Clinical Applications of Spectral Domain OCT

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Glaucoma Service, Massachusetts Eye and Ear Infirmary
No relevant financial disclosures
Clinical Applications of Spectral Domain OCT

2D qualitative subjective

3D quantitative objective
Clinical Applications of Spectral Domain OCT OVERVIEW

LOOKING BACK...

BACKGROUND:
- SDOCT development
- Comparing older imaging technologies with the clinical exam
- Clinical applications of older imaging technologies
- SDOCT has clinical advantages over older imaging technologies
  - 3D versus 2D
  - higher resolution
  - better reproducibility

LOOKING FORWARD...

NEW TECHNOLOGY CONCEPTS:
- Validation...
  - Are measurements consistent with...
    - current gold standard methods of clinical evaluation?
    - known glaucoma pathophysiology?

SDOCT IS POTENTIALLY BETTER FOR:
- Facilitating glaucoma diagnosis
- Longitudinal assessment of disease progression
- Risk stratification
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OCT Development

How OCT Works
Time Domain OCT

- OCT 1995-1999
- OCT2 2000-2001
- OCT3 (Stratus) 2002-2006

low resolution
slow acquisition speed

Pictures from Carl Zeiss Meditec, Inc
Spectral Domain OCT

Maciej Wojtkowski, PhD

3D Spectral Domain OCT

("video-rate' spectral domain OCT)

Johannes de Boer, PhD

3D Spectral Domain OCT
video-rate imaging
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- SDOCT is potentially better for:
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Studies suggest that older imaging modalities (GDxVCC, HRT, TD-OCT) are the same\textsuperscript{1-4} or better\textsuperscript{5-6} than a general eye doctor’s exam…but not better than a glaucoma specialist’s eye exam.\textsuperscript{6}

Studies suggest that older imaging modalities (GDxVCC, HRT, TD-OCT) are the same\textsuperscript{1-4} or better\textsuperscript{5-6} than a general eye doctor’s exam…but not better than a glaucoma specialist’s eye exam.\textsuperscript{6}

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<th>Scanning Laser Polarimetry</th>
<th>GDx</th>
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<td>Confocal Scanning Laser Ophthalmoscopy</td>
<td>HRT</td>
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<td>Optical Coherence Tomography</td>
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imaging modalities offer potential advantages over the clinical exam: 1) objective data, 2) quantitative data.
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American Academy of Ophthalmology

- Literature review from January 2003 to February 2006
- Studies on detecting glaucoma progression showed that although there was often agreement on progression between the structural and functional VF tests, a significant proportion of glaucoma patients progressed by either the structural or the functional test alone.
- ONH and RNFL imaging devices provide quantitative information for the clinician.
- The information obtained from imaging devices is useful in clinical practice when analyzed in conjunction with other relevant parameters that define glaucoma diagnosis and progression.

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3D (Video Rate) SDOCT
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3D (Video Rate) SDOCT vs. Time domain OCT3

- 600 uW power
- 29,326 A-lines per sec
  - 1/29 seconds per image
- SLD (840 or 875 nm)
- 2-3 microns

- 750 uW power
- 400 A-lines per sec
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- SLD (820 nm)
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Spectral domain OCT is associated with better scan quality and better reproducibility compared with time domain OCT.1-4

**Spectral domain OCT** is associated with **better scan quality and better reproducibility** compared with time domain OCT.¹-²

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<td>0.46 to 3.5% COV</td>
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Spectral domain OCT is associated with better scan quality and better reproducibility compared with time domain OCT.¹⁻³

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VALIDATING NEW OCT PARAMETERS
quantifying neuroretinal rim tissue

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VALIDATING NEW OCT PARAMETERS

new methods:
3D spectral domain OCT

old methods:
CD ratio assessment of 5 glaucoma specialists

old methods:
MD
PSD

Spectral Domain OCT

VALIDATING NEW OCT PARAMETERS

quantifying neuroretinal rim tissue

Minumum Distance Band Versus Cup-Disc Ratio

Spectral Domain OCT
VALIDATING NEW OCT PARAMETERS

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VALIDATING NEW OCT PARAMETERS

Is there good structure-function correlation?

Huijuan Wu, MD, PhD, 2009
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Glaucoma Diagnosis

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- Better development of normative databases
- Macular, optic nerve head, retinal nerve fiber layer scans (or a combination)
- Combining structural and functional tests

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Longitudinal Assessment of Disease Progression

• Better reproducibility
Spectral Domain OCT
Longitudinal Assessment of Disease Progression

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- Ongoing longitudinal studies:
  - AIG (Advanced Imaging for Glaucoma)
  - DIGS (Diagnostic Innovations in Glaucoma Study)
  - MEEI/MGH
  - etc.
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- Imaging devices (GDxFCC, HRT3, TD-OCT2, SDOCT) may be capable of predicting the onset of glaucoma prior to clinically detectable field loss (i.e. pre-perimetric glaucoma).

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Collaborators

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• Joan Miller, MD

Thanks!