopause is characterised by a persistent loss of follicular function, which results in a permanent stop of menstruation. If there is amenorrhoea for 12 consecutive months without a pathological or physiological cause, menopause is said to have happened.<sup>1</sup> As the women ages, number of primary ovarian follicles in ovary rapidly decreases leaving insufficient numbers to react to the effects of FSH. As a result, there is no LH surge and no ovulation. These changes lead to decrease in the level of estrogen and progesterone.<sup>2</sup> The change in the level of these hormones causes physiological changes in various organs, one of which is at the level of the cornea. It has been seen that there are estrogen receptor, progesterone

receptor (PR) and androgen receptor (AR) in the nuclei of human corneal epithelial, stromal and endothelial cells.<sup>3</sup> So, decrease in the level of estrogen and progesterone bring about change in the cornea in post-menopausal women. Changes that are seen in cornea of postmenopausal women include decrease in level of tear film, changes in the corneal curvature that is steepening of central curvatures in both horizontal and vertical meridians, decrease in central corneal thickness.<sup>4-6</sup> Fluctuation in the central corneal thickness is also seen to occur during different phases of menstrual cycle, showing the correlation between female hormones level and the central corneal thickness. Studies have found that in mid cycle that is day 15 and 16, the percentage rise in thickness was 5.6%.<sup>7</sup> The accuracy of intraocular pressure

measurements can be impacted by changes in CCT, which could result in incorrect glaucoma patient diagnosis or therapy. Changes in CCT may also affect the results of corneal refractive procedures like LASIK and increases the progression of ectasias.<sup>8</sup> So, this study is designed to compare central corneal thickness in pre and postmenopausal women.

**METHODS**

It is a prospective, cross sectional observational, case control study conducted in Department of ophthalmology, GMC, Jammu for a period of 6 months from October 2022 to March 2023. 54 eyes of 27 patients each for premenopausal (Group 1) and postmenopausal women (Group 2) were taken. Written informed consent was taken of all the patients

**Sample size**

Minimum sample size of 27 per group was calculated on basis of mean and standard deviation from previous study  $\alpha=0.05$ ,  $\beta=0.2$  using openepi software.

**Inclusion criteria**

Inclusion criteria were; Group 1: Women who have attained menopause (i.e., women who did not menstruate for the last 12 consecutive months) of age group 40-60 years. Group 2: Healthy women who have not attained menopause (control group) in reproductive age group ranging from 40-60 years of age.

**Exclusion criteria**

Exclusion criteria were; Group 1: Women with ocular disease, Women on HRT (hormonal influence on CCT), Women with systemic diseases. Group 2: Pregnancy, Recent history of childbirth/abortion, Women on oral contraceptive pills, Women with irregular periods or polycystic ovarian disease, Women with any systemic diseases, Women with any ocular disease.

Detailed past medical, ocular and surgical histories and personal history of all patients were recorded. On examination complete general physical examination was carried out. Ocular examination will include visual acuity (uncorrected and best corrected) using Snellen’s chart, anterior segment examination by slit lamp biomicroscopy and IOP was measured using non-contact tonometry. Central corneal thickness was measured using Topcon SP-1P (Figure 1-2).

**Statistical analysis**

The mean central corneal thickness of both the groups was measured and compared using unpaired t-test,  $p<0.05$  was considered statistically significant.

**RESULTS**

The mean age of post-menopausal women was found to be  $52\pm 2$  years and pre-menopausal women was found to be  $48\pm 3$ .

**Table 1: Mean and standard deviation of two groups.**

Groups	N	Mean	SD
Group 1	54 eyes	524	18.67
Group 2	54 eyes	558	20.83

The mean of group 1 was found to be  $524\pm 18.67$  microns and the mean of group 2 was found to  $558\pm 20.83$  microns (Table 1). In Group 1, 1 woman is in the age group 44-46, 4 women in age group 47-49, 11 in age group 50-52, 8 in age group 53-55, 3 in age group  $>55$  (Table 2).

**Table 2: Age distribution of women in group 1.**

Age in group 1 (years)	N
40-43	0
44-46	1
47-49	4
50-52	11
53-55	8
$>55$	3

**Table 3: Age distribution of women in group 2.**

Age in group 2 (years)	N
40-43	2
44-46	6
47-49	11
50-52	7
53-55	1
$>55$	0

**Table 4: Demographic distribution.**

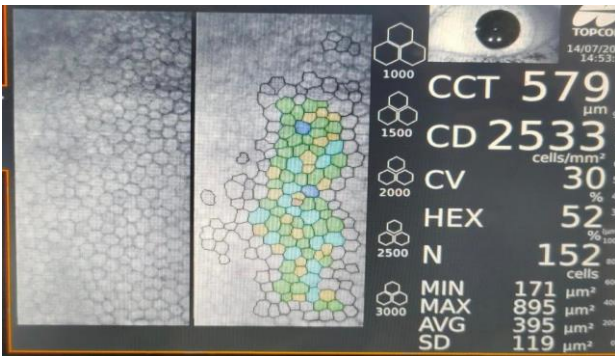
Residence	Group 1, N (%)	Group 2, N (%)
Urban	14 (51.85)	15 (55.5)
Rural	13 (48.14)	12 (44.4)

In Group 2, 2 women are in age group 40-43, 6 woman is in the age group 44-46, 11 women in age group 47-49, 7 in age group 50-52, 1 in age group 53-55 (Table 3). Group 1 had 13 (48.14%) women belonging to rural areas and 14 (51.85%) women belong to urban areas while in Group 2 had 15 (55.5%) belong to urban area and 12 (44.4%) belong to rural area (Table 4). In group 1, 1 (1.85%) eye had CCT between 500-509 microns, 15 (27.77%) had between 510-519, 22 (40.74%) between 520-529, 12 (22.22%) in range of 530-539, 4 (7.4%) between 540-549, 1 (1.85%) in between 550-559. In group 2, 2 (3.7%) had CCT in range of 510-519, 2 (3.7%) between 520-529, 5 (9.25%) between 530-539, 10 (18.51%) between 540-549, 12 (22.22%) between 550-559, 12 (22.22%) in range of

560-569, 11 (20.37%) in between 570-579 (Table 5, Figure 3).

