IPS 2008 奈良

PROGRAM & ABSTRACT BOOK

18th International Visual Field & Imaging Symposium

May 21-24, 2008

PROGRAM & ABSTRACT BOOK

International Perimetric Society

Perimetry is the quantitative evaluation of the visual field. The aim of the IPS is "To promote the study of normal and abnormal visual function in the entire visual field, and to ensure and facilitate the cooperation and friendship of scientists of different countries working and interested in this discipline."

Previous Symposia

1974: Marseiles, France
1976: Tübingen, Germany
1978: Tokyo, Japan
1980: Bristol, UK
1982: Sacramento, CA, USA
1984: Santa Marguerita Ligure, Italy
1986: Amsterdam, The Netherlands
1988: Vancouver, Canada
1990: Malmö, Sweden
1992: Kyoto, Japan
1994: Washington, D.C., USA
1996: Würzburg, Germany
1998: Gardone Riviera, Italy
2000: Halifax, Canada
2002: Stratford upon Avon, UK
2004: Barcelona, Spain
2006: Portland, OR, USA

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Welcome to Nara

Dear Colleagues & Friends:

It is my great pleasure to welcome you to the 18th Visual Field Symposium of the International Perimetric Society, IPS 2008. To date, the IPS symposium has been held twice in Japan: the 3rd IPS was held in Tokyo in 1978 and the 10th IPS was held in Kyoto in 1992. Through the IPS meetings, we have been witnesses to the remarkable development of perimetric and imaging technology in the past 30 years.

Our host city for IPS 2008, Nara City, was Japan's first capital and remains a beautiful and ancient city dotted with numerous temples and shrines of great historical significance. Most of these are located within the extensive grounds of Nara Park. The city is symbolized by the delightful presence of more than one thousand deer, regarded as messengers of the gods, who roam freely in the park. Located in the center of Nara Park is Nara Prefectural New Public Hall, the venue of IPS 2008. The symposium will take place in a traditional Noh Theatre that serves as a multipurpose facility within the public hall.

The Program Committee has prepared an excellent scientific program. The fifth IPS lecture, presented by Professor Fritz Dannheim, is entitled "The Evolution of the Optic Disc Analysis: Past, Presence and Outlook". The special presentation for the Aulhorn Lecture will be given by Professor Anders Heijl and is entitled "How Better Perimetry Can Improve Glaucoma Management". As part of the social program, we will offer a guided walking tour of Nara Park that includes the most important sites, Todaiji Temple and Kasuga Taisha Shrine.

In addition to the scientific and social programs, we will have exhibit booths and featured presentations at the sponsored morning and luncheon seminars. The Society is grateful to all the sponsors. Their tremendous support and cooperation have helped in putting together all the components of a successful meeting.

We encourage you to take full advantage of this opportunity to meet and develop relationships with the finest professionals in the field amid the unique atmosphere of IPS 2008. At the same time, we invite you to enjoy the renowned attractions of beautiful Nara City.

Nara City and I welcome you to Japan!

Chota Matsumoto

Chota Matsumoto, M.D.
IPS 2008 Local Host
Department of Ophthalmology
Kinki University School of Medicine
Japan Perimetric Society

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Prof. Franz Fankhauser
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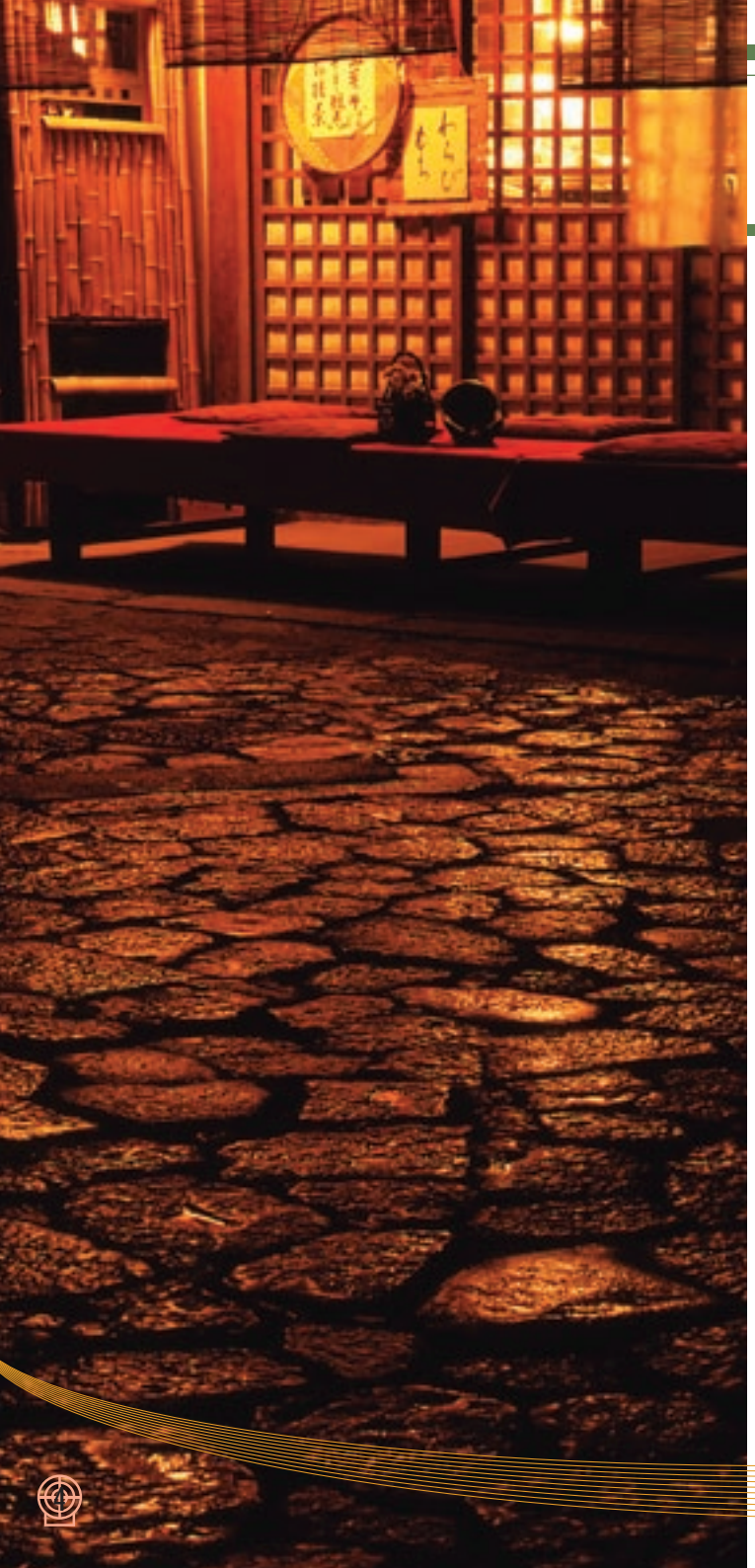


Meeting Information

Venue

Nara Prefectural New Public Hall
101 Kasugano-cho, Nara City, Japan 630-8212
Phone: +81-742-27-2630
Fax: +81-742-27-2634

Official Language

English (English-Japanese simultaneous interpretation provided)

Registration

On-Site Registration Fees are:

IPS Members	60,000 JPY
Non Members	70,000 JPY
Residents/Fellows*	45,000 JPY
Accompanying Persons	45,000 JPY

* Residents/Fellows must submit an official university certificate or letter, in conjunction with their registration, which confirms their status. Documentation must come from a supervisor, or department head.

