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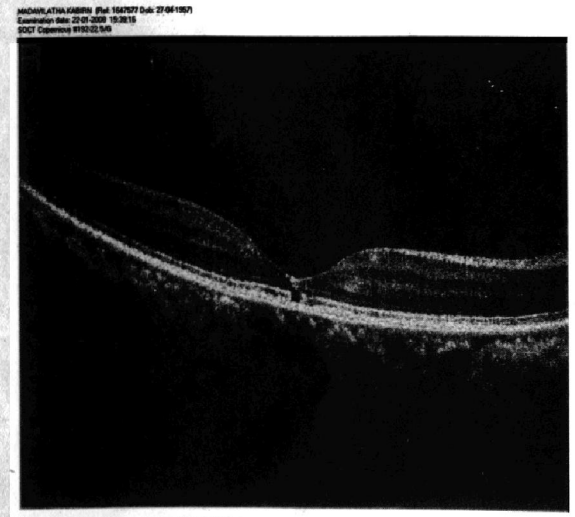

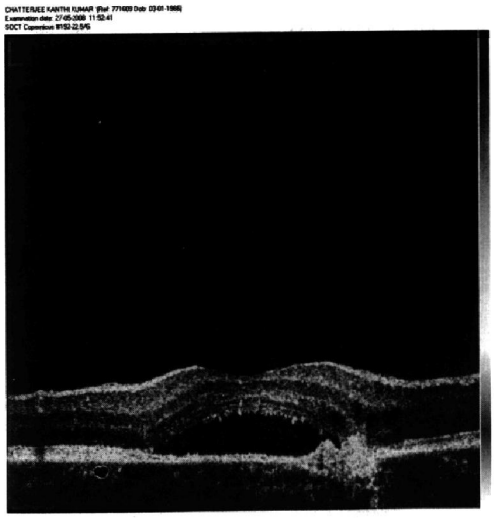

SANKARA NETHRALAYA

EDITORIAL

This issue's perspective has a detail look at Spectral Domain OCT which offers several advantages over the conventional OCT. This may become the choice of retinal surgeons in the future. This issue also has an interesting study comparing the Retinometer with the PAM. PASCAL which is a new laser system is introduced to the readers. Teleophthalmic Pathology- a new tool utilizing the telemedicine technology completes the issue

Dr S Meenakshi - *Editor*

Dr Shubhra Goel - *Associate Editor*

PERSPECTIVE:

Spectral Domain OCT

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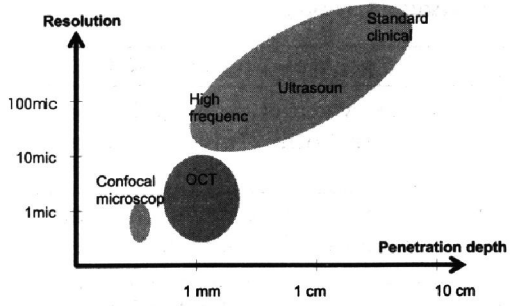
Introduction

Optical coherence tomography (OCT) is a medical imaging technology that can perform high-resolution cross-sectional imaging of tissue morphology in situ and in real time.

Optical coherence tomography imaging is analogous to ultrasound, except that it uses light rather than sound and measures the echo time delay and magnitude of reflected or backscattered light using low-coherence interferometry. Cross-sectional images are generated by directing an optical beam onto tissue and scanning it in the transverse direction, thus yielding a data set that can be displayed as false-color or grayscale images.[1]

Optical coherence tomography can perform optical biopsy by imaging tissue microstructure without the need to excise and process specimens.

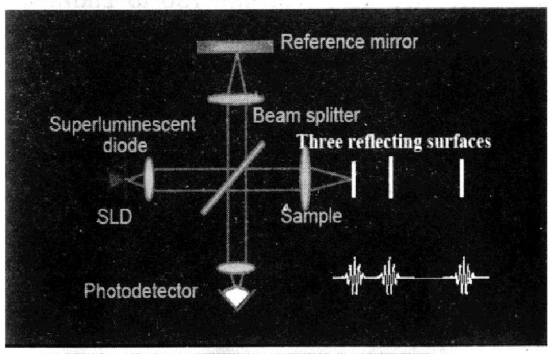


Principle of Time Domain OCT

Time domain OCT is based on the principle of Low coherence interferometry. In conventional interferometry, the interference takes place over large distances. In OCT machines as the spectrum of wavelengths used is very wide, interference takes place in very small distance.

This broad spectrum can be produced by either using

- Super luminescent diode source
- Femtosecond lasers



The light (820 nm) is broken into 2 beams using a beam splitter. One beam is sent to the reference mirror, the other beam is directed towards the eye. The reference mirror keeps moving and the interference pattern produced by the interference of the 2 beams is recorded. Areas of the retina which reflect the light a lot will produce greater interference than the other areas. This pattern is accorded a colour scale where red denotes highest reflectivity and black denotes the lowest reflectivity.

The image produced is an A scan image. It is a single slice, once the light beam passes through the entire cross section of the Retina, it produces multiple such A scans. All, the A scans are combined to produce the 2 dimensional cross sectional (B scan) image of the Retina.

The Axial resolution is 8 to 10 microns and it can process upto 512 scans in 1 sec.

Limitations of Time domain OCT

- As, the axial resolution is 8 – 10 microns, the IS/OS junction, Plexiform layer, Ganglion layer and the Photoreceptor layers cannot be visualized to the extent desired

- As the reference mirror keeps moving, movement artifacts are present
- As fewer A scans can be taken per second, the time taken for the procedure is more

To overcome the problem of axial resolution, the next generation OCT machine was developed, called the Ultra High resolution OCT. Here, the axial resolution was improved to 2-3 microns. But Imaging speeds for UHR OCT were typically 150 to 250 axial scans per second[2,3,4,5,6] slower than standard-resolution OCT, so coverage was more restricted and artifacts due to eye motion were more severe.

Recently, dramatic advances in OCT technology have enabled UHR OCT imaging 50 times faster than standard-resolution OCT systems and 100 times faster than previous UHR OCT systems.[7,8,9,10] These techniques are known as Fourier domain or spectral detection.

Principle of Fourier Domain OCT

Echo time delays of light are measured by acquiring the interference spectrum of the light signal and taking its Fourier transform.[11,12]

The reference arm is held fixed, and the optical path length difference between sample and reference reflections is encoded by the frequency of the interferometric fringes as a function of the source spectrum. Two configurations have prevailed in Fourier domain systems: spectral domain (SD) OCT uses a grating to spatially disperse the spectrum across an array-type detector, and in swept source (SS) OCT a narrow band laser is swept across a broad spectrum, encoding the spectrum as a function of time.

