بسم الله الرحمن الرحيم

Recent Modalities In Tonometry

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Goldmann applanation tonometry

- ❖ Corneal shape (radius and astigmatism)
- ❖Elasticity, rigidity and corneal thickness.
- ❖ Overestimated in thick and more rigid corneas.
- ❖ Underestimated in thinner corneas, leading to misdiagnosis of glaucoma.

Devices that measures pressure independent of corneal variables :

- ❖ The Reichert Ocular Response Analyzer.
- ❖The PASCAL dynamic contour tonometer

- Ocular response analyzer (ORA) is a device able to provide an in vivo dynamic measurement of corneal viscoelastic behavior.

- **IOPG** - Goldmann Correlated IOP
- **IOPCC** - Corneal Compensated IOP
- **CH** - Corneal Hysteresis
- **CRF** - Corneal Resistance Factor

Static vs. Dynamic Measurement

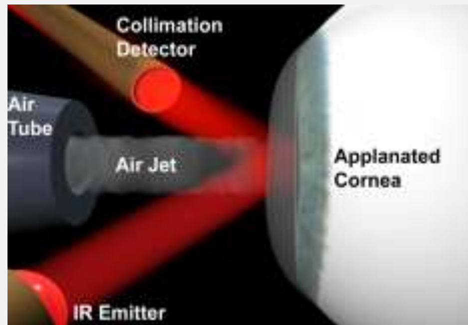
GAT make 'static' measurements. As they derive IOP from the force measured during a steady state applanation of the cornea.

ORA makes a 'dynamic' measurement, monitoring the movement of the cornea in response to a rapid air impulse.

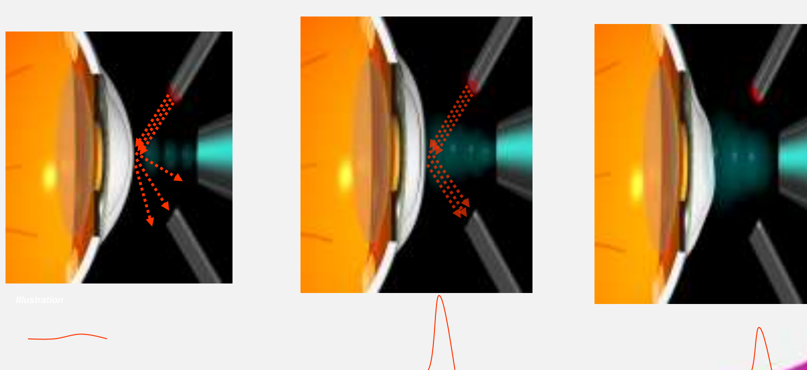
ORA Signal Analysis

The ORA optical system records 400 data samples of reflected IR light intensity during the rapid (30 ms) in/out corneal deformation.

The optical signal (red curve) is a "dynamic map" of the cornea during the rapid in/out deformation.



The signal provides additional information about corneal biomechanical properties, revealing "signature" characteristics of the eye being measured.



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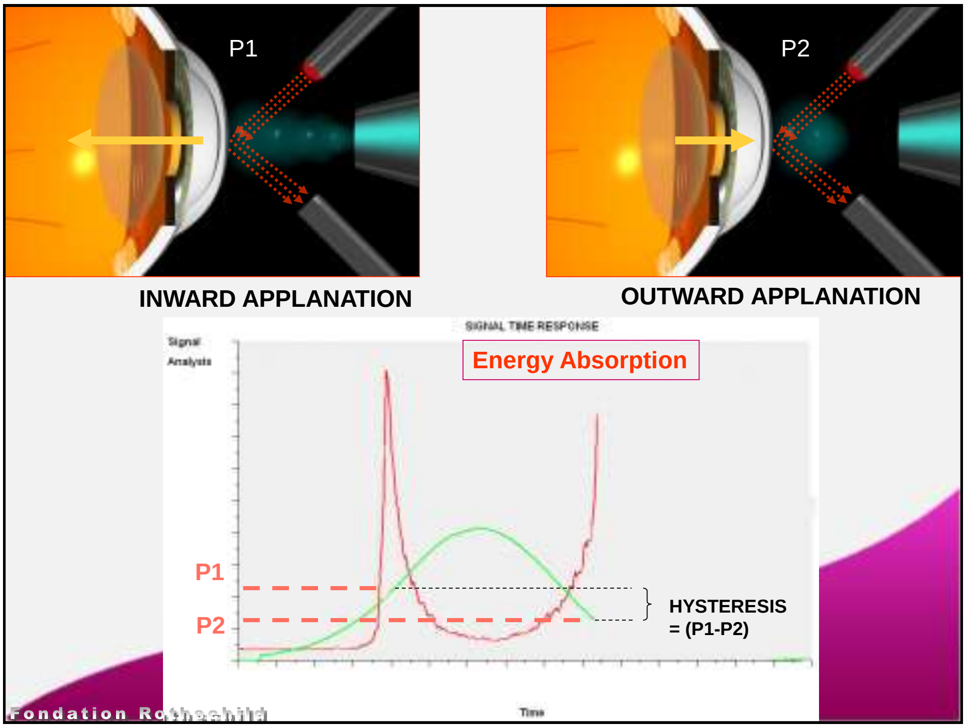
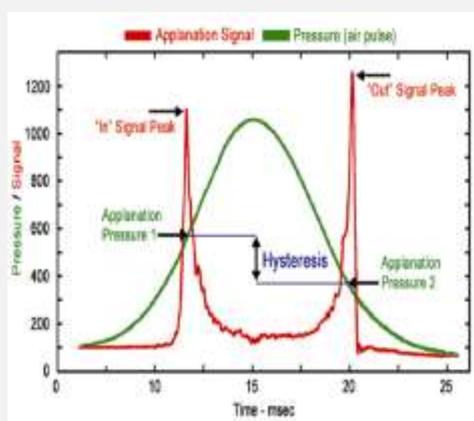