Registration Entitlement

For IPS Members, Non Members, Residents/ Fellows

- Congress Kit, including a set of official publications
- All Scientific Programs/Exhibition
- Welcome Party on May 21
- "Shikayose" (Deer Gathering) on May 23
- "Noh" Performance on May 23
- Conference Tour on May 23
- Closing Banquet on May 24
- Morning/Luncheon Seminars
- Coffee Breaks

For Accompanying Persons

- Welcome Party on May 21
- "Shikayose" (Deer Gathering) on May 23
- "Noh" Performance on May 23
- Conference Tour on May 23
- Closing Banquet on May 24
- Coffee Breaks

Registration Desk

The registration desk for the meeting is located in the lobby on the first floor of the Nara Prefectural New Public Hall. Registration desk opening hours are:

May 21	12:00-18:00
May 22	8:00-17:30
May 23	8:00-13:30
May 24	8:00-17:30

Name Badge

All registered attendees will receive a name badge. Please wear the badge for all meeting activities.

General Information Desk

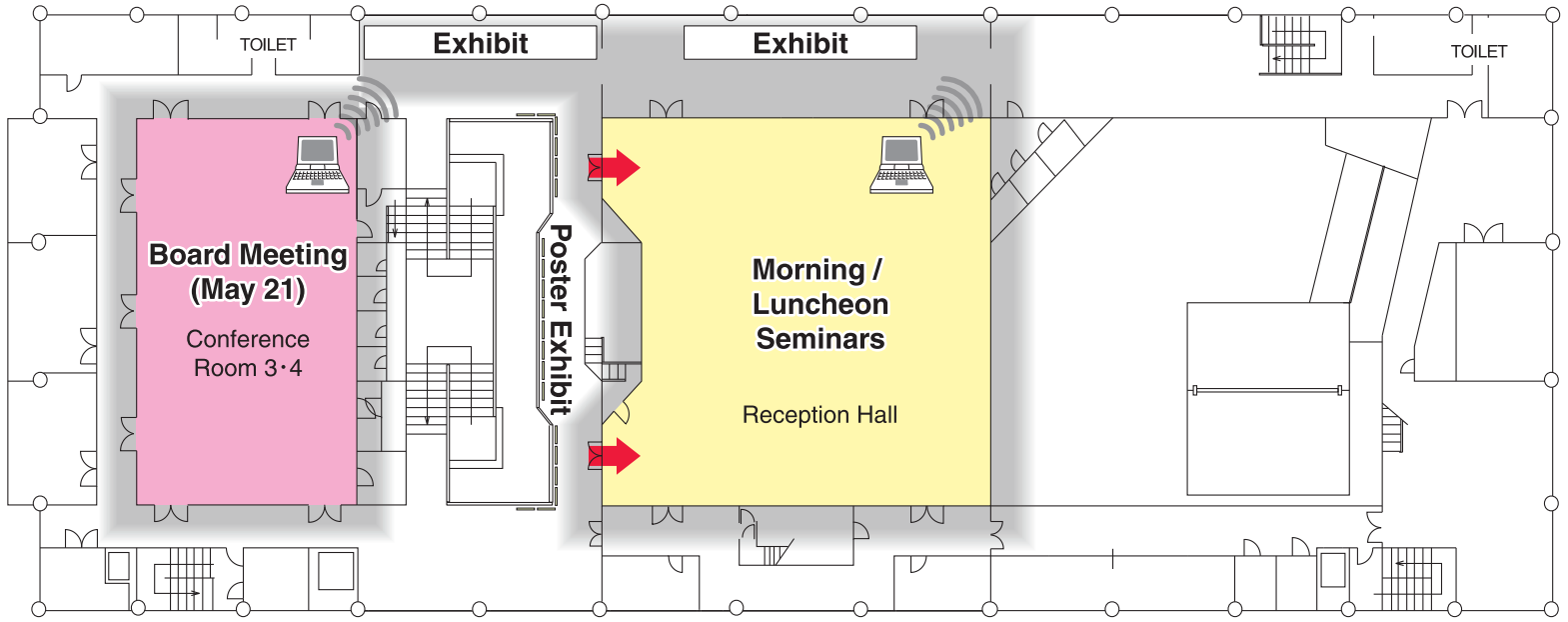
Inquiries concerning the meeting may be made at the general information desk located next to the registration desk.

Tour Desk

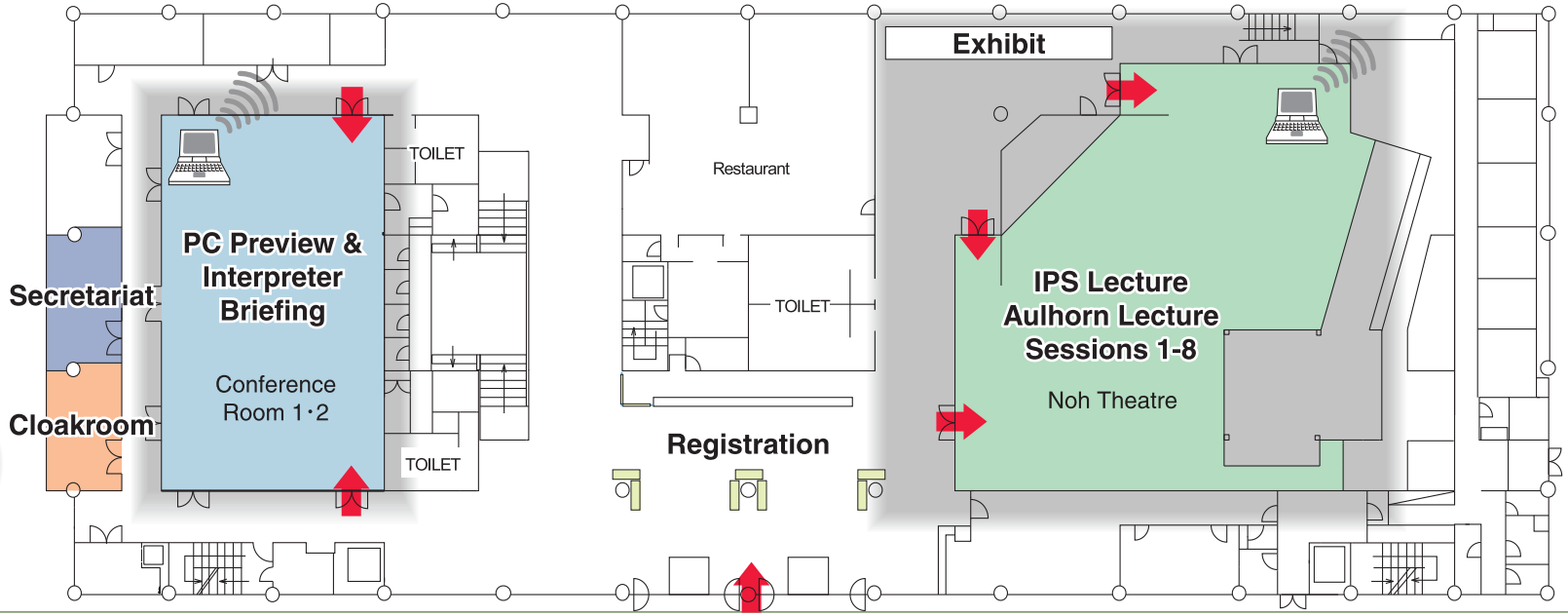
Inquiries concerning hotel accommodations, transportation or accompanying persons' programs may be made at the tour desk, located near the registration desk.

