# Central Corneal Thickness in Mentally Challenged (MC) Children

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**Abstract:** *Purpose*: A case-control study to assess central corneal thickness (CCT) values in mentally challenged (MC) children.

*Participants and Methods*: Children with mental disability were enrolled in the study. Age-matched and healthy control subjects from a similar ethnic background were enrolled in the study. Central corneal thickness was measured by ultrasound pachymetry. Six consecutive measurements were made at the center of the cornea of each eye. Only the right eye of each child in each group was included in the statistical analysis.

*Results*: Twenty-seven children in the MC group (14 boys and 13 girls) and 34 age-matched and healthy control subjects (23 boys and 11girls) were enrolled in the study. The mean age was 9.74 ± 2.697 years (range 7- 17years). The mean age in control group was 10.2 ± 2.185 years (range, 8-17 years). In the MC group, mean CCT value was 505.76 ± 31.23 mm in the right eye. In the control group, mean CCT value was 528.59 ± 30.35 mm in the right eye. CCT value in the MC group was significantly lesser than in the control group for right eye (P =0.006).

*Conclusions*: Mentally challenged (MC) children had a decreased central corneal thickness compared with healthy control subjects. CCT should be kept in mind during measurements of intraocular pressure (IOP) in MC children with because decreased central corneal thickness may give an artificially low intraocular pressure measurement by applanation tonometry.

**Keywords:** Mentally challenged, central corneal thickness, pachymetry.

People with intellectual disabilities (ID) or mentally challenged (MC) children are more prone for ocular abnormalities than general population [1,2]. In addition to higher risks for visual impairment or blindness, higher prevalences of refractive errors, cataract, strabismus, keratoconus, and optic atrophy have been reported for MC people or children with Down's syndrome [1,2].

Central corneal thickness is an important parameter to evaluate corneal barrier and endothelial pump function [3]. Accurate measurement of CCT is useful in the diagnosis of corneal diseases [4]. It is must before keratorefractive surgery and contact lens prescription [5]. Measurement of central corneal thickness is now recognized to be important in the evaluation of patients with ocular hypertension, normal tension glaucoma or glaucoma [6,7].

CCT is affected by age, race, sex, presence of glaucoma, diurnal changes, refractive error, genetic influences, diabetes, and intraocular pressure [8]. Pediatric central and paracentral corneal thickness increase slowly over time and reach adult thickness at 5 to 9 years of age [9].

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We performed a study to determine whether CCT measurements in a group of MC children were different from those in healthy controls.

## MATERIALS AND METHODS

Twenty children (14 male and 13 female) who were selected randomly from mentally challenged children, from a child development and rehabilitation center attached to our organization and were included in the study. The degree of mental disability ranged from mild to severe. Their mean age was 9.74 ± 2.7 years (range, 7 to 17years). The control group was made up of 34 age- and sex-matched healthy individuals (23 men and 11 women) with normal intellectual capacity and without any systemic or intraocular pathology (mean age 10.2 ± 2.2 years; range, 8-17 years).

All participants were similar in ethnic background. Two groups were evaluated in the same manner. Written informed consent to undergo all measurements was obtained for each child in each group.

Each participant underwent, a full ophthalmologic examination including refraction, external eye examination, a slit-lamp examination, and evaluation of posterior segments. People with a history of corneal disease such as keratoconus, dystrophies, scar, surgical incision, contact lens wear, or who were

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currently using topical medication were not included in the study [10]. Among excluded, three children had micro cornea, one was pseudophakic and one was uncooperative for pachymetry examination.

All participants included this study were examined at the same time of day (4.00-6.00 PM) and at the same constant room temperature in our hospital and had been awake for at least 2 hours before the measurements [11].

CCT was obtained with an ultrasonic pachymetry system (Quantum medical ultrasonic pachymeter, France). Calibration was performed according to the recommendations. The cornea was anesthetized with one drop of topical proparacaine hydrochloride 0.5 %. (Paracaine eye drops, Sunways India).

Ultrasonic pachymetry is a highly reliable and reproducible technique of measuring cenral corneal thickness. The intraclass correlation coefficient range of intra observer and interobserver measurement in study by Miligor *et al.* [12] was found to be 0.95-0.97 and 0.89 and 0.95 respectively. The expected variability with this was found to be less than +/- 1% and +/- 2% respectively.

While the child was sitting, measurements were taken as the tip of the probe was targeted to the center of the undilated pupil and was perpendicular to the cornea. This was confirmed by a beep produced by the instrument. Each child was asked to blink before central corneal thickness measurements to avoid any bias because of corneal drying. The probe was sterilized with alcohol after each participant was examined.

Six consecutive measurements were made at the center of the cornea of each eye, and the mean value was calculated. Pachymetry measurements can be significantly influenced by probe placement and observer bias is possible. Therefore, all measurements were performed by the same examiner masked to the numeric data and only right eye of each child was used for statistical analysis.