**Table 5: Comparison of central corneal thickness among two groups.**

Central corneal thickness in microns	Group 1 (post-menopausal women)	Group 2 (pre-menopausal women)
500-509	1	0
510-519	15	2
520-529	22	2
530-539	12	5
540-549	4	10
550-559	1	12
560-569	0	12
570-579	0	11



**Figure 1: Central corneal thickness using specular biomicroscopy.**

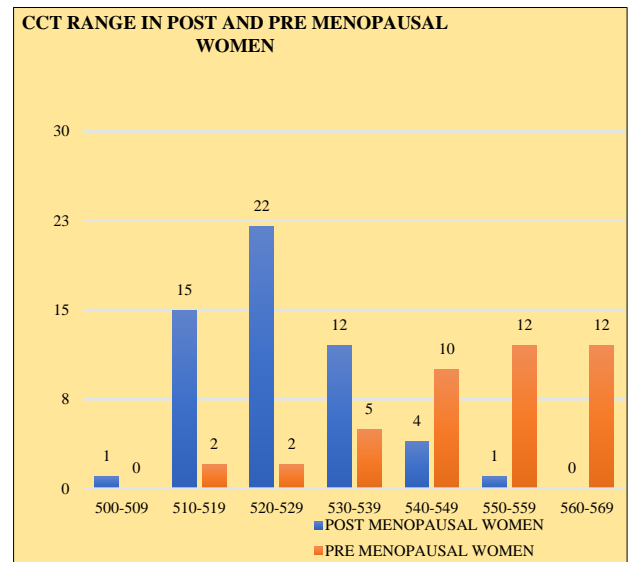


**Figure 2: Central corneal thickness using specular biomicroscopy.**

**DISCUSSION**

The results of this study show that postmenopausal women had significantly lower central corneal thickness (CCT) than premenopausal women. These findings offer important information on the possible effects of menopause on corneal health. Menopause-related hormonal changes may be the reason for the reported decline in CCT in postmenopausal women. Estrogen, a

hormone whose levels sharply drop during menopause, is essential for preserving tissue hydration and integrity. The discovery of estrogen receptors in the corneal stroma and epithelium<sup>(9)</sup> raises the possibility that hormones directly affect the condition of the cornea. Reduced estrogen levels may influence the metabolic processes necessary to maintain corneal thickness and change the hydration of the cornea. As a result, the lower estrogen levels found in postmenopausal women may have led to the thinner CCT found in this study.



**Figure 3: Comparison of central corneal thickness among two groups.**

Correct estimation of central corneal thickness is important. Increase in CCT leads to overestimation while decrease in CCT leads to underestimation of IOP.<sup>(10)</sup> This leads to errors in diagnosing and treating glaucoma patients. Measurement of central corneal thickness is also essential during refractive surgeries. It is important to have knowledge about variation in central corneal thickness during different phases of menstrual cycle and make necessary adjustments.<sup>11</sup> Also, cases have been reported with progression of ectasia with the changes in the level of estrogen and progesterone which can be linked to decrease central corneal thickness.<sup>12</sup>

Keskin et al conducted a study to evaluate central corneal thickness (CCT) differences between women in the premenopausal and postmenopausal period and found that there was significant decrease in the CCT in postmenopausal women and there is a linear correlation in the level of estrogen and CCT.<sup>13</sup> Sharma et al compared the central corneal thickness in 30 post-menopausal women with the women in reproductive age group and showed that postmenopausal women have significantly thinner CCT as compared to women in reproductive age group (534.50±12.13 microns, 558.18±9.15 microns respectively).<sup>14</sup> Ghahfarokhi et al evaluated CCT alterations during menstrual cycle. They concluded that during menstrual cycle thickest cornea is achieved at the

ovulation time and the thinnest at the end of the end of cycle which is consistent with raised estrogen during mid cycle.<sup>15</sup> Birgul et al conducted a study to find the changes in eye in pre and postmenopausal women and found no difference in CCT in the two groups.<sup>16</sup> Even though our study offers important proof that postmenopausal women have lower CCT, there are several limitations. The sample size was low to detect minute differences or take into account possible subgroup variation. The results would be validated by larger, more diverse research in the future, which would also assist to identify variation among different subgroups. Furthermore, the study's cross-sectional design made it difficult to determine if menopause and CCT alterations are related causally. More solid proof of the temporal relationship between menopause and CCT modifications would come from longitudinal studies which monitor women through the menopausal transition.

## CONCLUSION

In conclusion, this study adds to our knowledge on postmenopausal women's corneal health. The results point to a strong correlation between menopause and lowered CCT. In order to fully understand the clinical significance of these alterations, future research is needed to the underlying mechanisms and solve the observed shortcomings.

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