Floor Plan Nara Prefectural New Public Hall

Second Floor



First Floor



Wireless internet access available

Social Events

Wednesday, May 21

Welcome Party

Time: 17:30-19:30
Location: Nara Prefectural New Public Hall
Fee: included
Dress: Casual

Welcome Party will be held in a beautiful garden of Nara Prefectural New Public Hall. Let the networking begin whilst you enjoy food and drink. Fee is included in registration. The party is open to all food and drink registered participants.

Thursday, May 22

Japanese Dinner

Time: 18:00-
Location: Heijo
Fee: 13,000 JPY
Dress: Casual

Seats are limited in number and are available on a first-come-first-served basis.

You can enjoy a wide variety of traditional Japanese dishes in a tatami-mat room full of atmosphere.

Shuttle bus services will be provided to and from the event sites. (See page 10 for details.)

Friday, May 23

"Shikayose" (Deer Gathering)

Time: 7:30-7:50
Location: Tobihino, Nara Park
Fee: included

With a French horn tone, many deer will flock from various quarters. The event of Deer Gathering dates from 1892.

"Noh" Performance

Time: 13:10-13:40
Location: Nara Prefectural New Public Hall
Fee: included

Noh is a traditional Japanese performing art which developed in the 14th century.

Walking Tour in Nara Park

Time: 13:50-
Location: Todaiji Temple (Daibutsuden Hall, Nigatsudo Hall), Kasuga Taisha Shrine
Fee: included
Dress: Casual

The local organizing committee offers a guided walking tour of Nara Park. The tour is included in the registration fee and is open to all registered participants.

Saturday, May 24

Closing Banquet

Time: 19:00-
Location: Banquet Room HITEN, Hotel Nikko Nara
Fee: included
Dress: Smart Casual

Closing Banquet will be held at Hotel Nikko Nara as a finale to IPS 2008.
Following the meal, we will enjoy the traditional national singing. Fee is included in registration. The banquet is open to all registered participants.

General Information

Banks
Banks are open from Monday to Friday, 9:00-15:00 (Closed on Saturdays, Sundays and national holidays). Some automatic teller machines (ATMs) are available for cash withdrawal by credit card everyday (except national holidays) from 9:00 to 19:00 at almost all major banks.

Climate
The temperature in Nara in May typically ranges between 20-25 degrees centigrade during the day.

Credit Cards
Visa, MasterCard, American Express, and Diners Club cards are widely accepted at hotels, department stores, shops, and restaurants as well as at major train stations.

Currency
Most currencies and traveler's checks can be exchanged at international airports, large branches of major banks, and hotels. A passport may be required for currency exchange services.

Electricity
100 volts alternating current at a frequency of 60 Hz. is used in western Japan.

Insurance
The Organizing Committee will assume no liability whatsoever for injury or damage to persons or property during the Congress. Please make your own arrangements for health insurance and any other necessary insurance.

Postal Service
Hotels often provide simple postage services. Post offices are open from Monday to Friday, 9:00 to 17:00.

Time
Japan Standard Time is 9 hours ahead of UTC (Coordinated Universal Time).

Tipping and Consumption Tax
Tipping is not customary in Japan. However, major restaurants or hotels may add a 10% to 15% service charge to your bill. A 5% sales tax is already included in the prices shown.

Map of Downtown Nara

Symposium Venue:

Nara Prefectural New Public Hall

From Hotel Nikko Nara / Nara Washington Hotel Plaza

A 40-minute walk or a 15-minute ride by taxi

From Nara Hotel

A 15-minute walk or a 10-minute ride by taxi

Shuttle Bus Services

Wednesday, May 21

To Symposium Venue: (For Welcome party)	Nara Hotel	→	Nara Prefectural New Public Hall	
	17:00		**17:10**	
	Hotel Nikko Nara	→	Nara Prefectural New Public Hall	
	17:00		**17:15**	
From Symposium Venue:	Nara Prefectural New Public Hall	→	Nara Hotel	
	20:15		**20:25**	
	Nara Prefectural New Public Hall	→	Hotel Nikko Nara	
	20:15		**20:30**	

Thursday, May 22

To Symposium Venue:	Nara Hotel	→	Nara Prefectural New Public Hall	
	7:45		**7:55**	
	Hotel Nikko Nara	→	Nara Prefectural New Public Hall	
	7:40		**7:55**	
From Symposium Venue:	Nara Prefectural New Public Hall	→	Nara Hotel	
	17:45		**17:55**	
	Nara Prefectural New Public Hall	→	Hotel Nikko Nara	
	17:45		**18:00**	
From Symposium Venue to Japanese Dinner Venue:	Nara Prefectural New Public Hall	→	Japanese Dinner*	
	17:35		**17:55**	

* After Japanese Dinner, buses will be provided to Nara Hotel/Hotel Nikko Nara.

Friday, May 23

To Shikayose (Deer Gathering) Area:**	Nara Hotel	→	Shikayose (Deer Gathering)	
	7:05		**7:15**	
	Hotel Nikko Nara	→	Nara Prefectural New Public Hall	
	7:00		**7:15**	
To Symposium Venue:	Nara Hotel	→	Nara Prefectural New Public Hall	
	7:45		**7:55**	
	Hotel Nikko Nara	→	Nara Prefectural New Public Hall	
	7:40		**7:55**	
From Symposium Venue:	Nara Prefectural New Public Hall	→	Nara Hotel	
	17:40		**17:50**	
	Nara Prefectural New Public Hall	→	Hotel Nikko Nara	
	17:40		**17:55**	

Saturday, May 24

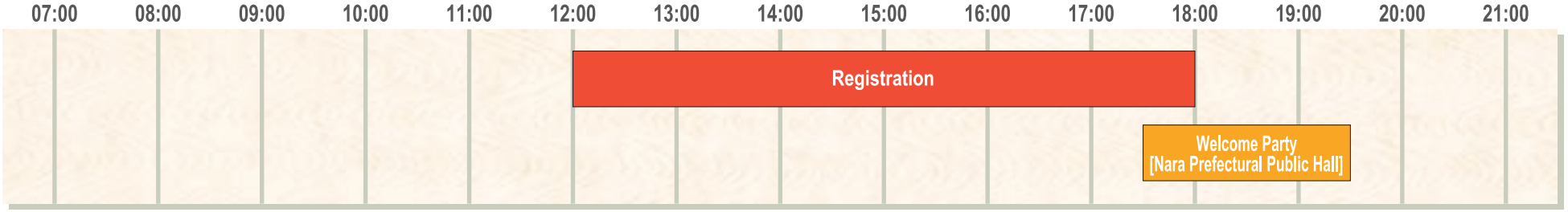
To Symposium Venue:	Nara Hotel	→	Nara Prefectural New Public Hall		
	7:45		**7:55**		
	Hotel Nikko Nara	→	Nara Prefectural New Public Hall		
	7:40		**7:55**		
From Symposium Venue to Closing Banquet Venue:	Nara Prefectural New Public Hall	→	Nara Hotel	→	Hotel Nikko Nara
	17:40		**17:50 18:35**		**18:50**
	Nara Prefectural New Public Hall	→	Hotel Nikko Nara		
	17:40		**17:55**		
From Closing Banquet Venue:	Hotel Nikko Nara	→	Nara Hotel		
	21:30		**21:45**		

**Shikayose area is within walking distance of Nara Hotel and Nara Prefectural New Public Hall. Those who stay at Nara Hotel will be guided to the area.