Advantages of Fourier Domain OCT

- With increased imaging speed, individual images are acquired within a fraction of a second, thereby minimizing motion artifacts.
- Because motion-correcting cross-correlation algorithms are not required, the images better represent the true topography of the retina.
- In addition, it is possible to use high densities of axial scans to obtain high-definition OCT images, thus improving image quality and visualization of intraretinal layers.
- Multiple images may be acquired rapidly at different locations or orientations, thereby improving retinal coverage.
- It also is possible to acquire 3-dimensional OCT data that achieve comprehensive retinal coverage and enable individual OCT images to be registered precisely to fundus features.[13]

	Time domain OCT	**Spectral Domain OCT**
Type of image produced	Combines multiple A scans to give a 2 dimensional B scan	Combines A scans done in 2 directions to generate both 2 and 3 dimensional images
Principle	It uses the interference pattern produced by the reflection of light from the reference mirror and the retina to generate the image. Moving the reference mirror the interference image produced by the reflection of light from the various layers of the Retina is used to produce the A scan image	It uses the same principle as the Time domain OCT but the wavelength of light used is a spectrum. The pattern of each wavelength reflected interference would be different. This difference can be judged using a spectrometer. This reduces the scanning time and thousands of A scans can be done to generate even 3 dimensional images.
No of A scans	Upto 512	Upto 16000
3 D reconstruction	No	Yes

Technical specifications of Cirrus and Copernicus SD – OCT

There are various companies which have come up with Spectral Domain OCT machines. The two chief models of Spectral Domain OCT available in the market are Cirrus OCT and Copernicus OCT.

Features	Cirrus SD OCT	Copernicus SD OCT
Light Source	Super-luminiscent Diode	Super-luminiscent Diode
Wavelength	840 nm	840 nm
Axial resolution	5 ìm	6 ìm
Transverse resolution	15 ìm	18 ìm
A-scan resolution	1024 points	1024 points
Scanning speed	27,000 A Scans/sec	25,000 A-scans/second

Copernicus OCT Protocols

There are 4 different scanning protocols available for the user.

3 D scanning program: consists of a series of 30 to 200 equally spaced parallel line scans over a square region, the size of which you determine. This program enables precise 3 dimensional reconstruction of the Retina. This module gives the most reliable and exact results.

Asterisk scanning program: consists of a series of 2 to 32 equally spaced line scans through a common central axis. This program enables taking scans in high resolution in few directions. The default pattern has 15 lines of 7 mm length. The length of scan lines can be adjusted by adjusting the scan width and number of scans.

Animation scanning program: enables taking number of scans in one place. It is helpful for patients with gaze problem. A cine loop from scanned places can be observed.

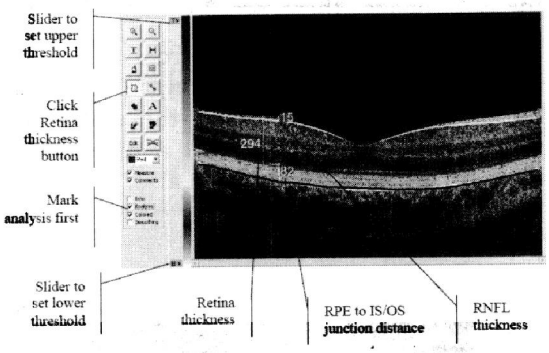
After the scanning program has been selected, the user is able to set the following parameters of the program.

- Number of B scans (Not available for single B scan program)
- Number of A scans per B scan

Generally, 2476 A Scans per B scan and 6 B Scans per second with 7 mm is preset in the Asterisk Scan while 743 A Scans can be taken per B scan with 50 B Scans per second in 3 D imaging.

Retina thickness measurement

The method of analyzing the Retinal thickness is depicted in the following image.



Red line: surface of retina Yellow line: boundary of NFL layer Green line: boundary of IS and OS layer. Sky-blue: boundary of the OS layer Dark blue line: boundary of the RPE layer White line: parabolic fit for end of RPE layer.

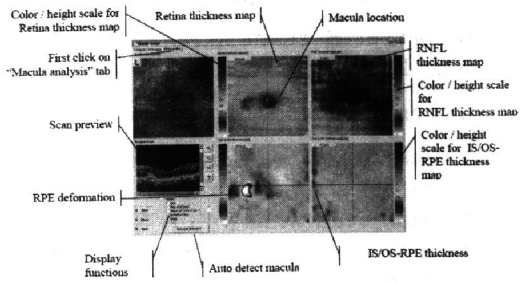
Retina analysis

The Retina analysis option gives 4 different maps

- Retina thickness map
- RNFL thickness map
- RPE deformation map
- IS/OS-RPE thickness map

These graphs give the thickness of the various parts in the form of a colour map where one colour depicts the minimum thickness and the other colour depicts the maximal thickness. There is a gradual

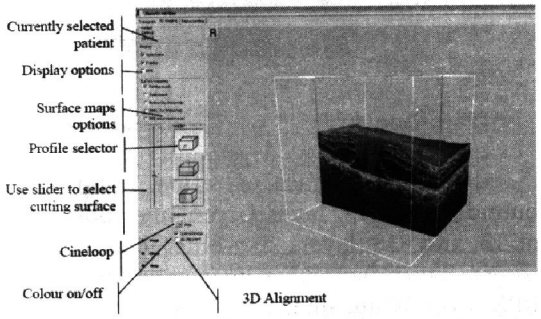
transition from the minimum to the maximum thickness using different colours and shades.



3 D visualization

The 3 D option can be used to take the 3 D image of the Retina and while viewing the 3 D image, there are 3 options.

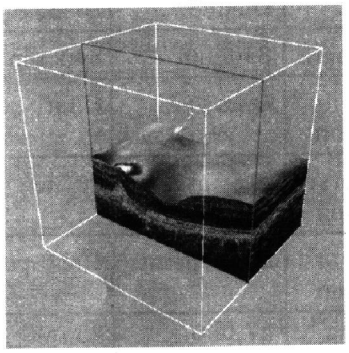
The image can viewed from top, front and side. With the new software, the play button can be pressed and the movie will play showing the different cut sections!!!! It's a lot of fun and very useful also!



