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Original Research Article

Effect of oral contraceptive pill on central corneal thickness and intraocular pressure in young females

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ABSTRACT

Background: The usage of oral contraceptive pills (OCP) consisting of estrogen and progesterone can interfere with central corneal thickness (CCT) results due to hormonal fluctuations. This study assessed the impact of oral contraceptive pill usage on central corneal thickness estimations in healthy young women.
Methods: This prospective study comprised forty women utilizing OCP for contraception (group 1) and forty control subjects utilizing OCP (group 2). All participants revealed no history of systemic or ocular medical conditions. CCT measurements were acquired using an ultrasonic pachymeter, and intraocular pressure (IOP) readings were evaluated with a noncontact tonometer during a patient's hospital visit. Demographic information and body mass index (BMI) scores of participants were documented.
Results: The mean ages were 28.5±6.08 for OCP+ patients (group 1) and 28.3±5.85 for OCP- patients (group 2) (P=0.88). The mean central corneal thickness (CCT) in group 1 was substantially higher than in group 2, with measurements of 575±39.4 µm and 518±28.8 µm, respectively (p=0.001). The average intraocular pressure (IOP) was 15.6±1.52 mmHg in group 1 and 15.1±1.14 mmHg in group 2 (p=0.16). The mean BMI values were 28.5±6.08 kg/m² for group 1 and 28.3±5.85 kg/m² for group 2 (p=0.91).
Conclusions: Our data suggested that CCT values were significantly elevated in patients utilizing OCP. Ophthalmologists must acknowledge the potential for increased CCT in these individuals.

Keywords: Central corneal thickness, Intraocular pressure, Oral contraceptive pills, Young women

INTRODUCTION

The evaluation of central corneal thickness (CCT) is essential for the diagnosis and management of numerous ocular disorders, such as glaucoma, keratoconus, refractive surgery, and the observation of corneal alterations after prolonged contact lens usage.[1,2]

The use of oral contraceptive pills (OCPs) is common during reproductive years. Nearly all women employ contraception at some point in their lives.[3] The primary contraceptive method employed by women in India is the OCP, representing 16.0%, although over 38% of these women are not utilizing any type of contraception at present. Gonadotropin hormones may affect corneal disorders, and central corneal thickness may be influenced by female hormones. Multiple research studies and case reports demonstrate the prevalence of diverse ocular diseases in women using oral contraceptives.[4]

The impact of ovarian and gonadotropin hormones on corneal biomechanics is unclear. There is an absence of commonly acknowledged information concerning this topic.

This study investigates the correlation between OCP usage and subsequent alterations in CCT associated with ocular diseases that may be alleviated.

Body mass index (BMI) measures body fat in humans by linking height to weight. A multitude of studies have established the correlation between BMI and both ocular and systemic variables.[5,6] A correlation was seen between raised BMI, increased corneal thickness, and increasing intraocular pressure (IOP).[5,6] Thus, we computed and contrasted the subjects' BMI.

METHODS

Study design

The study was prospective observational study.

Study setting

Study conducted by the Department of Pharmacology in collaboration with the Gynaecology and Ophthalmology Department at the New Civil Hospital, Surat, Gujarat.

Study duration

The study duration was January 2023 to January 2024.

We enrolled 40 young women utilizing oral contraceptive pills who were consecutively referred to our ophthalmology department from the gynaecology department of our hospital to investigate the effects of oral contraceptive use on central corneal thickness and to conduct a routine ocular examination (group 1). 40 healthy controls not utilizing oral contraceptive pills were also evaluated (group 2).

Inclusion criteria

Inclusion criteria involved adult female patients currently utilizing oral contraceptive pills (3 mg levonorgestrel + 0.03 mg ethinylestradiol) for at least the preceding 3 months (group 1), adult female patients who have never utilized any kind of hormonal birth control throughout their lifetime (group 2), and all participants had no systemic illness in this prospective clinical study.