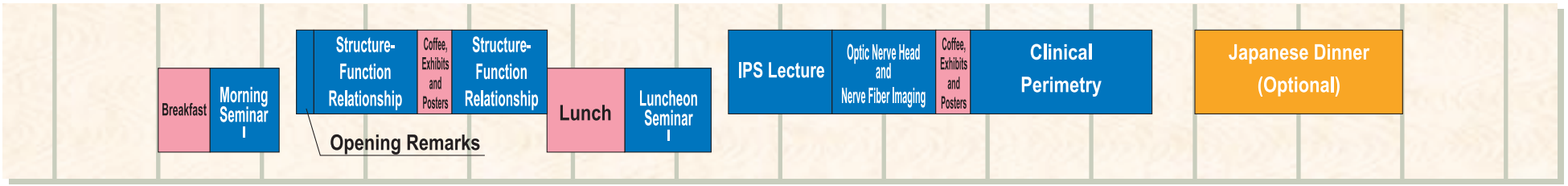
- Those who stay at Nara Washington Hotel Plaza, please take the buses departing and arriving at Hotel Nikko Nara.
- The bus schedule is subject to change depending on the event schedule.

Program at a Glance

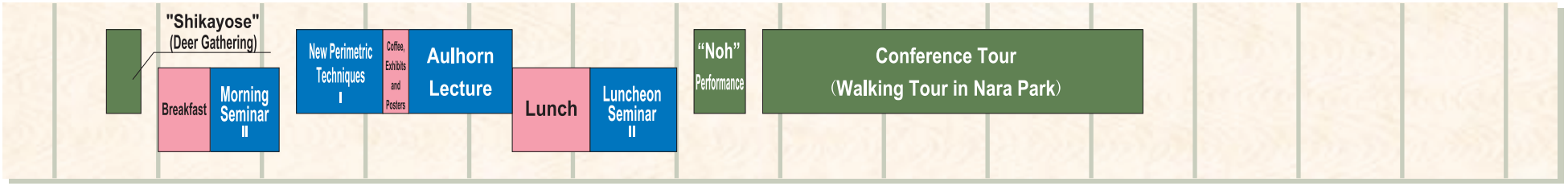
Wednesday, May 21



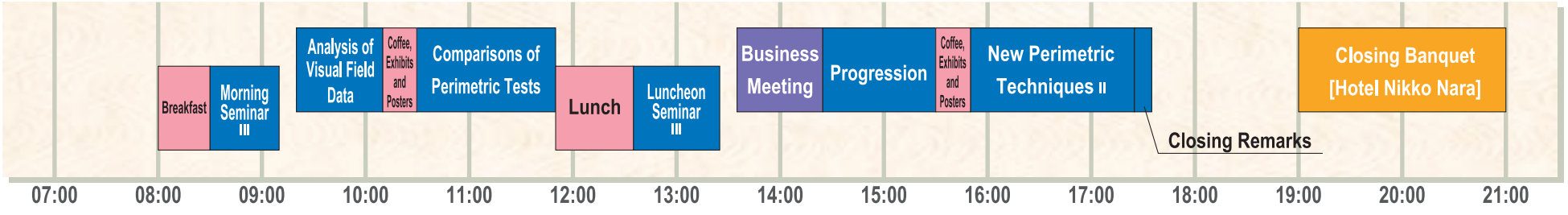
Thursday, May 22



Friday, May 23



Saturday, May 24



IPS Lecture: Fritz Dannheim M.D.

Thursday, May 22 13:30-14:30

Prof. Dannheim was born in 1942 in Stuttgart, southern Germany. He received his medical training in Munic and Tuebingen, and wrote his thesis in 1968 with Prof. Aulhorn on dark adaptation in the visual field. Following a fellowship with Professor Stephen Drance in Vancouver from 1968-69, he served as a resident at the Military Hospital Hamburg, the Dept. of Neurology at the General Hospital Hamburg-Harburg, and the University Eye Departments at Tuebingen and at Hamburg in 1972. Since becoming Assistant Professor in ophthalmology in 1985, Prof. Dannheim has held special interest in glaucoma, neuro-ophthalmology, perimetry, retinology and imaging. From 1995, he has been serving as a consultant at the General Hospital Hamburg-Harburg and practicing in the neighbourhood.

Since the first IPS symposium was held in 1974, Prof. Dannheim not only has participated in every IPS meeting but also had served as a Board Member of the IPS. Undoubtedly, he is the true witness to the history of the society and has made substantial contribution to the society meetings. His talk will be entitled "The Evolution of the Optic Disc Analysis: Past, Presence and Outlook."

The Evolution of the Optic Disc Analysis: Past, Presence and Outlook

Chairperson: Michael Wall

Fritz Dannheim

Asklepios Hospital Hamburg-Harburg & Outpatient Unit Seevetal, GFR

Digital assessment of the optic disc has become indispensable for high-grade management of glaucoma. This contribution illustrates the historical evolution of this technology from photography, stereophotography, stereo-chronoscopy, manual planimetry, photogrammetry, videographic stereoanalysis to the current laserscanning and OCT devices. An outlook tries to sketch new developments for further improvements in favour of reliable glaucoma management.

Aulhorn Lecture: Anders Heijl M.D., Ph.D.

Friday, May 23 10:25-11:25

Prof. Heijl is a graduate of Lund University Medical School where he also completed his residency in ophthalmology. He received a Ph.D. from Lund University in 1977 for his early work on computerized perimetry, and later completed a post-doctoral fellowship under the mentorship of Professor Stephen Drance at the University of British Columbia. Since 1990, Prof. Heijl has served as Chairman at the Department of Ophthalmology, Malmö University Hospital, Lund University, Sweden.

Between 1980 and 1996, Prof. Heijl served the IPS first as Scientific Secretary and later as President. From 1992, he has also served as Study Director of the Early Manifest Glaucoma Trial that he initiated. Since 2003, he serves as President of the Glaucoma Research Society, until recently known as the Glaucoma Society of the International Congress of Ophthalmology, and as the chief ophthalmological advisor to the Swedish National Board of Health and Welfare.

Prof. Heijl and his research group have invented and developed the Statpac programs for the Humphrey perimeter, including the now widely used concepts of Probability Maps, Pattern Deviation, Change Probability Maps, the Glaucoma Hemifield Test and the Glaucoma Progression Analysis programs. The Swedish Interactive Thresholding Algorithm (SITA) was also developed and adapted to Standardized Automated Perimetry and to Short Wavelength Automated Perimetry (SWAP) in his laboratory.

Prof. Heijl has published more than 170 scientific papers, chapters and books. He has served as Editor-in-Chief of Acta Ophthalmologica, and on the editorial boards of eight ophthalmic journals. Prof. Heijl has received scientific awards, or delivered invited name lectures on many occasions.