Surface mapping

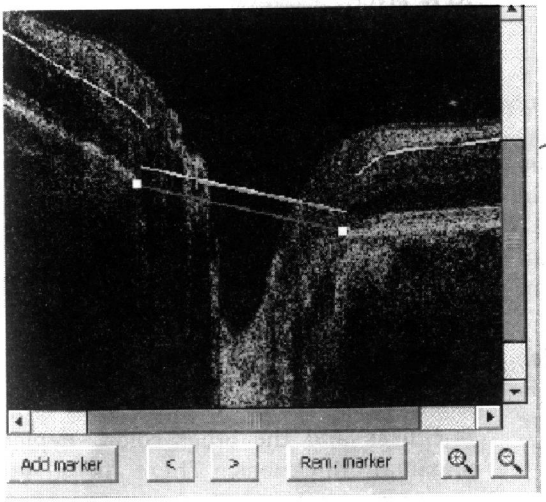
This function enables placing color mask on the surface of retina. It helps to easier locate single tomogram from 3D visualization. Five masks are available:

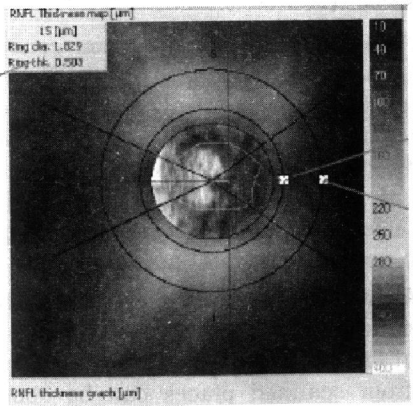
- Fundus mask
- Color mask
- Retina thickness map
- RNFL thickness map
- RPE deformation map

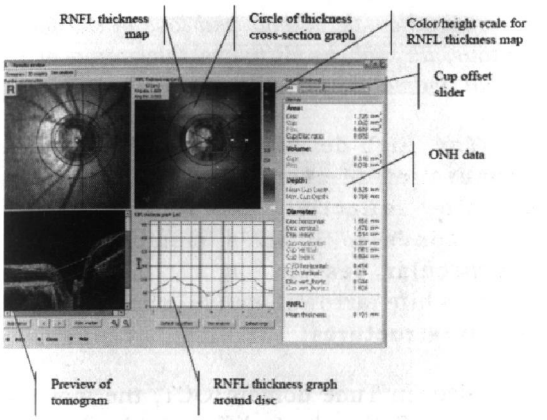


Disc Analysis

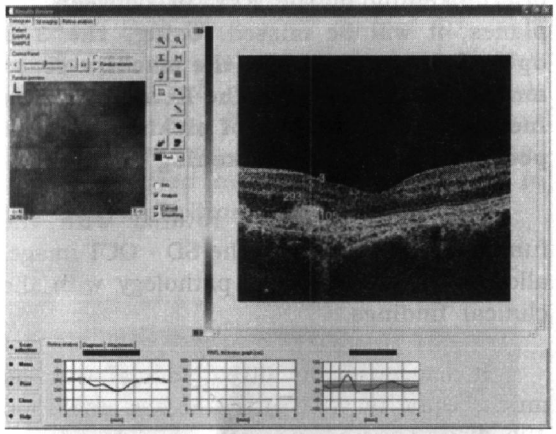
The disc analysis option can be used for the measurement of the RNFL thickness at the Optic disc and also the region around the disc. The region around the Optic disc can be marked with 2 concentric rings. The RNFL thickness can be measured between the 2 concentric rings.







Final Report



The final report can show the following features. The Asterisk Scan with the plane whose OCT image has been selected is shown in a box on the left. If, a 3 D image has been selected then the fundus picture with the plane in which the OCT image has been captured is shown.

The selected OCT image is shown on the right side of the report. Multiple images can be selected and shown

The Retina thickness, RNFL thickness and the RPE deformation graphs can be shown in the bottom of the report.

Also, there is an option for inserting comments at the bottom of the report .

Spectral Domain OCT in various Macular pathologies

1. Macular Hole

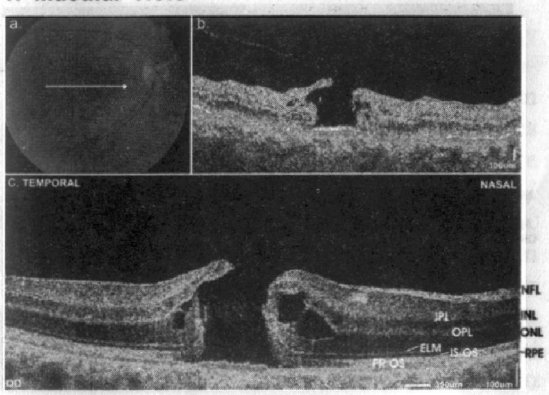


Figure 1

a. A 63-year-old woman diagnosed with a stage 2 full-thickness macular hole in her right eye (OD). Both the StratusOCT image (**b**) and SD - OCT image (**c**) clearly show a macular hole and intraretinal cysts. **The high-definition OCT image enables better visualization of cystic changes and photoreceptor impairment.** ELM = external limiting membrane; INL = inner nuclear layer; IPL = inner plexiform layer; IS/OS = photoreceptor inner segment/outer segment junction; NFL = nerve fiber layer; ONL = outer nuclear layer; OPL = outer plexiform layer; PR OS = photoreceptor outer segments; RPE = retinal pigment epithelium.

2. Macular Microhole

Many patients would complain of metamorphopsia and on examination with Time domain OCT nothing would be picked up. But, with SD-OCT, this new entity is now being picked up.

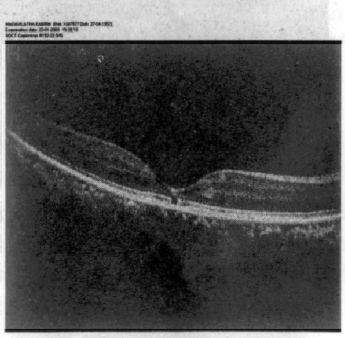


Figure 2

3. ARMD

Dry ARMD

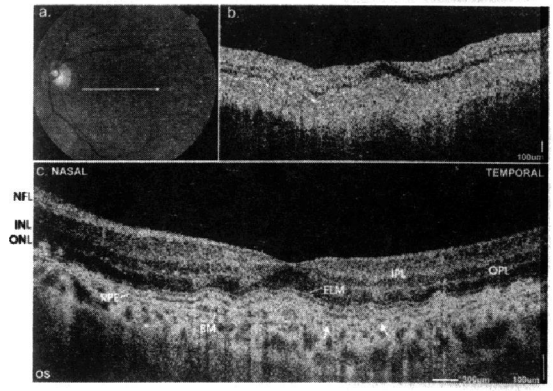


Figure 3: *A 76-year-old man with nonexudative age-related macular degeneration. Clinical examination showed multiple macular drusen in both eyes, which had been stable for the past several years,* ***b,*** *StratusOCT showed irregularities in the retinal pigment epithelium (RPE), representing drusen.* ***c,*** *The SD - OCT image better reveals the true topography of the retina, thereby improving the visualization of RPE irregularities.* ***Bruch's membrane (BM) is clearly visible*** *and labeled.* ***Regions of high reflectivity between BM and the RPE are evident*** *in the temporal region of the image (white arrows)* ***and may represent an early stage of neovascularization.***