Exclusion criteria

Exclusion criteria involved adult female patients who were pregnant or lactating at the time of their hospital visit to mitigate any impacts on CCT, adult female patients with a prior history of dry eye, glaucoma, keratitis, uveitis, systemic or topical corticosteroid administration, ocular surgery or trauma, corneal irregularities such as scarring, dystrophies, microcornea, keratoconus, keratoglobus, contact lens usage, corneal injury, topical medication application, and significant spherical (>−6.0D or >+3D) or cylindrical (>±1.50D) refractive errors to mitigate the potential influence of these conditions on CCT.

All participants exhibited normal menstrual cycles ranging from 21 to 35 days in duration. The date of the last menstrual period was recorded. The BMI scores of patients were assessed to determine if there were any significant differences between the groups. The body mass index (BMI) was computed using the formula given.

$$BMI = Weight/height^2\ [kg/m^2]$$

A BMI ranging from 19 to 24.9 kg/m² is classified as normal.[7]

Each participant had a comprehensive ophthalmologic evaluation, which included best-corrected Snellen visual acuity assessment, biomicroscopic examination of the anterior segment and fundus, and intraocular pressure measurement using a noncontact tonometer. Three successive intraocular pressure measurements were obtained for each eye, and the average value was documented. The ultrasonic pachymeter was employed to assess CCT. Following the application of topical proparacaine hydrochloride 0.5%, measurements were conducted using the probe tip aimed at the centre of the pupil and perpendicular to the cornea, while the participant focused on a stationary object. The probe was disinfected with alcohol following the examination of each subject. A minimum of five consecutive measurements was taken for each eye, and the average value was documented.

All CCT and IOP measurements were conducted by the same experienced physician throughout the same time frame (10:00 am–12:00 pm) and within the same phase of the menstrual cycle (luteal phase) for the women.

We have recorded the dates of the last menstrual periods of the subjects. The luteal phase can be confirmed based on the date of the last menstrual period and a gynaecological consultation.

Ethical approval

This study was approved by the Institutional Ethics Committee of the Government Medical College and New Civil Hospital, Surat. Informed consent was obtained from all participants following an explanation of study and the provision of participant inform sheet (PIS).

Statistical analysis

Statistical analysis was carried out using Jamovi version 2.3.18. At first, we conducted a power analysis for our study (α=0.05, power of the test=0.80). The calculated sample size was eighty patients.

Quantitative variables were presented as mean±standard deviation for continuous variables and as median with minimum-maximum values or percentages for categorical/string variables.

The independent samples t-test was utilized to compare continuous results between two groups. Statistical significance was established at $p<0.05$.

RESULTS

The mean ages were 28.5±6.08 for OCP + patients (group 1) and 28.3±5.85 for OCP-patients (group 2) (p=0.88) (Figure 1).

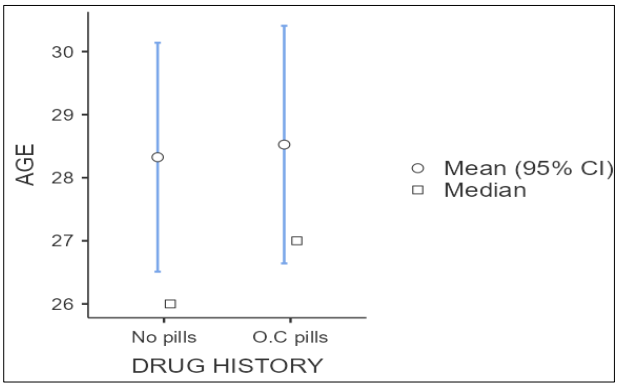

Figure 1: Comparison of age between the groups.

The mean duration for OCP use in group 1 was 15.8 months (3–28 months). The optimal corrected visual acuities of all patients in both groups were 0.0 LogMAR. The mean CCT values were substantially greater in group 1 compared to group 2 (575±39.4 µm against 518±28.8 µm, respectively) (p=0.001) (Figure 2).