Ocular Response Analyzer

The Reichert Ocular Response Analyzer measures the pressure values at applanation as the cornea is moving in and as it is moving out. The difference in values equals corneal hysteresis, which is a measure of viscoelastic damping.



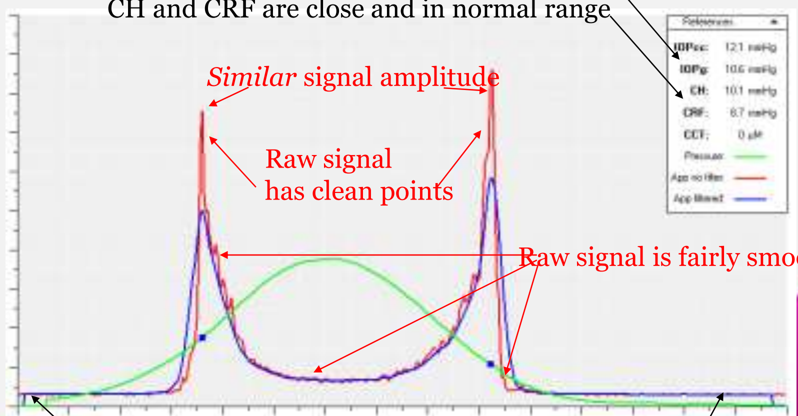
Identifying Normal Signals

IOPcc and IOPg are close and in normal range
CH and CRF are close and in normal range

Similar signal amplitude

Raw signal
has clean points

Raw signal is fairly smooth



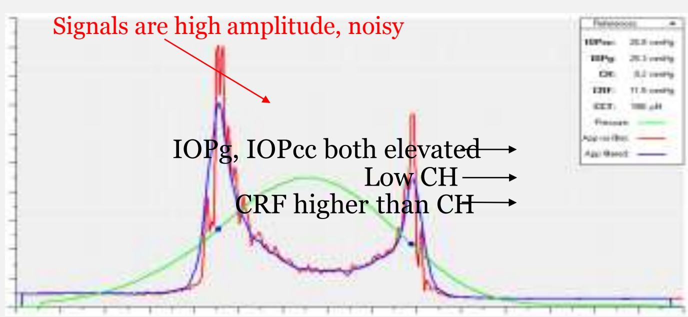
Baseline signal is "flat" and nearly same amplitude on both sides

Identifying POAG Signals

Uncontrolled Subject, moderately high IOP

Signals are high amplitude, noisy

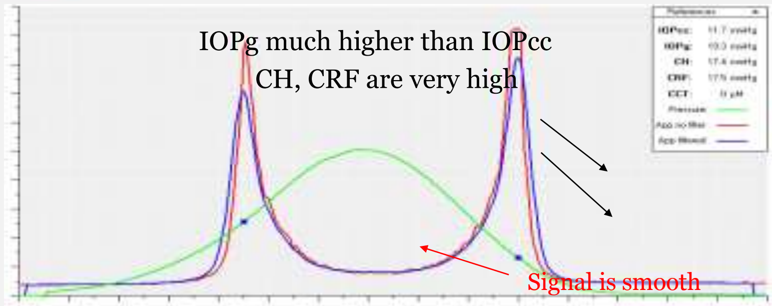
IOPg, IOPcc both elevated
Low CH
CRF higher than CH



