

Research Article

The Relationship between Intra-Ocular Pressure and Central Corneal Thickness in Saudi Population

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Abstract: The aim of this study was to determine, and relate Central Corneal Thickness and Intra-ocular pressure in healthy Saudi people. A prospective, cross-sectional, observational study was performed that included 200 normal Saudi adult individuals. Intra-ocular pressure was measured by the ocular response analyzer and Goldman Applanation Tonometry. The central corneal thickness (CCT) was measured using Pentacam system. The mean IOP was 15.12±3.5. Mean A positive correlation was found between CCT ($r=0.447$, p value=0.000) and IOP mm Hg ($r=0.878$ and p value=0.000). A positive correlation was found between CCT ($r=0.412$, p value 0.000) and IOP g ($r=0.183$, p value 0.007). This study demonstrated a linear relationship between Intra-ocular pressure and CCT. This would suggest the effect of pathological corneal thinning (ectasia) to have underestimation of the Intra-ocular pressure, and corneal edema can overestimate the Intra-ocular pressure.

Keywords: Central Corneal Thickness, Intra-ocular pressure (IOP), Corneal Hysteresis (CH), Ocular response analyzer, Goldman applanation tonometry, Pentacam system.

INTRODUCTION

Central Corneal Thickness found to has an impact on the IOP measurement since it was correlated to the Corneal Hysteresis [1]. Corneal hysteresis gained the attention of the ophthalmologist society and scientist from the first article published by Luce *et al.* [2] in vivo corneal biomechanics evaluation through Ocular Response Analyzer (ORA; Reichert Ophthalmic Instruments, Depew, NY). Many parameters were tested and correlated to gain the practical values of CH to help in the diagnosis and the prognosis and most importantly is Glaucoma.

In this study we are trying to correlate the Intra-ocular pressure (IOP) to Central Corneal Thickness (CCT) using Corneal Hysteresis (CH) values.

METHODOLOGY

Demographic and clinical data were obtained including age and gender.

Comprehensive ophthalmologic examination

Intra-Ocular pressure was measured by two methods: Static and Dynamic. Static method using Goldman applanation tonometry performs 'static' measurement. The IOP is calculated through a steady force applied to the cornea with fluorescein/Benoxynate premixed drops. The Ocular Response Analyzer is based on Non-Contact Tonometer method. It performs 'dynamic' measurements. The IOP is calculated from the movement of the cornea in response to a rapid air impulse. Central Corneal Thickness measured using Pentacam Machine (Pentacam; Oculus Inc, Wetzlar, Germany).

Exclusion criteria were age under 18, previous corneal or ocular surgery, eye disease, use of topical drugs, corneal scars and/or opacities, irregular astigmatism, History of any chronic systemic disease, contact lens wearers.

SPSS Windows System using Spearman's rank correlation to determine the coefficient correlation. Student two-sample test was used when difference between data was evaluated.

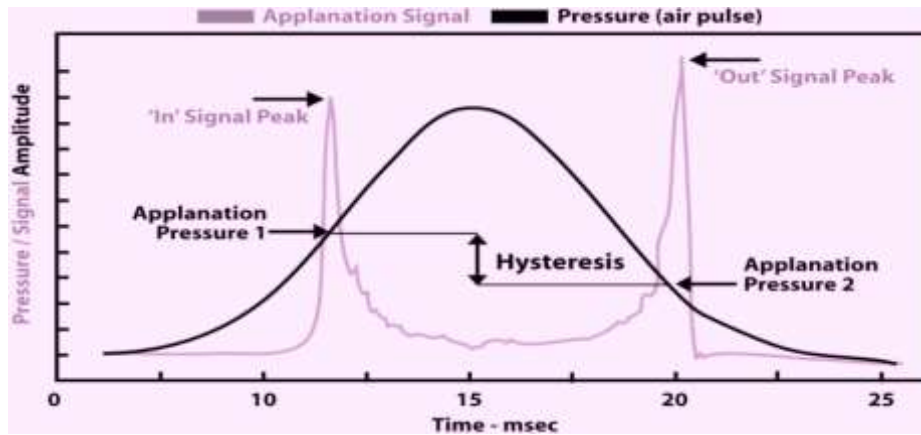


Fig. 1: Pressure/ Signal amplitude against time

RESULTS

This is an observational cross sectional study done on 200 Saudi patients, 82 were females and 118 were males. Mean age of the patients was 33.6 + 11.75 years, central keratometry was 43.2+1.40 D, central corneal thickness was 551.8+32.87 μ m, corneal resistance factor was 11.07+2.31 and IOP was 15.12+3.5. These demographic characteristics of Patients are shown in Table 1.