How Better Perimetry Can Improve Glaucoma Management

Chairperson: David B. Henson

Anders Heijl

Department of Ophthalmology, Malmö University Hospital, Lund University

The large glaucoma RCTs have shown that glaucoma progression rates vary very much between patients. The RCTs have also clarified the important risk factors for glaucoma progression. But even using those factors we now know that the disease course in individual patients cannot be predicted. IOP reduction has been shown to be highly effective, but progression is the rule also in treated patients with IOP levels within normal statistical limits who have been followed for a long time. Really low IOP levels are associated with considerably smaller risk of progression, but are not attainable without a large cost in side- effects and complications.. Tonometry alone is, therefore, never sufficient, regardless of IOP levels; in glaucoma management we must always follow and quantify glaucoma damage. Treatment goals in glaucoma management are expressed in terms of visual function, and structural test can, therefore, never replace visual function tests (perimetry), at least as long as we do not have way of translating structural findings to visual function.

Perimetry is under-utilized today. Studies have shown that often visual fields are obtained with long intervals, sometimes as long as two years. Analyses of data from EMGT show that the frequency of testing is of pivotal importance to detect glaucoma progression within a reasonable time frame. A recently published analysis of the influence of test frequency on the ability to identify rapidly progressive eyes show that an average of three fields per year for two years is needed to find eyes that progress by 2dB/years[1].

Perimetry is also badly understood by many clinicians. Many ophthalmologists do not understand the usage of available computer-assisted analyses and many are unaware of, and therefore do not use, existing software for following glaucoma progression. Misconceptions about perimetry are common: perimetry is often erroneously thought to more difficult than it is, impossible for elderly patients or patients with low visual acuity et cetera. Negative attitudes and poor instruction of patients can threaten the quality of perimetric results, while trials have shown that with good instructions and reasonable support almost all patients are able to produce informative and reliable test results, that can be used not only for diagnosis but also to follow the disease course reliably.

More and better perimetry could prevent a lot of glaucoma disability. We have an educational duty visavi our colleagues and a political duty to ensure appropriate reimbursement of perimetry, the most important tool in glaucoma management.

1. Chauhan B, Garway-Heath DF, Goni FJ, Rosetti L, Bengtsson B, Wiswanatahn AC, Heijl A. Practical recommendations for measuring rates of visual field change in glaucoma. Br J Ophthalmol 2008 Jan 22 [Epub ahead of print].

Scientific Program

Wednesday, May 21

12:00-18:00 **Registration**

17:30- **Welcome Party at Garden**

Thursday, May 22

8:00-8:30 **Breakfast at Reception Hall**

Morning Seminar I 8:30-9:10 Reception Hall

New Generation In Structure And Function For Glaucoma Management — The New Humphrey Visual Field Analyzer With Guided Progression Analysis And Newly Featured Optical Coherence Tomographers, Stratus OCT And Cirrus HD-OCT

Carl Zeiss Meditec Co., Ltd.

Chairperson: *Aiko Iwase*

New Glaucoma Applications For Optical Coherence Tomography
Vincent Michael Patella

Effective Use Of Perimetry In Glaucoma Management
Anders Heijl

Opening Remarks 9:20-9:30 Noh Theatre

Session 1 9:30-11:45 Noh Theatre

Structure-Function Relationship

Moderators: *Linda Zangwill and Ronald S. Harwerth*

9:30- **1-01**
A Structure-Function Map Derived From Medmont Perimetric Data
Andrew Turpin

9:45- **1-02**
Quantifying Concordance Between Structure And Function Measurements In The Clinical Assessment Of Glaucoma
Haogang Zhu

10:00- **1-03**
Relationship Between Functional And Structural Changes In Glaucoma Suspects And Early Glaucoma Patients
Hiroki Nomoto

10:15- **1-04**
Structure-Function In Glaucoma: A New Hypothesis
Marta Gonzalez-Hernandez

10:30-10:50 **Coffee, Exhibits and Posters**

10:50- **1-05** Poster
The Threshold Values In MATRIX Reflect The Nerve Fiber Layer Thickness In Early Glaucoma Patients
Katsuhiko Maruyama

10:55- **1-06** Poster
Ability Of OCT To Detect Localized Retinal Nerve Fiber Layer Defects In Patients With Normal Standard Automated Perimetry Results
Shinji Ohkubo

11:00- **1-07**
Longitudinal Changes In Structure And Function: Results From The Diagnostic Innovations In Glaucoma Study (DIGS)
Linda Zangwill

11:15- **1-08**
Nonlinear And Linear Models For Predicting Structure From Function In Glaucoma
Ronald S. Harwerth

Scientific Program

11:30- **1-09**
How Do Psychophysical Estimates Of Ganglion Cell Sampling Density Relate To Structural Measurements At The Optic Nerve Head In The Normal Ageing Eye?
Tony Redmond

11:45-12:30 **Lunch at Reception Hall**

Luncheon Seminar I 12:30-13:20 Reception Hall

Ocular And Brain Changes In Glaucoma Monkey Models

Santen Pharmaceutical Co., Ltd.

Chairperson: *Chota Matsumoto*

Changes Of The Visual System In A Monkey Model Of Glaucoma
- Structural Changes In Retina And Optic Nerve Head
Masaaki Sasaoka

Changes Of The Visual System In A Monkey Model Of Glaucoma
- Lateral Geniculate Nucleus And Visual Cortex
Ronald S. Harwerth

IPS Lecture 13:30-14:30 Noh Theatre

Chairperson: *Michael Wall*

The Evolution Of The Optic Disc Analysis: Past, Presence And Outlook
Fritz Dannheim

Session 2 14:30-15:30 Noh Theatre

Optic Nerve Head And Nerve Fiber Imaging

Moderators: *Paul Artes and Goji Tomita*

14:30- **2-01**
Biological Shape Models Of Optic Nerve Topography In Patients With Glaucoma And Healthy Controls
Paul Artes

14:45- **2-02**
Interpretation Of Optic Disc Images For Glaucomatous Damage: Reference Data From Specialists
Jonathan Denniss

15:00- **2-03** Poster
Performance Of Glaucoma Probability Score Classification (GPSC) In Glaucoma Screening With HRTII: Comparison With Moorfield's Regression Analysis (MRA)
Hisashi Takeda

15:05- **2-04**
A New Method For Evaluating Stereometric Data From The Heidelberg Retinal Tomograph (HRT3)
Geoff Sampson

15:20- **2-05** Poster
Agreement Of Structural Abnormality By Heidelberg Retina Tomography And Optical Coherence Tomography In Ocular Hypertensive And Glaucomatous Eyes
Ryo Asaoka

15:25- **2-06** Poster
Inner Retinal Layer Measurements With Fourier Domain Optical Coherence Tomography And Its Correlation With Optic Disc Topography Measured By Heidelberg Retina Tomography In Glaucomatous Eyes With Hemifield Defects
Goji Tomita

15:30-15:50 **Coffee, Exhibits and Posters**

Session 3 15:50-17:35 Noh Theatre

Clinical Perimetry

Moderators: *Ulrich Schiefer and Aiko Iwase*

15:50- **3-01**
Pre-anatomic And Pre-perimetric Glaucoma
Manuel Gonzalez de la Rosa

16:05- **3-02**
The Diagnostic Ability Of Anderson Criteria On Glaucomatous Visual Field Defects In Eyes With Myopic- And Nonmyopic-Type Optic Disc
Tairo Kimura

16:20- **3-03**
Test-Retest Differences Of The Visual Field In Retinitis Pigmentosa
Chris Johnson

16:35- **3-04**
Little Recovery Of Visual Field Defect In The Ischemic Retina In Branch Retinal Artery Occlusion
Hiroyuki Iijima