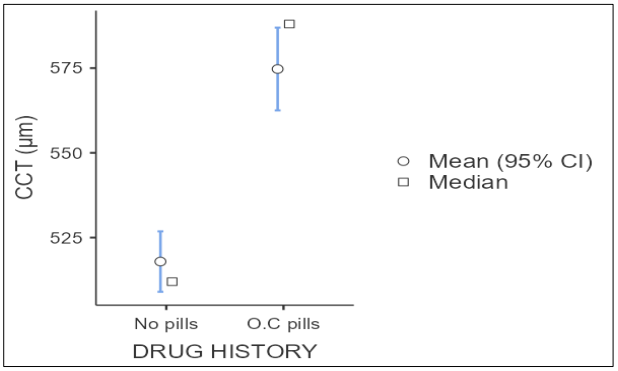

Figure 2: Comparison of central corneal thickness levels between the groups.

The mean IOP value was 15.6±1.52 mmHg in group 1 and 15.1±1.14 mmHg in group 2. No substantial difference existed between the two groups regarding mean IOP values (p=0.16) (Figure 3).

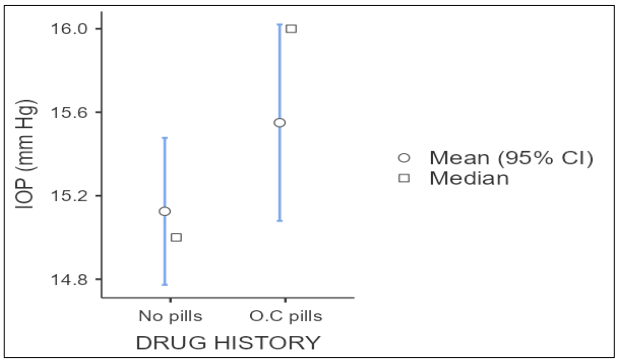

Figure 3: Comparison of intraocular pressure between the groups.

The average BMI scores were 28.5±6.08 kg/m^2 in group 1 and 28.3±5.85 kg/m^2 in group 2. The disparity between the two groups was not statistically significant (p=0.91) (Figure 4).

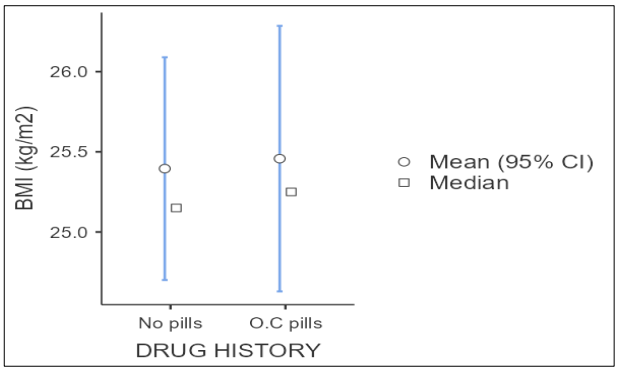

Figure 4: Comparison of body mass index between the groups.

The demographic and clinical information are presented in Table 1.

Table 1: Demographic features and clinical measurements of study subjects.

Demographic	OC pills + group (n=40)	OC pills – group (n=40)	P value
Age, years (minimum-maximum)	28.5±6.08 (21 – 40)	28.3±5.85 (21 – 40)	0.88
CCT, µm (minimum-maximum)	575±39.4 (488 – 630)	518±28.8 (478 – 582)	0.001
IOP, mmHg (minimum-maximum)	15.6±1.52 (14 – 18)	15.1±1.14 (14 – 18)	0.16
BMI, kg/m^2 (minimum-maximum)	28.5±6.08 (21.4 – 29.7)	28.3±5.85 (21.4 – 31.1)	0.91

DISCUSSION

This study found that CCT values were markedly elevated in patients utilizing OCP.

There is an increase in the utilization of oral contraceptive pills among females of reproductive age, as well as their extended application in controlling menstrual periods for patients. Numerous studies and case reports have indicated the incidence of various ocular illnesses, including retinal vascular lesions, in women utilizing OCP.[4] Sex hormones seem to affect both the anatomical and functional characteristics of the anterior and posterior components of the eye.[4]

CCT and IOP are variable parameters. Ocular and systemic variables are recognized to affect CCT and intraocular pressure (IOP). This study examined the effect of OCP usage on these parameters. CCT significantly influences the precise measurement of IOP, the crucial parameter in glaucoma diagnosis and treatment.

