Role Of Ultrasound Biomicroscopy In Imaging Anterior Segment Of The Eye

Essay
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Dedication

To my sweet family;

My lovely husband and lovely son

My dear father

My great mother

My lovely sisters

My father in law

My mother in law

My sister in law

My brothers in law

This work would have never come true without

your support & encouragement

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List Of Abbreviations

µm	Micrometer
AC	Anterior chamber
ACG	Angle closure glaucoma
AC-IOL	Anterior chamber intraocular lens
AOD	Angle opening distance
ARA	Angle recession area
AS-OCT	Anterior segment optical coherence topography
BM	Bowman's membrane
CB	Ciliary body
CBS	Capsular block syndrome
CCC	Continues curvilinear capsulorhexis
CT	Corneal thickness
CCT	Central corneal thickness
CPU	Central processing unit
dB	Decibel
DM	Descemet's membrane
FDA	Food and drug administration
Hz	Hertz
ICE	Iridocorneal endothelial syndrome
IOFB	Intraocular foreign body
IOL	Intraocular lens

KI	Keratoconus index
MHz	Megahertz
Mm	Millimeter
MRI	Magnetic resonance imaging
Nd YAG	Neodymium Yttrium-Aluminum-Garnet
PACG	Primary angle closure glaucoma
PAS	Peripheral anterior synechia
PC	Posterior chamber
PC-IOL	Posterior chamber intraocular lens
PCT	Peripheral corneal thickness
PTK	Phototherapeutic keratectomy
PKP	Penetrating keratoplasty
PVDF	Polyvinylidene difluoride
PVDF-TrFE	polyvinylidene fluoride trifluoro-ethylene
PZT	Lead zirconate titanate
OAG	Open angle glaucoma
OCT	Optical coherence tomography
TCPD	Trabecular ciliary process distance
TIA	Trabecular-iris angle
TMW	Trabecular meshwork
UBM	Ultrasound biomicroscopy

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Introduction

Ultrasound biomicroscopy (UBM) is a high-resolution ultrasound technique that allows non-invasive in-vivo imaging of structural details of the anterior ocular segment at near light microscopic resolution and provides detailed assessment of anterior segment structures, including those obscured by normal anatomical and pathological relations ***(Dada et al., ٢٠١١).***

In general, increasing frequency increases the resolution but decreases tissue penetration, which makes UBM an ideal tool for imaging anterior segment of the eye as UBM is performed with a ٥٠ MHz probe giving resolution of ٤٠ microns (similar to Image with low power microscope) and the depth of ٤mm. ***(Liebmann and Ritch, ١٩٩٦).***

There are many applications regarding this imaging method including imaging the details of The angle, ciliary body, zonule, posterior chamber, so it is helpful in understanding the different types of glaucoma ***(Liebmann and Ritch, ١٩٩٦).***

UBM strength lies firstly in its ability to produce cross sections of the living eye at microscopic resolution without violating the integrity of the globe or affecting the internal relationships of the structures imaged ***(Palvin and Foster, ١٩٩٨),*** secondly, UBM is not dependent on clarity of the media, it can visualize detailed structures in presence of opacities**.**

UBM is capable of imaging the cornea, iris, anterior chamber, anterior chamber angle, posterior chamber, and ciliary body with great detail. The structures surrounding the posterior chamber, previously hidden from clinical observation can be imaged and their normal anatomical relationships can be assessed. The various forms of angle closure glaucoma can be differentiated ***(Liebmann and Ritch, ١٩٩٨).***

Important information on the cornea can be obtained by UBM such as intrastromal corneal scars, internal corneal changes after penetrating injuries or keratoplasties, corneal dystrophies and other lesions ***(Fries et al., ١٩٩٦).*** UBM can be considered a useful tool to study keratoconus and to obtain reliable measurements of corneal thickness related to the severity of the disease determined by videokeratography ***(Avitabile et al., ١٩٩٨).***

UBM is a valuable tool for evaluating childhood cataracts and associated ocular anomalies as well as anterior segment biometric characteristics ***(El Shakankiri et al., ٢٠٠٩).*** Also, the degree and extent of lens subluxation and the degree of zonular defect can be evaluated using UBM examinations preoperatively, which is necessary in the selection of surgical protocol ***(Liu et al., ٢٠٠٤).***

In cases of trauma, UBM has high clinical value in diagnosis of anterior segment contusion, especially in corneal edema, hyphema and hypotony. Also it can show angle recession, cyclodialysis, iridodialysis, zonular breaking, lens dislocation and vitreous protrusion to posterior chamber ***(Lai et al., ١٩٩٦).***

Another advantage for UBM that it is a non-invasive method for detecting anterior segment intraocular foreign bodies after perforating trauma. It can be used to accurately diagnose foreign bodies and assist in surgical management, particularly when direct visualization is obscured because of the trauma ***(Weinberger et al., ١٩٩٨).***

UBM offers an accurate method to evaluate anterior chamber tumor shape, denisty, local invasion ***(Marigo et al.,***

٢٠٠٠) and the posterior margin ***(Bianciotto et al., ٢٠١١),*** also, detailed imaging of the tumor's interface with the angle structures may aid the surgeons in choosing the most appropriate technique to ensure total removal ***(Giuliari et al., ٢٠١١).***