Wet ARMD

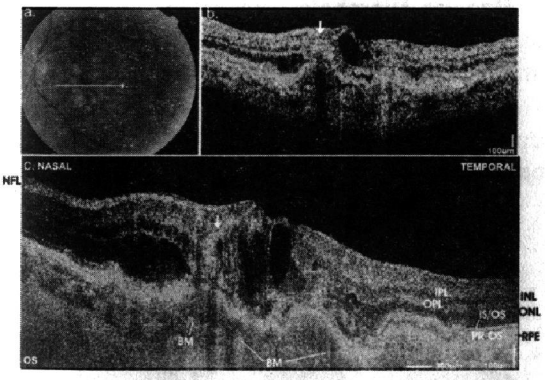


Figure 4: *A 67-year-old man with confluent soft drusen and persistent submacular fluid. StratusOCT* ***(b)*** *and SD – OCT image* ***(c)*** *showed intraretinal cystic edema and loss of the foveal contour, as well as diffusive thickening of the retinal pigment epithelium (RPE).*

The high-definition image improves visualization of cystic changes and shows a thin reflective band that likely corresponds to Bruch's membrane (BM). Neovascular vessels slightly nasal to the fovea (white arrows) **cause shadowing of deeper structures.**

Also, in Time domain OCT, the machine scans the Retina in 6 different planes, so if there was a small pocket of Sub Retinal Fluid, or Thickening of the RPE in between the planes, it will be missed. **Using, the 3 D option of the SD – OCT , the machine scans more than 50 planes of the Retina, thereby increasing the chances of picking up small pockets of SRF or thickening of RPE.**

The image can be rotated with the fundus picture overlying the SD - OCT image, allowing to correlate the pathology with the clinical findings.

It also picks up Vitreo Macular traction much better because of the higher resolution

3. Diabetic Macular Edema

The different patterns seen in Diabetic Macular edema include

- **Diabetic Macular edema with Retinal thickening**
- **DME with cystic changes**
- **DME with a Neuro sensory detachment**
- **DME with Epiretinal membrane**
- **DME with Schisis**

Also, the photoreceptor layer is better visulised with the SD-OCT, thus additional information can be gained.

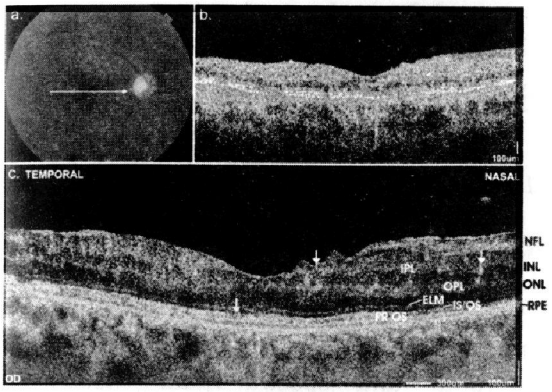


Figure 5
a**. A 37-year-old man diagnosed with proliferative diabetic retinopathy in his right eye (OD). Both StratusOCT (**b**) and SD - OCT (**c**) show hard exudates as highly reflective areas visualized in the intraretinal space (white arrows). **Photoreceptor changes (yellow arrow) and an epiretinal membrane (red arrow) are visualized in the high-definition OCT image.

5. CSR

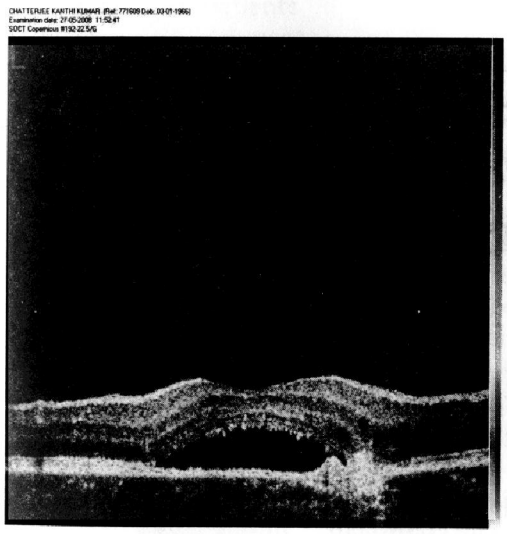


Figure 6

There are many additional features that are picked up with the SD OCT

- **Elongation of the outer segment of the Photoreceptor layer**
- **The features of the photoreceptor layer like granularity and the contour are better appreciated**
- **Also, the RPE features like thickening, thinning, PED etc are better visulaised.**

Conclusion

Spectral Domain OCT is definitely another great tool in the hands of the Vitreo-Retinal surgeon. Due to the higher resolution and better coverage of the Retina, it gives additional information. It provides more details regarding the Photoreceptor layer, IS/OS junction and External limiting membrane. Also, features like small pockets of SRF in CNVM which were being missed earlier with Stratus OCT are now being picked up. This often contributes to the final Clinical decision, making a qualitative difference in the management of the patient

References

1. *D. Huang, E.A. Swanson and C.P. Lin* et al., *Optical coherence tomography,* Science *254 (1991), pp. 1178–1181*
2. *W. Drexler, H. Sattmann and B. Hermann* et al., *Enhanced visualization of macular pathology with the use of ultrahigh-resolution optical coherence tomography,* Arch Ophthalmol *121 (2003), pp. 695–706.*
3. *T.H. Ko, J.G. Fujimoto and J.S. Duker* et al., *Comparison of ultrahigh - and standard-resolution optical coherence tomography for imaging macular hole pathology and repair,* Ophthalmology *111 (2004), pp. 2033–2043.*
4. *G. Wollstein, L.A. Paunescu and T.H. Ko* et al., *Ultrahigh-resolution optical coherence tomography in glaucoma,* Ophthalmology *112 (2005), pp. 229–237.*
5. *E. Ergun, B. Hermann and M. Wirtitsch* et al., *Assessment of central visual function in Stargardt's disease/fundus flavimaculatus with ultrahigh-resolution optical coherence tomography,* Invest Ophthalmol Vis Sci *46 (2005), pp. 310–316.*
6. *T.H. Ko, J.G. Fujimoto and J.S. Schuman* et al., *Comparison of ultrahigh and standard resolution optical coherence*

Dr Rashmin Gandhi India

Dr S Ambika India

Dr Satya Karna India

Dr Navin Jayakumar India

Dr R Banik India

The delegates will participate in following sessions

Afferent visual system

Pupil

Thyroid Ophthalmopathy

Neuroimaging

Ocular motility

Controversies in Neuro Ophthal practise

Neuro Ophthal quiz

Each session will comprise of two key note addresses and 4 case discussions classified in to Basic,Intermediate, Advanced and Obscure! categories.

