

Central Corneal Thickness (CCT) and its Association with Ocular Parameters in a Large Central European Population Results from the Gutenberg Health Study

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Purpose

To evaluate the gender- and age-related distribution of CCT in a large German sample and to analyze its relationship with intraocular pressure (IOP) and further ocular factors.

Material & Methods

Gutenberg Health Study:

- Population-based, prospective, observational single-center study in the Rhein-Main-Region in western Mid-Germany with a total of approximately 15000 participants.
- 5000 participants (2540 male, 2460 female) were included in this analysis, age 35 to 74 years at enrollment.
- All participants underwent a complete ophthalmological examination: slitlamp biomicroscopy, non-contact IOP and CCT measurements (optical pachymetry), fundus examination, fundus photography, visual field testing (Matrix-FDT).

Results

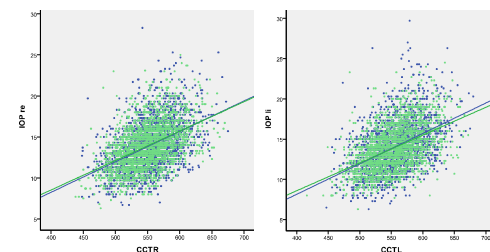
Mean CCT was $556.5 \pm 34.2 \mu\text{m}$ (male) and $551.8 \pm 35.3 \mu\text{m}$ for female subjects, respectively. Younger participants (35-44 years) had thicker CCT compared to older age decades. IOP was significantly associated with CCT. A $10 \mu\text{m}$ increase of CCT corresponded to an increase in IOP between 0.35-0.38 mmHg, depending on eye and gender. Multivariate linear regression analysis revealed significant associations between gender, spherical equivalent and CCT ($p < 0.0001$, and $p = 0.03$).

Table 1: Description of the study population and prevalence of selected eye parameters, stratified by gender

| Number, % (N) | Population men 50.8 (2540) 56.0 ± 10.9 | Population women 49.2 (2460) 55.0 ± 11.0 |
|---|--|--|
| Age (Year) | 56.0 ± 10.9 | 55.0 ± 11.0 |
| Body Mass Index (kg/m ²) | 27.7 ± 4.1 | 26.7 ± 5.4 |
| Body area (m ²) | 2.03 ± 0.17 | 1.77 ± 0.17 |
| Height (m) | 1.77 ± 0.07 | 1.64 ± 0.07 |
| Ocular Parameters, % (weighted data) | | |
| Glaucoma | 1.34 | 1.68 |
| Contact lenses | 3.24 | 6.51 |
| Use of eye drops | 6.79 | 12.43 |
| Antiglaucomatous medication | 1.46 | 2.03 |
| Corneal pathology (right or left) | 0.48 | 0.48 |
| Lens status (pseudophakic, right or left) | 1.53 | 1.76 |
| Eye disease in family history | 3.79 | 5.58 |

Figure 1a (left) and b (right):

Scatter plots of the difference between non-contact applanation tonometry readings versus central corneal thickness readings in μm in right eyes (Figure 1a) and left eyes (Figure 1b).



● men
● women

Right eyes: men R^2 linear = 0.205, women R^2 linear = 0.235, $p < 0.0001$

Left eyes: men R^2 linear = 0.209, women R^2 linear = 0.229, $p < 0.0001$

Table 2: Prevalence of selected eye parameters, stratified by gender and weighted according to the ground population of 100.000 people

| Mean CCT (N = 4698) | 35 – 44 years | 45 – 54 y. | 55 – 64 y. | 65 – 74 y. | Total |
|---------------------|---------------|--------------|--------------|--------------|--------------|
| Men | 561.1 ± 34.5 | 554.1 ± 33.3 | 557.5 ± 34.9 | 555.4 ± 34.2 | 556.5 ± 34.2 |
| Women | 551.3 ± 34.7 | 551.8 ± 35.6 | 551.2 ± 34.9 | 552.7 ± 36.2 | 551.8 ± 35.3 |
| Total | 555.3 ± 34.9 | 553.1 ± 34.3 | 554.4 ± 35.1 | 554.1 ± 35.2 | 554.2 ± 34.9 |

Table 3 Association between gender, age and ophthalmological factors on central corneal thickness.

| Right eyes/ Left eyes | Regression coefficient, P-value | |
|--|---------------------------------|-------------------|
| Gender | -4.96 / -4.735 | <0.0001 / <0.0001 |
| Age in years | -0.06 / -0.07 | 0.24 / 0.1688 |
| Spherical equivalent | 0.47 / -0.37 | 0.03 / 0.089 |
| Glaucoma history (no versus yes) | 3.66 / 3.57 | 0.26 / 0.28 |
| Contact lenses (no versus yes) | 0.10 / -2.86 | 0.97 / 0.31 |
| Lens status (phacic versus pseudophacic) | 0.73 / 2.15 | 0.90 / 0.47 |
| Iris colour (bright versus dark) | 0.68 / 1.07 | 0.55 / 0.35 |

Conclusions

The GHS is the first population based study evaluating mean CCT and associated ophthalmological parameters in a representative German sample. We found significant positive associations between CCT and IOP. Gender was significantly associated with CCT, too. CCT was not associated with age, contact lens wearing, positive family history for glaucoma, lens status, or iris color.

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