Ocular Applications Of Pentacam

Essay
Submitted in partial fulfillment of Master Degree
in Ophthalmology

By

Mohammad Hassan Shabana
M.B.B.Ch

Supervised by

Prof.Dr. Ahmed Abdalla Darwish
Professor of Ophthalmology
Faculty of Medicine
Ain Shams University

Dr.Mohammad Abdelhameed Abdelfatah Kabeel
Lecturer of Ophthalmology
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams Univesity
2009

Acknowledgment

*Praise to **Allah** who gave me everything and who allowed this work to be done.*

It is indeed an honor to me to supervised by **Prof. Dr. / Ahmed Abdalla Darwish,** Professor of Ophthalmology, Faculty of Medicine, Ain Shams University, *who was really so supportive & helpful to me in this study.*

I'm really grateful to ***Dr. /Mohammad Abdelhameed Abdelfatah Kabeel***, Lecturer of Ophthalmology, Faculty of Medicine, Ain Shams University, *for his valuable advices and continuous efforts and his guidance to me throughout this study.*

Of course, I can't find enough words to thank my parents and my family for their endless support.

Abbreviations

3D	**Three Dimensional**
ACD	**Anterior Chamber Depth**
AC M	***AC Master Apparatus***
BFS	***Best-Fit-Sphere***
C	***Cortical cataract***
CBDS	***Capsular Bag Distension Syndrome***
CCT	***Central Corneal Thickness***
CD	***Cell Density***
CM 3910	**Double-Scheimpflug Camera**
CR	***Coefficient of Repeatability***
CT	***Corneal Thickness***
D	***Diopters***
ER	**Endoplasmic Reticulum**
HR	***High Resolution***
ICL	***Implantable Contact Lens***
IOL	***Intraocular Lens***
IOP	***Intraocular Pressure***
LASEK	***laser-Assisted Sub Epithelial Keratectomy***
LASIK	**Laser in Situ Keratomileusis**
LOCS III	**Lens Opacities Classification System III**
LPI	***Laser Peripheral Iridotomy***
NC	***Nuclear Color***
Nd: YAG	**Neodymium-doped Yttrium Aluminium Garnet**
NO	***Nuclear Opalescence***
OCT	**Optical Coherence Tomography**
OD	**Right**
OLCR	**OLCR pachymeter**
OS	**Left**
P	***Posterior subcapsular cataract***
PAC	***Primary Angle Closure***
PACD	***Peripheral Anterior Chamber Depth***
PACG	***Primary Angle-Closure Glaucoma***
PAR	***Posterior Apical Radius***
PAR CTS	***PAR Corneal Topography System***

PAS	**Periodic Acid –Schiff**
PCO	***Posterior Capsule Opacification***
PEA	***Phacoemulsification aspiration***
PIOL	***Phakic Intraocular Lenses***
PMD	***Pellucid Marginal Degeneration***
PMMA	**Polymethyl Methacrylate**
PMN	**Poly Morph Nuclear leukocyte**
PKP	**Penetrating Keratoplasty**
PRK	**Photorefractive Keratectomy**
RK	**Radial Keratotomy**
SE	***Spherical Equivalent***
S/PLaser	**Self-Pulsating Laser**
TMS	***Topographic Modeling System***
UBM	**Ultrasound Biomicroscope**
US	***Ultrasound***
WTW	***White-to-white distance***

LIST OF FIGURES

CONTENTS

Introduction

Pentacam is a multipurpose instrument that is capable of external ocular photography, corneal pachymetry, corneal topography, densitometry and anterior chamber analysis.

The Pentacam imaging device has been operational in ophthalmic practice since it was approved for use in the United States in 2004. The Pentacam is considered as a multifunctional imaging device by the manufacturer. The reliability of Pentacam in measuring central corneal thickness (CCT) and anterior chamber depth (ACD) have been rigorously tested (Barakana et al, 2005). Several studies report that the Pentacam has excellent reliability in measuring CCT and ACD in normal and keratoconus populations. The repeatability of posterior corneal elevation was also reported in a recent publication (Chen and Lam, 2007).

The Pentacam allows fast, noncontact examination of the anterior eye segment while the patient is sitting in front of the camera, thus providing good patient comfort and preventing application of local anesthetics and corneal erosions. However, patients have to be able to fixate while the measurement is being made, which can be a problem for children, older patients or patients with nystagmus. (Rufer et al, 2005).

The Pentacam (Oculus, Inc., Lynnwood, Wash., USA) utilizes Scheimpflug imaging. It is a rotating Scheimpflug camera that provides 50 Scheimpflug images during one scan in less than 2 seconds with 500 true elevation points per image. The Pentacam has two integrated cameras. One is located in the center for the purposes of detection of the size and orientation of the pupil, and to control fixation. The second is mounted on the rotating wheel to capture images of the anterior segment. The Scheimpflug image is a complete picture from the anterior surface of the cornea to the posterior surface of the lens.

The slit images are photographed on an angle from 0 to 180 degrees to avoid shadows from the nose. It generates 25,000 true elevation points for each surface, including the center of the cornea. Possible eye movements are captured and corrected internally (Gerste, 2004).

The Pentacam rotating Scheimpflug camera is useful for screening patients because important parameters, especially chamber angle in different positions, ACD, pachymetry, corneal radii and diameter and lens position can be evaluated in examination within a very short period with good reliability (Devereux et al, 2000).