Please e-mail the

Organizing Secretary
Rashmin Gandhi and S Ambika

if you need further clarifications.

We hope to see you in Chennai

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Potential Acuity Using Heine Lambda Retinometer and Potential Acuity Meter in Cataract patients

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Introduction:

Cataract has been reported to be the cause of blindness in more than 60% of the elderly blind population in south India (Vijaya et al, 2006, Murthy et al, 2005; Nirmalan et al, 2003; Dandona et al, 2001). The treatment for cataract is surgical management. Prediction of potential post operative acuity has always been a challenge to the clinician. Hence it is necessary for the clinician to have a quantitative measure of potential visual acuity of his/her patients.

Green (1970) made the earliest attempt and described Laser generated interference fringes as a potential vision test in cataracts. Later, Minkowsky (198) described Potential Acuity Meter (PAM) using letters optotypes as a potential vision test in cataract patients. This novel method did not require conversion of grating acuity to Snellen acuity. In this aspect it was different from the laser interferometers described by Green. Since then, many studies have attempted to compare the usability of the two instruments in cataract patients. The PAM, undoubtedly a useful instrument in finding potential acuity, has its own disadvantages. Its reliability was found to deteriorate progressively from mild to severe cases (58.3% in mild to 7% in severe cases) by Gus et al (2000). Apart from underestimating visual acuity by at least two lines in severe cataracts (Cuzzani et al, 1998; Gus et al, 2000; Chang et al, 2006), PAM also fails to give an exact prediction of visual acuity in patients having other ocular comorbidity in addition to cataract (Lasa et al, 1995; Gus et al, 2000). The accuracy of the Laser Interferometry (LI) was reported to be less in posterior subcapsular cataract (Lasa et al, 1995) and in severe cataracts (Faulkner, 1983; Lasa et al, 1995). Nevertheless, the advantage of LI remains that it is fast and can be used on illeterate patients as well. The Heine Lambda Retinometer uses this technique of laser interferometry for potential acuity testing. Our study aims at finding the usability of the Heine Lambda Retinometer (HLR) to measure the potential visual acuity in patients undergoing cataract surgery in a hospital based south Indian population.

Instrument:

The Heine Lambda Retinometer works on the principle of Maxwellian view by which a halogen bulb is imaged through a red filter into the patient's pupil. The grids with variable spacing can be positioned in the parallel beam of the Maxwellian view resulting in a circular test pattern with equally spaced red and black lines on the retina. The orientation of the lines can be chosen from four options by means of a knob. The grating constant (the inverse of spatial frequency) can be varied in Snellen steps using another knob. The subject will look in to the instrument and report the orientation of the grating. The smallest grating constant at which the subject gives the correct response is considered the potential acuity of the subject. The acuity range is from 20/300 to 20/25 in 6 steps. The model used in the study is a handheld model of the retinometer.

The manufacturers recommend no refractive correction for up to 6D of ametropia and hence the same protocol was followed in our study.

Methods:

Approval was obtained from the Research and Ethics Subcommittees of Vision Research Foundation prior to the commencement of the study. Signed informed consent was obtained from all the participants before enrolling them into the study. 27 Subjects who had been selected as fit to undergo a cataract surgery based on the clinician's decision were recruited from the surgery fixing center. Subjects with cataract who had a visual acuity of 3/60 or better on Snellen chart were enrolled for this study. Subjects with other ocular comorbidities were excluded from the study. Subjects who developed complications during or following the cataract surgery were excluded from the study. Further, patients having tremors, nystagmus and debility were excluded. The type of cataract surgery was not a criterion for selection or rejection of subjects in this study. Potential acuity was found using PAM and HLR for all subjects who met the inclusion criteria. Signed informed consent was obtained from all the patients prior to testing. All patients underwent the HLR procedure first followed by testing g with PAM. This was done so because the PAM is more time consuming procedure than HLR as the number of acuity levels in more in PAM. The patient was followed up till he/she returned for refraction post-operatively. The post-operative visual acuity and other relevant information were noted in a pre-designed Proforma. The post-operative best corrected visual acuity (BCVA) was compared with the predictions of PAM and HLR. The acuities obtained using the Heine Lambda Retinometer and the PAM pre-operatively were compared with the BCVA obtained on the day of the glass appointment using the Altman Bland analysis. All visual acuity scoring were converted into logMAR units before analysis.

Results:

The mean visual acuity as predicted by PAM and HLR were found to be 0.17 ± 0.073 and 0.15 ± 0.065 respectively. The PAM and HLR consistently underestimated the visual acuity by more than 0.1 logmar (0.14 and 0.12 logmar respectively). Two by two tables were constructed to find the accuracy of PAM and HLR at two cut off levels of 6/9 (0.1760) and 6/7.5 (0.0969) of BCVA. PAM showed an accuracy of 77.8% and 44.4% in the 6/9 and 6/7.5 cutoff levels respectively. HLR had an accuracy of 88.9% and 55.6% at the 6/9 and 6/7.5 cutoff levels respectively. Altman and Bland analysis was also done and it showed good equivalence between HLR and BCVA (Fig 1). But no such equivalence was found between PAM and BCVA. (Fig 2)

Non-parametric tests were done to compare the HLR, PAM and BCVA. Statistically significant differences were found between the logmar acuity of HLR and Post-operative BCVA (Wilcoxon test, $p<0.0001$). Similar statistically significant difference was found between logmar acuity of PAM and post-operative BCVA (Wilcoxon test, $p<0.001$).

Correlation between differences in PAM acuity and BCVA against BCVA was performed; similar correlation was calculated for HLR. Spearman correlation showed a negative correlation for both PAM and HLR ($r = -0.556$, $p=0.003$ & $r = -0.80$, $p<0.001$ respectively). This shows that the predictions of both instruments become more accurate as the prognosis becomes better. This is also shown in figures 3 & 4.