16:50- **3-05**
Perception Of Metamorphopsia Under Monocular And Binocular Conditions Evaluated By M-CHARTS And AMSLER CHARTS In Patients With Macular Diseases
Eiko Arimura

17:05- **3-06**
Evaluation Of Full-Field Sensitivity Test (FFST) Measures For Clinical Trials And Relationship To Wayfinding
Ronald Schuchard

17:20- **3-07** Poster
Central Visual Field Changes In Myopic Glaucoma With Optic Disc Ovality
Rishu Inoue

Scientific Program

17:25- **3-08** Poster
Scotopic, Mesopic, And Photopic Perimetry In Acute Zonal Occult Outer Retinopathy
Kazuki Kuniyoshi

17:30- **3-09** Poster
Objective Visual Field Evaluation Using Multifocal Visual Evoked Potentials In Patients With Intracranial Disease Complicated By Mental Disorder
Eiichi Yukawa

18:00- Japanese Dinner (Optional) at Heijo

Friday, May 23

7:30-7:50 "Shikayose" (Deer Gathering)

8:00-8:30 Breakfast at Reception Hall

Morning Seminar II 8:30-9:10 Reception Hall

HAAG-STREIT AG

The Role And Potential Of Kinetic Perimetry - Current And Future Developments
Ulrich Schiefer

Fully Automated Kinetic Perimetry With Computer-Simulated Virtual Patients
Chota Matsumoto

Session 4 9:20-10:10 Noh Theatre

New Perimetric Techniques I

Moderators: *Chris Johnson and Chota Matsumoto*

9:20- **4-01**
Age-Corrected Normative Data For The Entire (90°) Visual Field, Assessed With Full Threshold Automated Static Perimetry And A Fast Thresholding Algorithm (GATE)
Ulrich Schiefer

9:35- **4-02** Poster
Quantitative Assessment Of The Visual Field Loss Due To Retinitis Pigmentosa Using Semi-automated Kinetic Perimetry
Katarzyna Nowomiejska

9:40- **4-03**
Comparison Between Semi-automated Kinetic Perimetry (SKP) And Fully Automated Kinetic Perimetry (AKP = Program K) In Patients With Visual Field Loss
Shigeki Hashimoto

9:55- **4-04**
Influence Of Media Opacities On Flicker Perimetry
Chota Matsumoto

10:10-10:25 Coffee, Exhibits and Posters

Aulhorn Lecture 10:25-11:25 Noh Theatre

Chairperson: *David B. Henson*

How Better Perimetry Can Improve Glaucoma Management
Anders Heijl

11:25-12:10 Lunch at Reception Hall

Luncheon Seminar II 12:10-13:00 Reception Hall

Alcon Japan Ltd.

Chairperson: *Yoshiaki Kitazawa*

Normal Tension Glaucoma: Clinical Challenges And New Therapeutic Concepts
David S. Greenfield

13:10-13:40 "Noh" Performance at Noh Theatre

13:50- Walking Tour in Nara Park

Scientific Program

Saturday, May 24

8:00-8:30 **Breakfast at Reception Hall**

Morning Seminar III 8:30-9:10 Reception Hall

Topcon Corporation

Chairperson: *Makoto Araie*

Three-Dimensional Visualization And Thickness Mapping Of RNFL Using SD OCT
Yijun Huang

Session 5 9:20-10:10 Noh Theatre

Analysis Of Visual Field Data

Moderators: *Richard P. Mills and Michael Wall*

9:20- **5-01** Poster
A Comparison Of Catch Trial Methods Used In Conventional Perimetry In Glaucoma Patients
Carrie Doyle

9:25- **5-02**
Use Of A Continuous Probability Scale To Display Visual Field Damage
Michael Wall

9:40- **5-03** Poster
Area-Threshold Curves Obtained Using Various Objects
Tsuyoshi Yoneda

9:45- **5-04** Poster
Influence Of Ocular Optical System Aberrations In Perimetry, Especially For Peripheral Vision Measurement
Genichiro Takahashi

9:50- **5-05**
How Do Different Test Strategies For Estimating Perimetry Thresholds Behave When The Dynamic Range Of Measurement Varies?
Ciara Bergin

10:05- **5-06** Poster
Risk Factors For Progressive Visual Field Loss That Threatens Fixation
Sanae Kanno

10:10-10:30 **Coffee, Exhibits and Posters**

Session 6 10:30-11:50 Noh Theatre

Comparisons Of Perimetric Tests

Moderators: *Fritz Dannheim and Genichiro Takahashi*

10:30- **6-01** Poster
Comparison Of The Retinal Sensitivities And The Global Indices In SITA Standard And Dynamic Strategies
Hirotaka Suzumura

10:35- **6-02** Poster
Detectability Of Early Stage Glaucomatous Visual Field Defects In Dynamic And SITA Standard Strategies
Shiro Mizoue

10:40- **6-03**
Variability With Multisampling Suprathreshold Perimetry And SITA Standard Perimetry In Glaucoma
Michael Horler

10:55- **6-04** Poster
The Relationships Between Threshold Estimates And Effective Dynamic Ranges Of Standard Automated Perimetry (Size III And V), Motion And Matrix Perimetry
Kimberly Woodward

11:00- **6-05**
Conventional (Octopus G1X) And Flicker Fusion Perimetry (Pulsar) In Glaucoma: A Clinical Comparison
Fritz Dannheim

11:15- **6-06** Poster
Pulsar Perimetry In Diagnosis Of Early Glaucoma
Marco Zeppieri

11:20- **6-07**
Potential Of Frequency Doubling Technology For Earlier Detection Of Damage Than Standard Automated Perimetry In Glaucoma With Lowered Intraocular Pressure
Aiko Iwase

11:35- **6-08**
Comparison Of N-30 And 24-2 Threshold Programs Of Frequency Doubling Perimetry For The Evaluation Of Glaucomatous Visual Field Defect Severity
Shoichi Morise

11:50-12:35 **Lunch at Reception Hall**

Luncheon Seminar III 12:35-13:25 Reception Hall

New Perspectives In Detecting Glaucoma Progression
Pfizer Japan Inc.

Chairperson: *Yoshiaki Kitazawa*

Detection Of, Magnitude Of And Risk Factors For Progression In The Early Manifest Glaucoma Trial
Anders Heijl

13:35-14:25 **Business Meeting at Noh Theatre**

Session 7 14:25-15:30 Noh Theatre

Progression

Moderators: *David Garway-Heath and Yoshio Yamazaki*

14:25- **7-01**
Comparison Of Analysis Methods For Progression Of Visual Field Defect
Yoshio Yamazaki

14:40- **7-02**
Detection Of Local Visual Field Deterioration In Patients With Diffuse Improvement Using Cluster Trends Analysis
Sachiko Okuyama

14:55- **7-03** Poster
The Influence Of Initial Visual Field Sensitivity On The Rate Of Visual Field Loss Over Time In Glaucoma Patients
Paraskeva Hentova-Sencanic

15:00- **7-04**
Specificity Of The Program Threshold Noiseless Trend (TNT) For Perimetric Progression Analysis
Manuel Gonzalez de la Rosa

15:15- **7-05**
Sensitivity Performs Better Than Slope At Predicting Future Progression In Early Glaucoma
Stuart Gardiner