Mean CCT, CRF, IOP and SER values and P values shown in Table 2.

Corneal hysteresis was negatively correlated with IOPcc (-0.433, p value 0.000). A positive correlation was found between central corneal thickness (r=0.412, p value 0.000) and IOPg (r=0.183, p value 0.007) Table 2.

Table 1: Demographic Characteristics of 200 Saudi Patients.

Characteristics	Mean + SD
Age (y)	33.6+11.75
CCT(μ m)	551.8+ 32.87
SER(D)	-0.771 +1.97
CRF	11.07+ 2.31
IOP	15.12 +3.5

Table 2: Comparison of the Corneal Biomechanical Matrics between males and females

Corneal Biomechanical Matrics	Males (Mean +SD)	Female (Mean+SD)	p value	95% CI
CCT(μ m)	551.15+ 31.9	552.85+34.48	0.714	-10.81303 to 7.42150
SER(D)	-0.831+ 2.12	-0.710+ 1.844	0.670	-0.68208 to 0.43928
IOP	15.50+3.87	16.67+12.92	0.328	-3.53712 to 1.18590
CRF	10.83+2.18	11.47+2.48	0.047*	-1.28104 to -0.00738

Values are described as Mean \pm SD; *p value < 0.05 is taken as statistically significant.

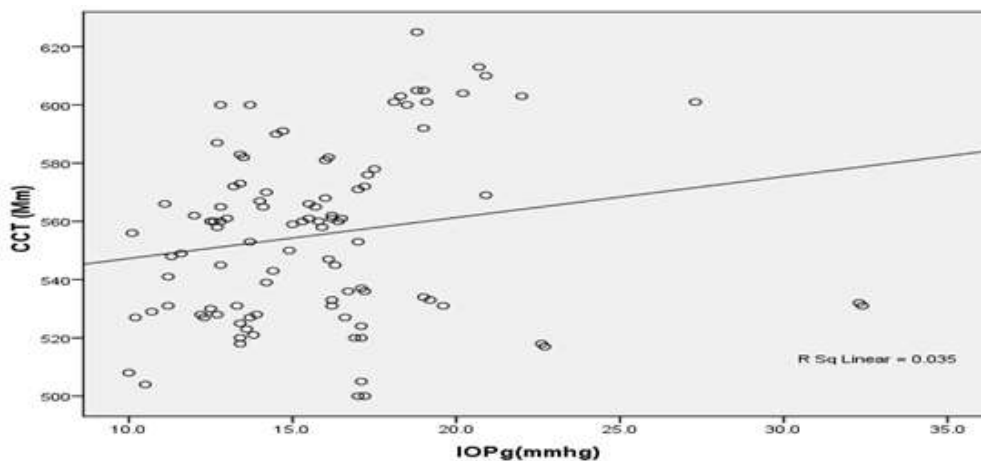


Fig. 1: CCT showed positive association with IOPg (r=0.243, p=0.015; Spearman’s rank correlation)