The measurement of CCT assists the ophthalmologist in achieving an accurate diagnosis for improved management of glaucoma and individuals at risk for the condition. Reduced CCT and increased IOP have been suggested as prognostic indicators for the onset and advancement of glaucoma.[8]

CCT seems to rise during ovulation and toward the conclusion of the menstrual cycle, both of which transpire following the peak of oestrogen levels. Giuffrè et al noted that CCT varies throughout the menstrual cycle, being minimal at the period's onset and maximal at its conclusion.[9] These alterations may be attributable to hormonal impacts; oestrogen receptors are present in human corneas, indicating that oestrogen may play a role in corneal physiology. In a separate study, Sony indicated that the cornea appeared thickest either at the onset or conclusion of the menstrual cycle due to fluctuations in ovarian and gonadotropin hormones.[10]

Numerous studies have reported the impact of BMI on IOP. The BMI showed a substantial positive connection with IOP.[11] Stojanov et al demonstrated that obese individuals had considerably elevated intraocular pressure compared to individuals of normal weight. Mori et al identified increased intraocular pressure in individuals with a body mass index exceeding 25 in Japan.[12,13] Pérez et al proposed that increased IOP correlates with obesity. The correlation among elevated BMI, increased corneal thickness, and high intraocular pressure was also noted. In this investigation, BMI scores did not exhibit significant differences between the groups.

Numerous studies exist about hormonal alterations during pregnancy and their impact on corneal biomechanics. The balanced influence of several hormones on the cornea during pregnancy may not alter corneal biomechanics.[14] Moreover, hormone replacement therapy and prolonged exposure to oestrogen and progesterone appear to have no impact on IOP or the likelihood of elevated IOP.[15] Another study highlighted the preventive role of female hormones in women with primary open-angle glaucoma (POAG).[16]

Various hypotheses exist about intraocular pressure during pregnancy. A minor reduction in IOP was observed alongside an enhanced outflow of aqueous humor from the anterior chamber, correlated with progesterone during pregnancy.[17] The ciliary processes and aqueous outflow channels are responsive to hormonal modulation.[18] Corneal scleral stiffness diminishes due to physiological relaxation during pregnancy, which may also contribute to the reduction in IOP.[19] Efe et al indicated that an elevation in CCT was associated with a reduction in IOP during the second and third trimesters of gestation.[20]

The length of oral contraceptive pill usage is a significant determinant in predicting glaucoma. Prolonged usage of oral contraceptive pills for five years or more was linked to a slight elevation in the incidence of primary open-angle glaucoma.[21] The average duration of oral contraceptive pill usage among our subjects was less than five years.

The use of oral contraceptives does not seem to elevate the risk of ocular conditions such as conjunctivitis, keratitis, iritis, lacrimal disorders, strabismus, cataracts, glaucoma, or retinal detachment, with the potential exception of retinal vascular lesions. There is no reliable evidence indicating a significant rise in the risk of ocular disorders among patients utilizing oral contraceptive pills. Chen et al investigated the correlation between oral contraceptive pill usage, contact lens wear, and the manifestations of dry eye in healthy young women.[22] Tear osmolarity was unaffected by oral contraceptive pills in their investigation.

Nonetheless, the utilization of oral contraceptive pills was identified as a risk factor for retinal vascular occlusion in patients undergoing in-vitro fertilization.[23] Orlin et al demonstrated bilateral corneal copper accumulation resulting from the use of oral contraceptives.[24] Regular hormonal fluctuations during gestation may significantly affect the course of keratoconus. Nonetheless, these alterations are ephemeral and entirely reversible.

Limitations

We have not conducted serum hormone testing to verify the levels of oestrogen and progesterone. Measurements were conducted during the luteal phase of the patients. We were unable to compare the data between the follicular and luteal phases. This may warrant more investigation.

CONCLUSION

The observed difference in corneal thickness values among young women may be attributed to ovarian and gonadotropin hormones. This study recommends the introduction of CCT measurement as an integral component of ocular examinations in women utilizing OCP, particularly during IOP assessments, when considering refractive surgery, contact lens application, or monitoring for glaucoma and keratoconus. Consequently, ophthalmologists must recognize the potentially increased CCT values in patients utilizing OCP.

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