Discussion:

The HLR is good instrument to find out the potential acuity in cataract patients. It is reported to have a better accuracy than the PAM. Also, difference in acuity as predicted by HLR was less than that by PAM. But it needs to be considered that the HLR uses grating acuity and subsequent Snellen conversion. Since grating acuity is generally known to over estimate the visual acuity, (Gstalder and Green 1971, Friedman et al

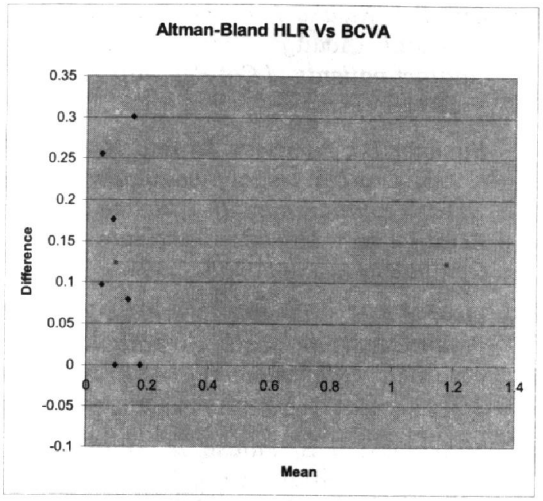

Figure 1-Showing Altman Bland analysis for equivalence between HLR and Post-Operative BCVA

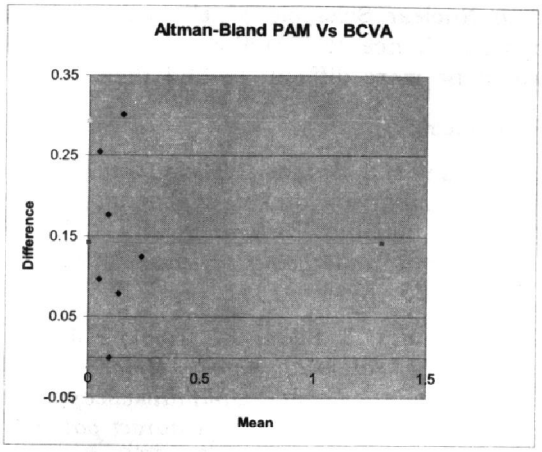

Figure 2 - Showing Altman Bland analysis for equivalence between PAM and Post-Operative BCVA

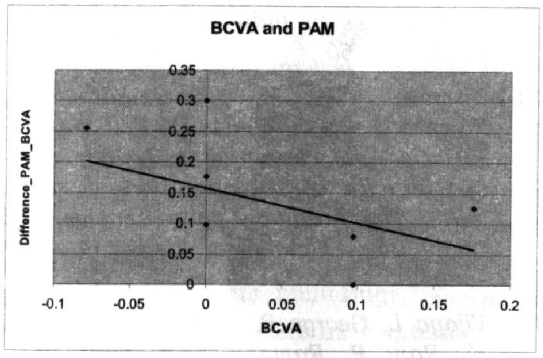

Figure 3 - Showing Best Correted Post-operative visual acuity in relation with the difference between predicted and BCVA for PAM

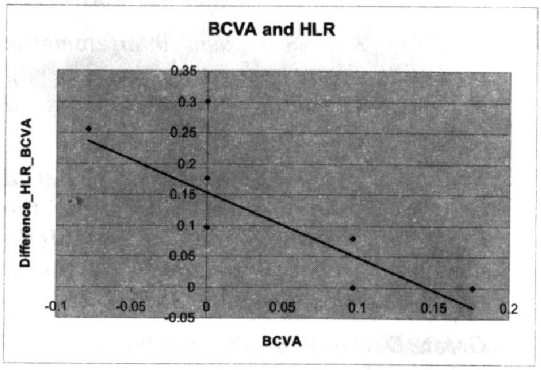

Figure 4 - Showing Best Corrected Post-operative visual acuity in relation with the difference between predicted and BCVA for HLR

2004, Kushner 1995) the lesser difference predicted by HLR as compared to PAM is only questionable. Nevertheless, many of the participants reported HLR to be more easily comprehensible and lesser time consuming than PAM. Both the instruments are more accurate if the prediction of post-operative visual acuity is 6/9 or higher. Hence, both PAM and HLR can be relied upon in clinical practice if the visual acuity predicted is higher than 6/9. The performances of both instruments were the same if the pre-operative visual acuity was more than 3/60.

Cataract is a growing concern in India and the age of onset is earlier than in many of the western countries (Nirmalan et al, 2003). Hence the behaviour of the instruments was compared in the Indian population for the first time. The findings are mostly consistent with previous studies except that the underestimation reported by earlier studies is exaggerated in our study. This is probably because of the higher prevalence of Posterior Sub-Capsular Cataract (Wong et al, 2005) than in other population. PSC is a more scattered opacity

than Nuclear Sclerosis which is a localized opacity. Hence the window of clear space would be more difficult to find than in NS.

References:

1. *Chang M A, Airiani S, Miele D et al (2006) A comparison of Potential Acuity Meter and Illuminated Near Acuity Card in patients undergoing phacoemulsification. Eye 20: 1345 – 1351*
2. *Cuzzani O E, Ellant J P, Young P W et al (1998) Potential Acuity Meter versus Scanning Laser Ophthalmoscope to predict visual acuity in cataract patients. J Cat Ref Surg 24: 263 – 269*
3. *Dandona L, Dandona R, Srinivasa M, Giridhar P, Vilas K, Prasad M N, John R K, McCarty C A, Rao G N (2001) Blindness in the Indian state of Andhra Pradesh. Invest Ophthalmol Vis Sci 42: 908 – 916*
4. *Faulkner W (1983) Laser interferometric prediction of post-operative visual acuity in patients with cataracts. Am J Ophthalmol 95: 626 – 636*
5. *Friedman DS, Munoz B, Massof RW et al (2002) Grating Visual Acuity using the Preferential looking method in Elderly nursing Home Residents. Invest Ophthalmol Vis Sci 43: 2572 - 2578*
6. *Green D G (1970) Testing the vision of cataract by means of laser generated interferometric fringes. Science 168: 1240*
7. *Gstalder and Green (1971) Laser Interferometric Acuity in Amblyopia. J Ped Ophthalmol 8(4): 251 - 256*
8. *Gus P I, Kwitko I, Roehe D et al (2000) Potential Acuity Meter accuracy in cataract patients. J Cat Ref Surg 26: 1236 – 1241*
9. *Kushner BJ, Lucchese NJ and Morton GV (1995) Grating visual Acuity with Teller Cards compared with Snellen Visual Acuity in Literate patients. Arch Ophthalmol 113(4): 485 - 493*
10. *Lasa M S M, Datiles M B, Freidln V (1995) Potential vision tests in patients with cataract. Ophthalmology 102: 1007 – 1011*
11. *Minkowski J S, Palese M, Guyton D L (1985). Potential Acuity Meter using a minute aerial pinhole aperture, Ophthalmology 90:1360 – 1368*
12. *Murthy G V S, Gupta S K, Bachani D, Jose R, John N (2005) Current estimates of blindness in India. Br J Ophthalmol 89:257 – 260*
13. *Nirmalan P K, Krishnadas R, Ramakrishnan R, Thulasiraj R D, Katz J, Tielsch J M, Robin A L (2003) Lens opacities in rural population of south India: The Aravind Comprehensive Eye Study. Invest Ophthalmol Vis Sci 44: 4639 – 4643*
14. *Vijaya L, George R, Arvind H, Baskaran M, Raju P, Ramesh S V, Paul P G, Kumaramanickavel G, McCarty C (2006) Prevalence and causes of blindness in rural population of the Chennai Glaucoma Study. Br J Ophthalmol 90: 407 – 410*
15. *Wong T Y, Loon S-C, Saw S-M (2006) The epidemiology of age related eye diseases in Asia. Br J Ophthalmol 90: 506-511*