Aim of the work

This study reviews the Pentacam corneal topography system, which is considered the gold standard for evaluating the anterior segment of the eye by a rotating scheimpflug camera.

Anatomy of the cornea

Macroscopic anatomy:

The transparent cornea forms the anterior one sixth of the. eyeball. (Bron et al, 1997).

Because its curvature is greater than the rest of the eye-ball, a slight sulcus, the sulcus sclera, marks the junction of the cornea with the sclera. Anteriorly, the cornea is convex but somewhat elliptical in shape, although the dimensions of the cornea vary considerably from one person to another, the approximate measurements are about 10.6 mm vertically but about 11.7 mm horizontally. (Rufer et al, 2005).

Posteriorly the cornea is concave, measuring about 11.7 mm in diameter. (Bron et al, 1997).

The cornea is thinnest at its center, measuring about 0.5-0.6mm and thicker at the periphery measuring about 0.7 mm. (Bron et al, 1997).

The radius of curvature of the anterior surface of the cornea is about 7.7mm; that of the posterior surface, 6.9mm. (Bron et al, 1997).

The anterior surface is frequently more curved in the vertical than in the horizontal planes.

The cornea is the main structure responsible for the refraction of light entering the eye. It separates the air, with a refractive index of 1.00, from the aqueous humor, the refractive index of 1.33. (Bron et al, 1997).

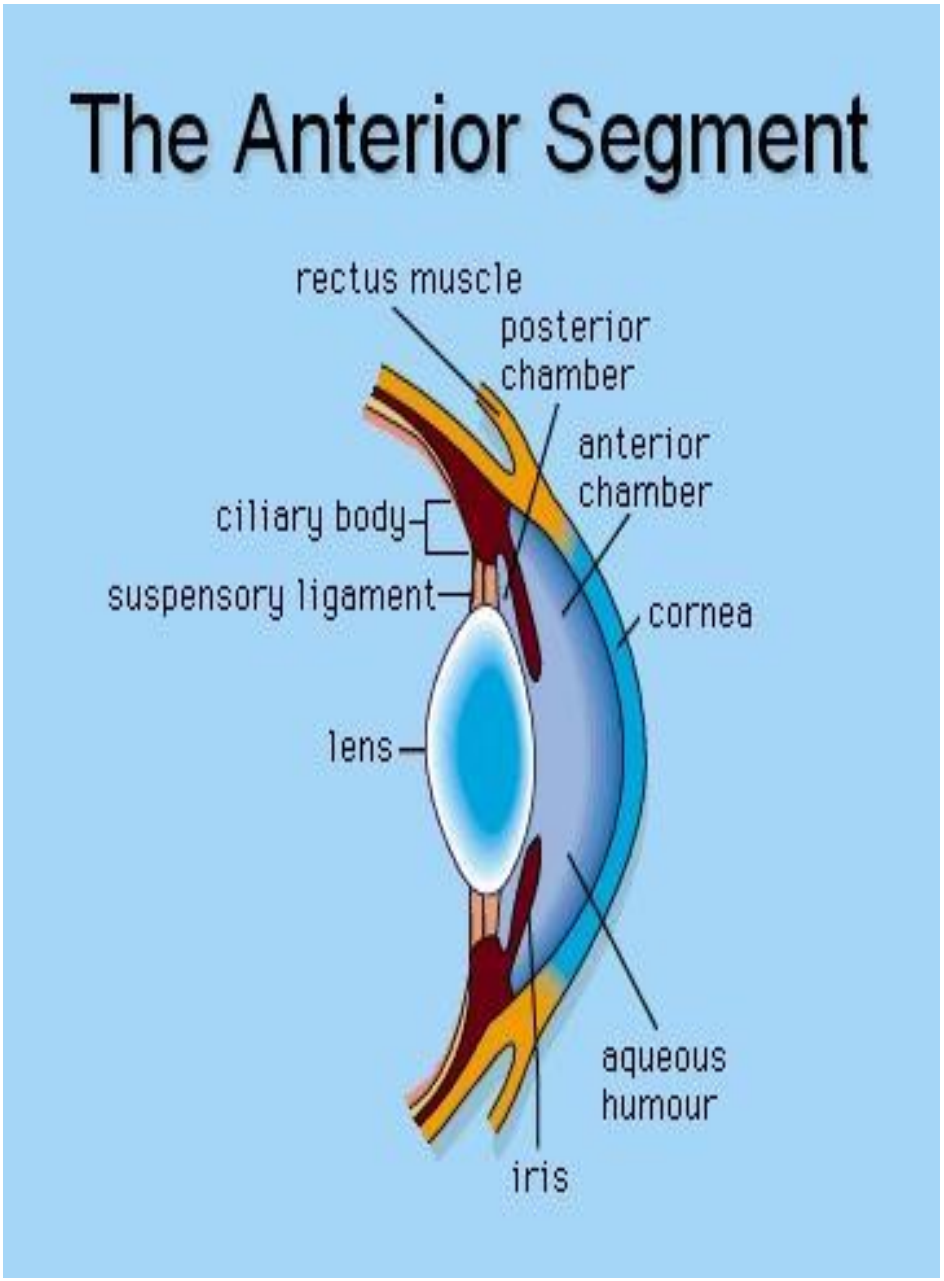

Figure 1. *Anterior segment anatomy.*

(Rufer et al, 2005)