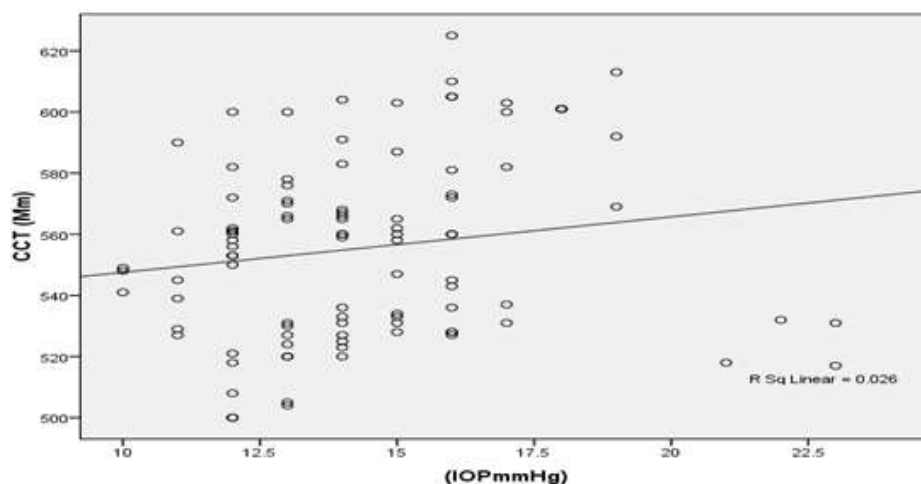


Fig. 2: Positive association between CCT and IOP mm Hg ($r=0.227$, $p=0.023$; Spearman's rank correlation)

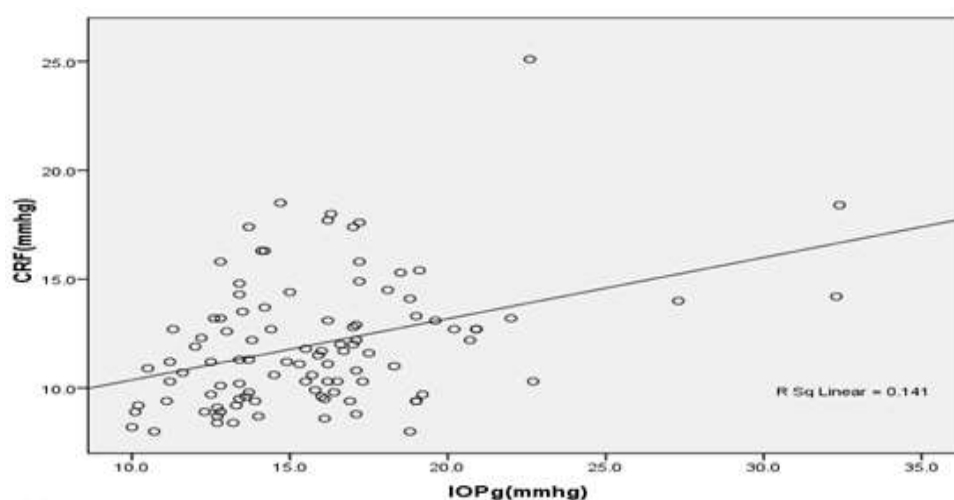


Fig. 3: CRF was positively correlated with IOPg ($r=0.363$, $p=0.000$; Spearman's rank correlation)

DISCUSSION

Luce [2], found a mean CH of 9.6 in a population of normal young patients (age range 23 to 38 years). Fontes *et al.* [3] found mean CH of 10.17 ± 1.82 in a Brazilian population (age range: 18 to 90 years). This study found a mean CH of 10.97 ± 1.72 (age range 18 to 70). Our outcome complements these former publications in an adult population. Our study showed no significant correlation between age and CCT. In the contrary, several studies indicated that CCT was inversely related to age [3-5]. The possibility that patient age may produce some part in the biomechanical properties of the cornea can't be rejected, since this study had a few number of volunteers to detect such a demographic significance. Broman *et al.* [6] also demonstrated that CH was correlated with CCT in patients coming to the glaucoma clinic, this finding might useful in adding the corneal biomechanics readings as a factor affecting the IOP. In addition, CRF was found positively related to IOPg which comes in an agreement with Liu and Roberts study [7] which has shown that tonometry is affected by the total corneal biomechanical features more than by central corneal

thickness alone. They also have shown that the effect of CCT on IOP is essentially nonlinear.

CONCLUSION

This study assessed the Central Corneal Thickness of healthy Saudi volunteers, and an association with CCT, age and IOP, was found. A larger number is needed to have a good reference data to corneal biomechanical metrics for our region. Although our data agrees with the previous studies published. More studies with a larger scale are recommended.

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