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New technology: Pattern Scan Laser

Chinmaya Sahu and Swakshyar Saumya Pal, Department of Vitreoretinal Services

Introduction

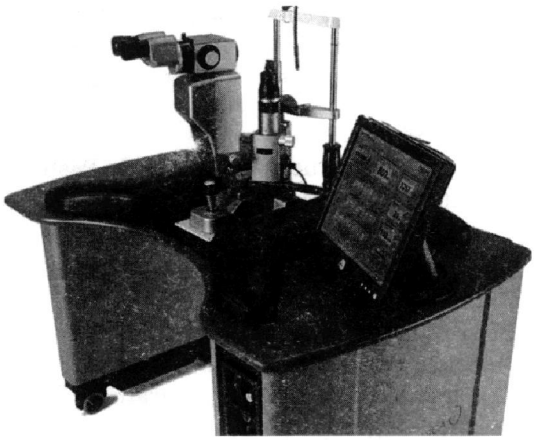
Laser photocoagulation remains the gold standard in the treatment of many retinal disorders. Conventional photocoagulation uses a single application of laser energy per shot and is usually delivered as a 100–200 ms duration burn. The PASCAL® (Pattern Scan Laser) Photocoagulator is a fully integrated pattern scan laser system designed to treat retinal diseases using a single spot or a predetermined pattern array of up to 56 spots.To achieve this, the pulse duration of each burn is reduced to 10–20 ms.

The PASCAL technology platform is based upon the use of a proprietary, semi-automated, pattern generation method employing short 532 nm laser pulses. These laser pulses are delivered in a rapid predetermined sequence resulting in improved precision, safety, patient comfort, and a significant reduction in treatment time compared with single-spot photocoagulation.

This fully integrated system incorporates design advancements including:

- Intuitive touch screen user interface
- Pattern scanner technology
- Advanced optics slit lamp
- Slit lamp mounted micromanipulator
- Dual slit lamp mounted rotary power controls
- PrecisionSpot™ laser delivery
- LIO compatible
- Wheelchair accessible table

Ergonomic features for physician and patient



Technical features: Comparing PASCAL with conventional

Technical features	PASCAL	Conventional
Laser	Frequency-Doubled Nd : YAG Diode-Pumped Solid State	Frequency-Doubled Nd : YAG Diode-Pumped Solid State
Wavelength	532 nm	532 nm
Patterns	Single Spot, Square Arrays, Octants, Quadrants, Full and Focal/Modified Macular Grids, Triple Arcs, Arcs	Single spot
Power	0 – 2000 mW delivered to corneal plane (in air)	0- 1500 mW
Treatment Pulse Durations	10 – 1000 ms	90ms – 2500 ms
Maximum spots per session	Upto 1200	600 -700

Controls and Displays

The main control panel is a liquid crystal display (LCD) with touch-screen control for the selection system parameters, such as Aim Beam intensity, Power, Exposure Time, System Status and Shut Down. At all times the system status - STANDBY, READY, or TREATMENT - is displayed.

The touch screen display is located on the slit lamp table and may be positioned as desired. The key switch, emergency shut off and table height adjustment are found on the front right-hand panel of the system base.

The position of the slit lamp microscope is controlled by a mechanical joystick. The size of the pattern can be adjusted depending on physician preference. The laser emission is ultimately controlled by the footswitch

Indications

PASCAL can be used for both Posterior and Anterior segment cases. The indications are as follows

- Proliferative and non proliferative diabetic retinopathy
- Choroidal neovascularization
- Branch and central retinal vein occlusion
- Age-related macular degeneration
- Lattice degeneration
- Retinal tears and detachments
- RAP
- CSR

In addition, the PASCAL Method can be used to perform:

- Iridotomy
- Iridectomy
- Trabeculoplasty in angle closure and open angle glaucoma

Treatment patterns

Upto five predetermined pattern types are available on PASCAL. They are

Square Arrays : Panretinal Photocoagulation

- 2x2 to 5x5 spot pattern delivery per foot pedal depression

Triple Arcs : Retinal Tears, Lattice Degeneration and PRP

- User variable radius and segment control

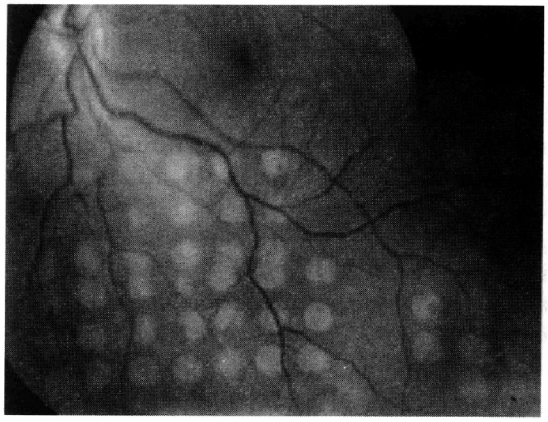
Focal / Modified Macular Grids : Macular Treatments