	IOPg	IOPcc	CH	CRF	CCT
High	X	X		X	
Ave	X	X	X	X	X
Low			X		X

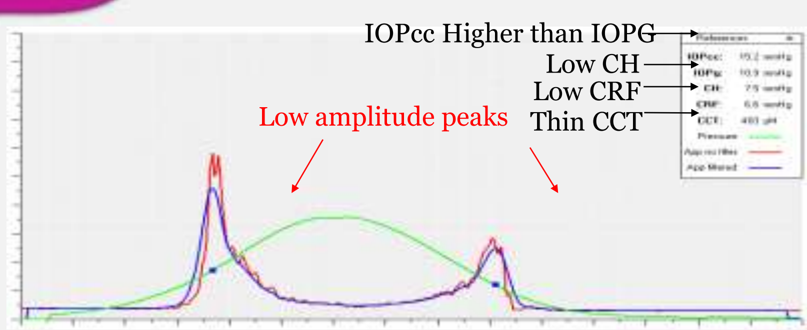
Identifying OHT Signals

Subject is a "false positive"

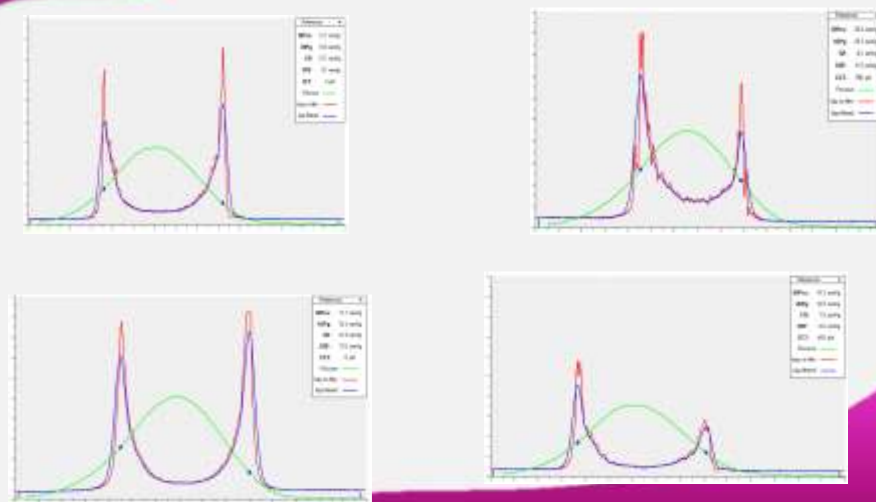


	IOPg	IOPcc	CH	CRF	CCT
High	X		X	X	X
Ave		X			
Low					

Identifying NTG Signals



	IOPg	IOPcc	CH	CRF	CCT
High		X			
Ave	X	X			
Low	X		X	X	X



ORA may be used to help identify and classify

conditions such as:

- corneal ectasia
- Fuchs’dystrophy.
- It may be clinically useful in refractive surgery.

Dynamic Contour Tonometer

The PASCAL dynamic contour tonometer (DCT) is a slit lamp–mounted device designed to measure IOP independent of corneal rigidity or thickness. It received FDA clearance in November 2003 and was commercially launched in August 2004.

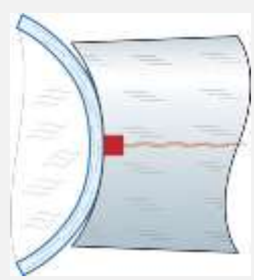
Static vs. Dynamic Measurement

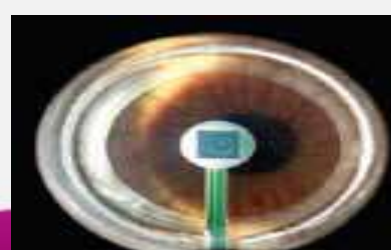
GAT make 'static' measurements. As they derive IOP from the force measured during a steady state applanation of the cornea.

DCT measure both 'static' pressure & pressure fluctuation (OPA) .

- DCT sensor tip: no applanation but relaxation
- Constant applanation force of one gram.
- LCD display shows :
  - IOP
  - OPA (ocular pulse amplitude)
  - Q (quality index)

Caption: The PASCAL's probe rests on the relaxed cornea with a constant force of one gram. Its piezoelectric sensor measures IOP 100 times per second.





- the Pascal was more accurate than other tonometers. It provided the most accurate IOP readings within ± 0.7 mmHg
- A study was done on 118 LASIK eyes, DCT proved to be better suited to monitor IOP than either Goldmann applanation tonometry or noncontact air puff tonometry.

Drawbacks of DCT

- More time consuming than Goldmann.
- Doesn’t seem as useful in diseased corneas or after corneal transplant.

Conclusion

- Still GAT is gold standard in measuring IOP in most cases.
- ORA is of value in cases of variation in corneal thickness affects the accuracy of measured IOP , corneal dystrophy and post refractive surgery .
- DCT masseurs true IOP independent on corneal properties like CCT & Corneal rigidity .

- DCT IOP is correlated with glaucomatous damage .
- Closely related to extend of glaucoma damage than GAT IOP.


Thank You