15:30-15:50 Coffee, Exhibits and Posters

Session 8 15:50-17:25 Noh Theatre

New Perimetric Techniques II

Moderators: *David B. Henson and Takeshi Yoshitomi*

15:50- **8-01**
Assessing The Utility Of A Combined Suprathreshold/Threshold Procedure For Retesting Visual Fields
Allison McKendrick

16:05- **8-02** Poster
Trial Model Of Perimeter For Measuring Binocular And Monocular Visual Fields Separately While Opening Both Eyes
Taketoshi Suzuki

16:10- **8-03** Poster
Trial Model For Measuring Retinal Function By Using Sense Of Color And Form
Shin Kouta

16:15- **8-04** Poster
Measurement Of Thresholds In Normal Subjects Using Fundus-Oriented Small-Target Perimetry
Yusuke Nakatani

16:20- **8-05** Poster
The Magnitude Of Stereopsis In Peripheral Visual Fields
Hiroshi Mochizuki

16:25- **8-06** Poster
The Effect Of Correction For Central Refractive Error On Thresholds For The Moorfields Motion Displacement Test (MDT)
Reza Moosavi

16:30- **8-07** Poster
A New Short-Wavelength Automated Perimetry With Flicker Target
Kazunori Hirasawa

16:35- **8-08**
The Heidelberg Edge Perimeter: A New Method For Visual Field Assessment
John Flanagan

16:50- **8-09** Poster
Glaucomatous Visual Field In "Pupil Perimetry"
Noriko Sato

17:55- **8-10** Poster
Utility Of Pupil Perimetry In Glaucoma
Ken Asakawa

17:00- **8-11** Poster
The Head Mount Diplay Type Pupil Perimeter
Fumiatsu Maeda

17:05- **8-12** Poster
Evaluating Pupil Light Reflexes With Color Stimuli
Keiichi Tanzawa

17:10- **8-13**
Higher Resolution Pupillographic Multifocal Perimetry
Ted Maddess

Closing Remarks 17:25-17:30 Noh Theatre

19:00- Closing Banquet at Hotel Nikko Nara

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Abstracts

1-01

A Structure-Function Map Derived From Medmont Perimetric Data

A Turpin[1], GP Sampson[2], AM McKendrick[2].

RMIT University, Melbourne, Australia[1], The University of Melbourne, Australia[2]

Purpose: There are several proposed maps that relate the location of structural changes in the retinal nerve fiber layer (RNFL) to alterations in perimetric sensitivity measured on a evenly spaced 6°x6° grid. The Central Threshold test of the Medmont Perimeter tests 96 locations arranged concentrically (eccentricities 3°, 6°, 10°, 15°, 22°, and 30°). This study aimed to derive a structure-function map for the Medmont pattern.

Methods: A structure-function map was derived using simplistic assumptions: 1) the retina is spherical; 2) the optic nerve head (ONH) is located at (15°, 3°) on the retina and has diameter 5°; and 3) axons follow the shortest path from ganglion cell to ONH around the surface of the sphere. This gives a sector of the ONH related to each visual field location. We then correlated HRT3 image features and Medmont patient data from 26 people with glaucoma and 22 glaucoma suspects, only using HRT data that was ±60° from the sector predicted by the spherical model. The HRT images were divided into 36 x 20° overlapping sectors, with rim area (RA) (normalised by disc area) and rim volume (RV) values extracted. Optic nerve head (ONH) features were correlated (Spearman) with perimetric sensitivity on a linear scale. Binocular asymmetry in disc features was also correlated with binocular sensitivity asymmetry. Correlations of $p<0.05$ were considered significant.

Results: The spherical model derived for a 24-2 pattern was similar to published maps. For the Medmont data, using binocular asymmetry improved correlation strength relative to single eyes alone (mean(sd) r=0.38(0.06) c.f. r=0.26(0.04)). The number of locations demonstrating a statistically significant relationship were: 10(RA) and 8(RV) for single eye, and 30(RA) and 36(RV) for binocular asymmetry analyses.

Conclusions: A partial structure-function map has been established using perimetric data obtained with the Medmont Perimeter. The method used for obtaining the map relies on two novel approaches: the geometry of spheres, which may be improved by employing assumptions based on biometric data; and the use of binocular asymmetries.

1-02

Quantifying Concordance Between Structure And Function Measurements In The Clinical Assessment Of Glaucoma

H Zhu[1], MJ Fredette[2,3], DR Anderson[2], DF Garway-Heath[4], DP Crabb[1].

City University, London, UK[1], Bascom Palmer Eye Institute, Miami, Florida, US[2], Laval University, Quebec City, Canada[3], Moorfields Eye Hospital, London, UK[4]

Background: Clinical decision in glaucoma can be misled by the inaccuracy and imprecision in individual measurements of structure and function, so combining data has the potential to make diagnosis more robust. With the measurements of 535 eyes from 3 different centres, we previously developed (Zhu et al; *IPS* 2006) a new model for this task using a Bayesian Radial Basis Function (BRBF), in which the visual field (VF) points and retinal nerve fibre layer thickness (RNFLT) profiles interact as 'groups' rather than as independent measurements.

Purpose: To develop and evaluate a clinically useful methodology to quantify and visualize structure-function concordance (SFC) in glaucoma by using this trained BRBF.

Methods: Repeat measurements on 54 eyes from 54 glaucomatous patients with 5 GDx (VCC) RNFLT scans and 5 Humphrey SITA VF tests were used (Fredette et al; *Ophthalmology* 2007). A best available estimate (BAE) for the VF was constructed by taking the pointwise average of the 5 repeat VFs. The BRBF takes each single RNFLT profile to predict the VF. We examined the difference between the prediction and the BAE and compared this to a randomly selected single VF versus the BAE. Next, a novel *SFC map* was derived for each subject charting the pointwise difference between the GDx-predicted (expected) and measured VF 'corrected' for the known response variability in VF at different sensitivity levels (Henson et al; *IOVS 1999*). The SFC Index (*SFCI*) summarises, like a correlation coefficient, the overall level of concordance between the predictions based on the RNFLT (structure) and the actual VF (function) for each subject.

Result: Mean absolute error for the prediction of the BAE VF was 4.5dB as compared to 2.6dB for the difference between a single random VF and the BAE. A large proportion of predictions (41%) closely match the BAE VF with high *SFCI* (>0.9) whilst 22% exhibit weak *SFCI* (<0.7) indicating poor concordance between structure and function measurements.

Conclusion: On average the BRBF model predicts BAE VF measurements from RNFLT measurements with error slightly worse than that exhibited in VF test-retest data. The SFC maps highlight subjects with poor concordance between their structural and functional measures. The SFC measures allow structure and function to be blended together: they may be used to identify unreliable measurements or other clinically useful information.

1-03

Relationship Between Functional And Structural Changes In Glaucoma Suspects And Early Glaucoma Patients

H Nomoto[1], C Matsumoto[1], S Okuyama[1], S Takada[1], S Hashimoto[1], E Arimura[2], F Tanabe[1], Y Shimomura[1].

Department of Ophthalmology, Kinki University School of Medicine, Osaka, Japan[1], Department of Ophthalmology, Kinki University School of Medicine, Sakai Hospital, Osaka, Japan[2]

Purpose: To evaluate the relationship between the abnormalities found by SAP, FDT, flicker perimetry, and SWAP at each test location and the 12 clock-hour sectors of retinal nerve fiber layer thickness (NFLT) measured by OCT in glaucoma suspects (GS) and patients with early glaucoma.

