# Posterior corneal astigmatism changes in cases with Keratoconus

**Thesis Study**

**Submitted for partial fulfillment of master degree in ophthalmology**

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# Dedication

*I dedicate my dissertation work to the soul of my mother (May God have mercy on her) she never left my side and encourage me a lot .*

*Special feeling of gratitude to my family ,and my lovely daughter.*

*To everyone help me and support me to complete this work.*

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# List of abbreviations

| | |
|---|---|
| **AB.** | Asymmetrical bow tie |
| **ARC** | Anterior radius curvature |
| **ART** | Ambrosio relational thickness |
| **Astig.** | Astigmatism |
| **ATR astigmatism** | Against-the-rule astigmatism |
| **BCDA** | Best corrected distant acuity |
| **CCT** | Central corneal thickness |
| **CKI** | Central keratoconus index |
| **CTmin** | Corneal thickness at the thinnest point |
| **CTSP** | Corneal thickness spatial profile |
| **D.** | diopter |
| **Dist CCT_CTmin** | Distance between Central corneal thickness and corneal thickness a the thinnest point |
| **ECM** | extra cellular matrix |
| **IHA** | Index of height asymmetry |
| **IHD** | Index of height decentration |
| IL | Interleukin |
| **IS.** | Inferior steepening |
| **ISV** | Index of surface variance |
| **IVA** | Index of vertical asymmetry |
| **KC** | keratoconus |
| **Mt DNA** | Mitochondrial DNA |
| **MMPs** | Matrix metalloproteinases |
| **PCA** | Posterior corneal astigmatism |
| **PPI avg** | Average progression index |

| | |
|---|---|
| **PRC** | Posterior radius curvature |
| **PTI** | percentage thickness increase |
| **Q-val** | Q Value |
| **RS** | Reference surface |
| **SB** | Symmetrical bow tie |
| **SMA** | Smooth muscle actin |
| **SRAX** | Skewed radial axes |
| **SS** | Superior steepening |
| **TCA** | Total corneal astigmatism |
| **TGF** | Tumor growth factor |
| **TL** | Thinnest location |
| **TNF** | Tumor necrosis factor |
| **UCVA** | Uncorrected visual acuity |
| **WTR astigmatism** | With-the-rule astigmatism |

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# INTRODUCTION

# Introduction :

Keratoconus is non inflammatory, ectatic corneal disorder characterized by progressive corneal thinning that results in corneal protrusion, irregular astigmatism, and decreased visual acuity.(Gomes et al, 2015)

The incidence of keratoconus is about 1 of 2,000 individuals with a higher incidence in refractive surgery candidates.(Jonas et al, 2009 )

The pathogenesis of keratoconus still unknown but in general it is multi factorial disease resulting from interaction between genetic, environmental and behavior factors. The genetic factors related to abnormalities in the corneal epithelium, the stromal keratocyte or an extracellular matrix component, that is why it occurred bilaterally with family history. Environmental and behavioral factors include contact lens wear and chronic eye rubbing. This interaction between these multiple different factors lead to an abnormal organization of the collagen fibers in corneal stroma with loss in the anchoring capacity of the collagen fibrils in the Bowman membrane,

that lead to decrease the collagen content in keratoconic corneas compared with normal corneas.(Gomes et al,2015)

Keratoconus starts posteriorly with early change in posterior corneal curvature, then progress to anterior corneal surface. So that curvature changes on the anterior corneal surface might miss signs of early posterior corneal ectasia.(Hosseini et al,2014)

The corneal posterior surface has been suggested to be useful and important clinical tool for keratoconus detection and even for subclinical cases.(Hosseini et al,2014)

The onset of keratoconus is insidious and the progression is irreversible therefore early diagnosis of keratoconus is needed. However, the variable risk of keratoconus progression make a challenge to manage these cases.(McGhee et al,2015)

Diagnosis of keratoconus has greatly improved from simple clinical diagnosis with the advent of better diagnostic devices like corneal topographers based on Placido disc and recent elevation based

tomography.(Davidson et al,2014) Since slit lamp examinations cannot detect keratoconus in early stages, and visual acuity may not be affected, corneal topography and tomography are the only reliable methods for detecting early keratoconus or keratoconus suspect.(Randleman et al,2008)

Although Placido disk–based corneal topography is known to be a highly sensitive and specific diagnostic tool, it only examines the anterior corneal surface, and does not evaluate the curvature and elevation of the posterior corneal surface, which is considered to be significant especially in early stage keratoconus detection. The development of new technologies, such as slit-scanning technologies, rotating Scheimpflug devices, and optical coherence tomography, makes it now possible to quantitatively measure the posterior corneal curvature, and to provide useful diagnostic information for the detection of keratoconus in a clinical setting.(Kamiya et al,2014)

Koch and his colleagues in 2012, found that significant increase of posterior corneal astigmatism (PCA)(0.86 ± 0.45 in patients with KC than normal eyes (0.30 ± 0.15 D). In 2016, Naderan &his associates reported a strong

correlation between anterior corneal astigmatism (ACA) and posterior corneal astigmatism (PCA) with severity of KC, More importantly ACA was more affected than PCA with an increase in the severity of KC. On the other hand, PCA was more affected than ACA in the early stages of KC.(Naderan et al,2016)