- Pattern subset of the Macular Grid with 4 concentric arcs

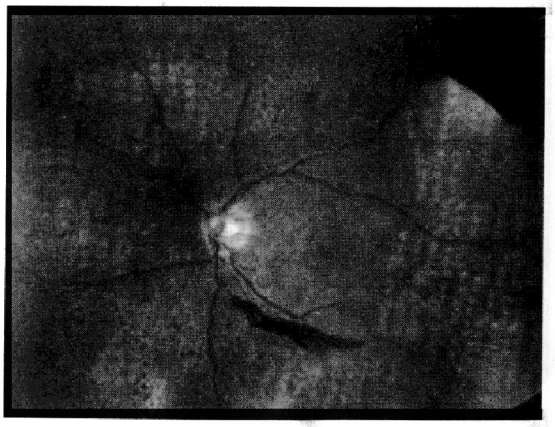
Full Macular Grids : Macular Treatments

- Pattern of 4 concentric rings totaling 56 spots encircle the fovea
- Smallest spot pattern diameter is greater than 2000 µm ("safety zone")
- Optional blinking fixation beam can be utilized to aid patient fixation

Single Spot : For all Conventional Treatments



Pan retinal photocoagulation for proliferative diabetic retinopathy. These 600 micron burns were obtained by using a 3x3 array.



Pan retinal photocoagulation for proliferative diabetic retinopathy. These 600 micron burns were obtained by using a 3x3 array.

Advantages of PASCAL laser

Speed

More efficient than standard single shot photocoagulation.

Improved Comfort

Patients are likely to experience less discomfort and therefore have more tolerance for the procedure.

Advanced Precision

Macular Grid treatment provides an improved margin of safety and dosimetry control when compared with single shot treatments. Unlike the irregular pattern placement obtained in single shot photocoagulation, PASCAL delivers more even pattern burns.

Ease of Use

The PASCAL Method of photocoagulation is similar to single shot photocoagulation, therefore physician training is minimal.

Our Experience

We have been doing laser with PASCAL system since October last year. Since then we have done over 300 procedures. The most common indication for which we have used PASCAL is Pan Retinal photocoagulation for Diabetic Retinopathy. We have also used PASCAL for barrage for Lattice, CNVM, Retinal Angiomatous Proliferans and other rare conditions. While doing PRP, the duration is set at 20 ms and spot size at 200 microns. As, the duration selected is less, the power required is much higher compared to conventional laser. But, the fluence which is power/area is much less for PASCAL as compared to conventional for the same spot size. As a result, the patient feels less pain, more number of burns can be applied per session and even if burns are accidentally applied over vessels, it does not cause as much damage. While doing laser for Diabetic Macular edema, the duration is set at 10ms and the spot size is 100 microns. We prefer doing either focal to microaneurysms or modified grid pattern. PASCAL system increases the speed of the procedure, causes less pain and is much more safe than the conventional system of laser.

SANKARA NETHRALAYA

invites you to participate in

Neuro Ophthalmology Update 2009

This galaxy of International faculty has been achieved to help provide a view of Neuro Ophthalmology to Indian ophthalmologists. The meeting will be held at the Sankara Nethralaya,Chennai on January 25 and 26, 2009.

The faculty list:

Dr Andrew lee USA

Dr David Zee USA

Dr Gordon Plant UK

Dr Helmut Wilhelm Germany

Dr Lingam Gopal India

Dr Neil Miller USA

Dr Peter Savino USA

Dr Prem Subramanian USA

Dr Robert Daroff USA

Dr Ulrich Schiefer Germany

Dr Vimla Menon India

AND

Dr Rashmin Gandhi India

Dr S Ambika India

Dr Satya Karna India

Dr Navin Jayakumar India

Dr R Banik India

The delegates will participate in following sessions

Afferent visual system

Pupil

Thyroid Ophthalmopathy

Neuroimaging

Ocular motility

Controversies in Neuro Ophthal practise

Neuro Ophthal quiz

Each session will comprise of two key note addresses and 4 case discussions classified in to Basic,Intermediate, Advanced and Obscure! categories.

Please e-mail the

Organizing Secretary
Rashmin Gandhi and S Ambika

if you need further clarifications.

We hope to see you in Chennai

Rashmin
Ambika

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LAST PAGE

Teleophthalmic Pathology in Sankara Nethralaya

Jyotirmay Biswas, Department of Ophthalmic Pathology

Telecommunications technologies offer new ways of delivering health care to individuals in remote communities and the usefulness of telemedicine (TM) is increasingly being studied for a variety of medical conditions. TM technologies are applicable in ophthalmology because standard ophthalmic instruments can be modified to capture and store images that can be digitized and transmitted for expert evaluation. TM can also be used to examine live patients using sophisticated video conferencing devices to transmit real-time images. As such, TM has been used in the assessment of diabetic retinopathy, human immunodeficiency virus-related retinopathy, glaucoma, cataract, ocular surface disorders, and in the follow-up of corneal transplant patients.

Tele pathology is defined as the practice of interactive diagnostic pathology performed at a remote location by viewing images on a visual display unit instead of directly on bright field light microscope. The concept of using video microscopy to provide diagnostic services to remote locations was first described in the USA in 1968, when monochrome images were transmitted in real time using a dedicated point to point microwave link.

Telepathology systems can be divided into dynamic telepathology (DT) and static telepathology (ST). In the DT systems, images are seen interactively on line as they are captured from the microscope. In contrast ST techniques use static images, which have been captured and achieved in a digital format and made available for access from a remote location.

Diagnostic accuracy of telepathology has been found to be 68.8% to 92% in frozen section and 86% to 96.4% in permanent section. Time taken for telepathology diagnosis is in average 4.7minutes.

The images can be saved in JPG format. Images should be taken in different magnifications. Ideally a gross photographs and microphotographs at 10X, 20X, 40X should be taken. Number of images can be many, best resolution can be obtained in 800X600 pixels atleast 500x300 pixels.

What you need from your end is a digital camera such as Nikon, Coolpix 4500, 4.0 MEGA pixels, 4x zoom. The correct interpretation depends entirely of the quality images you send to us. Make a short history of the patient along with all relevant data. Name may be withheld if needed and some short identification such as age, sex, site of biopsy is essential. Your finding and your working diagnosis is desirable. Please mention also your problems regarding the diagnosis of the case in the comments.

Please send the images with relevant history to our email: histopath@snmail.org or drjb@snmail.org. We will reply back to your email.

REFERENCES:

1. *Weinberg D.S.: How is telepathology being used to improve patient care? Clinical chemistry 42.5 : 831-835 ;1996*
2. *Onguru,O, Celasun B: Intra – Hospital use of a telepathology system. Pathology oncology research: Vol.6, No.3, 2000.*