### Statistics

The results were expressed as mean ± Standard deviation (SD) and were analyzed statistically by two sample t test with unequal variance. P value less than 0.05 was considered statistically significant. Mean difference was found for 95% confidence interval. Pearson's correlation coefficient was found for correlation between the IQ and the central corneal thickness.

## RESULTS

In study group out of 27 individuals, 14 (51.85%) were male and 13 (48.14%) female. The mean age was 9.74 ± 2.697 years (range, 7 - 17years). Two were twin with identical CCT measurements. In the control group, 23 (67.64%) were male and 11 (32.35%) were female with normal intellectual capacity and without any systemic or intraocular pathology. The mean age was 10.2 ± 2.185 years (range, 8-17 years).

Refractive error (objective) in MC group ranged from +0.5 to +1.5 Dsph in hypermetropes and -0.5 to -4.0 D sph in myopes and 0.25 to 1.25 Dcyl. Cataract was present in 1(1.89%), abnormal cupping in 2(3.78%), peripapillary atrophy in 1(1.89%) out of 53 eyes examined of 27 children. CCT corrected IOP was within reference range in patients with abnormal cupping. In control group 19 (55.88%) out of 34 had refractive error ranges from +0.5 to +1.0 D sph in hyperopes and -0.5 to -5.5 D sph in myopes and 0.25 to 1.25 D cyl in astigmatic children.

In the MC group, mean CCT value was 505.76 ± 31.23 mm in the right eye. In the control group, mean CCT value was 528.59 ± 30.35 mm in the right eye (range 450-580 mm). CCT value in the MC group was significantly lesser than in the control group for right eye (P =0.006). Central corneal thickness values were below 500 mm in both the eyes in 11 (40.74%) and in 1 (3.70%) of the 27 MC children. While only 3 (8.82%) controls had central corneal thickness measurements less than 500 mm in both eyes.

The confidence interval of 95 % shows the CCT was interval of 95% the CCT in MC children was

**Table 1: CCT Values in the Study and Control Groups**

| | | Number | Mean (µm) | Std. deviation | Std. Error Mean | Minimum values | Maximum values |
|---|---|---|---|---|---|---|---|
| Right eye Central Corneal Thickness | MC (Case) | 27 | 505.76 | 31.23 | 6.13 | 450 | 580 |
| | Normal (control) | 34 | 528.59 | 30.35 | 5.21 | 455 | 618 |

493.41 to 518.11 microns and for normal children it was 518 to 539.48 microns. The p value was 0.005 and was significant. Mean difference was found to be 22.83 microns and at 95% confidence interval was 6.97 microns to 38.69 microns.

Correlation of IQ with CCT was done by Pearson's correlation coefficient and was found to be negative that is -0.103 which is suggestive that the two data are independent of each other.

Individual CCT values for the study and control groups are shown in Table **1**.

## DISCUSSION

CCT is different for each person and changes from race, ethinicity and individuals. It is not related with other ocular dimensions like axial length, corneal diameter etc. [13]. It has a strong relationship with IOP and risk of glaucoma [7,8,14].

The accuracy of the Goldmann applanation tonometer is affected by corneal rigidity which is actually cornea's capacity to change in response to pressure. If corneal thickness is abnormal or the cornea has abnormal rigidity, IOP measurements become less accurate and less reliable [15].

Though the reports that the average CCT in normal children is similar to that of adults [16,17], the reports on central corneal thickness in children with mental disabilities is contrasting and conflicting. Everekliogl*u et al.* [4] in their work demonstrated that normal controls had thicker corneas centrally than children with Down syndrome. The authors hypothesized that the abnormality in collagen metabolism in patients with Down's syndrome may be the reason for higher prevalence of keratoconus and reduced CCT in such cases. Remzi *et al.* reported contrasting findings of higher CCT values in adult MC individuals [17]. The authors have not elaborated or reasoned as to why the individuals with MC should have a higher CCT. However, the two studies were done on different age group population. The mean age in Everekliogl*u et al.* [4] study was 9.28 ± 3.47 years whereas in Remzi *et al.* [18] study was 36.9 +/- 8.7 years. It is known that pediatric central and paracentral corneal thicknesses increase slowly over time and reach adult thicknesses at 5 to 9 years of age [9].

In conclusion, we found CCT to be lesser in children with mental disabilities than in normal controls. CCT should therefore be kept in mind during measurements of IOP in children with mental disabilities, because their corneas may be thinner than those in the general population. If corrected IOP measurements are used one may detect glaucoma early and prevent optic nerve damage by intervening at appropriate stage. It is also important before keratorefractive surgery. The cause of thinning of cornea in children with mental disabilities needs further research and investigation.

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