Methods: Subjects were 51 eyes of 51 GS and patients with early glaucoma. To reduce the age and axial length effects to the NFLT values, age and axis were restricted to 55-69 years old (mean: 61.4±5.3) and 23.5-25.5 mm (mean: 24.3±1.1). All subjects underwent HFA 24-2 full threshold (SAP), FDT (24-2-5), flicker perimetry (4-zone 38S), SITA-SWAP, and OCT (fast RNFL thickness). For SAP, FDT, flicker perimetry, and SWAP, test locations of 52 test points were estimated at normal and 5% abnormality levels, and the sectors of NFLT were measured by OCT. Relationship between visual field and NFLT was evaluated by comparing the significantly difference of NFLT with normal and 5% abnormal test locations. For each test location, it was investigated that which NFLT sectors significantly related to.

Results: SAP test locations in the superior and inferior hemifields related to 5-, 6-, 7-, 8-clock-hour sectors and 10-, 11-, 12-clock-hour sectors, respectively ($P < 0.05$, Mann-Whitney U-test). In the superior hemifield, 6-, 7-clock-hour sectors related to almost all locations. In the inferior hemifield, 11-clock-hour sector mainly related to the test locations. The results of FDT, flicker perimetry, and SWAP related to 5-, 6-, 7-, 8-clock-hour sectors in the superior hemifield, and to 1-, 2-, 3-, 10-, 11-, 12-clock-hour sectors in the inferior hemifield. FDT, flicker perimetry, and SWAP showed more locations related to the RNFL sectors than SAP.

Conclusions: Early functional changes in each test location which is detected by FDT, flicker perimetry, and SWAP relate to the structural changes with anatomically-corresponded RNFL sectors.

1-04

Structure-Function In Glaucoma: A New Hypothesis

M Gonzalez-Hernandez, Rodriguez de la Vega, E Medina-Mesa, M Gonzalez de la Rosa.

Hospital Universitario de Canarias, Universidad de la Laguna, Spain

Purpose: To compare the reproducibility and correlation between two procedures of functional study and two procedures of morphologic analysis.

Methods: Group A: 973 glaucoma cases were evaluated with respect to the correlation between the mean sensitivity of standard perimetry (SAP-MS) and of Heidelberg Retina Tomograph Rim Area (HRT II). Group B: 146 suspected and early glaucomatous eyes (Mean Defect SAP-MD <6dB), examined twice with laser polarimetry (GDx-VCC), HRT II, SAP and Pulsar perimetry.

Results: Group A: The logarithmic relation was not greater than the linear relation on dividing the two groups according to their MD (MD<>6dB). In normal subjects Pearson´s coefficient of variation for SAP-MS was 6.74% and for HRT II-Rim Area it was 22.14%. Group B: The logarithmic relations between morphology and function were not greater than the linear relation either. The reproducibility of the morphologic methods was greater (r=0.95 for GDx-NFI and 0.96 for HRT II-Rim Area) than the functional methods (P<0.001), of which Pulsar proved most reproducible (r=0.81 for the number of pathologic points Pulsar-NPP and r=0.56 for SAP-NPP, p<0.0001). The correlation between the two functional procedures (r=0.68; PULSAR-MS Vs SAP-MS) was greater than that between the morphologic procedures (r=-0.51; GDx-NFI Vs HRT II Rim Area) (P<0.05).
The standard error on estimating SAP-MS and Pulsar-MS from the data obtained in GDx-NFI was 1.75 dB and 2.25 src respectively. On estimating the value of MS from a perimetric examination with respect to the previous examination, the standard error was 1.37 dB for SAP and 1.31 src for Pulsar.

Conclusions: The curvilinear relation between morphology and function seems to be due to limitations in the dynamic range of the morphologic procedures, rather than a linear relation with the number of ganglion cells remaining. PULSAR presented greater reproducibility than SAP. The correlation morphology-function was better with GDx than with HRT II, and close to test-retest perimetric correlation.

- Supported in part by FEDER founding and FIS. Instituto Carlos III. Spain

1-05

Poster

The Threshold Values In MATRIX Reflect The Nerve Fiber Layer Thickness In Early Glaucoma Patients

K Maruyama[1], J Sakamoto[1], N Kojima[2], A Sugano[1], S Shirato[3].

Tokyo Medical University, Tokyo, Japan[1], Tokyo Medical University, Hachioji Medical Center, Tokyo, Japan[2], Yotsuya Shirato Eye Clinic, Tokyo, Japan[3]

Purpose: To evaluate the relationship between retinal nerve fiber layer (RNFL) thickness measured by optical coherence tomography (OCT) and the thresholds examined by two perimeters, Humphrey Field Analyzer (HFA), and Matrix, in early glaucoma patients.

Methods: Fifty-six patients (56 eyes, 22 male and 34 female patients) with primary open-angle glaucoma with early visual field defects (≧-6dB in HFA central 30-2 program) were enrolled in this cross-sectional study. Eligible criteria were corrected visual acuity equal to or better than 20/20, a refraction between -6.00 and +3.00 diopters, clear ocular media with no clinically significant cataract, and no previous ocular surgical history. The mean age (± SD) was 60.0 (± 9.3) years, ranged from 35 to 77; the mean refractive error was -2.46 (± 2.49) diopters; the mean MD in HFA was -1.97 (± 1.50) dB; and the mean whole circumferential RNFL thickness measured by OCT was 79.2 (± 16.0) μm, range from 43.8 to 123.8 μm.
The relationship between the total deviation (TD) of the upper or lower hemifield obtained by each perimeter and the RNFL thickness corresponding to each hemifield were evaluated by linear regression models, and the coefficient of determination (r^2) was calculated.

Results: Mean TD of all hemifields by each perimeter and corresponding RNFL thickness were correlated significantly, whereas their relationship in Matrix was stronger than that in HFA (The mean TD for HFA = -8.164 + 0.077 x RNFL thickness; p<0.0001, r^2=0.196. The mean TD for Matrix = -17.254 + 0.154 x RNFL thickness; p<0.0001, r^2=0.251).

Conclusions: The threshold values obtained by Matrix showed a greater association with RNFL thickness than the values obtained by HFA in early glaucoma patients.

1-06

Poster

Ability Of OCT To Detect Localized Retinal Nerve Fiber Layer Defects In Patients With Normal Standard Automated Perimetry Results

S Ohkubo[1], T Higashide[1], H Takeda[1], Y Nakatani[2], K Nitta[3], K Sugiyama[1].

Ophthalmology and Visual Science, Kanazawa University Graduate School of Medical Science, Kanazawa, Japan[1], Himi Municipal Hospital, Himi, Japan[2], Fukui-ken Saiseikai Hospital, Fukui, Japan[3]

Purpose: To evaluate the ability of optical coherence tomography (OCT, Carl Zeiss Meditec, Dublin, CA) to detect localized retinal nerve fiber layer (RNFL) defects in patients with normal standard automated perimetry (SAP) results (i.e., preperimetric localized RNFL defect).

Methods: Data was retrospectively reviewed from 26 eyes of 26 subjects with preperimetric localized RNFL defects identified in fundus photographs. The SAP was classified as glaucomatous according to the Anderson criteria (Anderson et al. Automated Static Perimetry. 1999:117).
The RNFL defects were evaluated with the peripapillary Fast RNFL thickness 3.4 program of OCT. On resulting RNFL thickness report printout, segment of the TSNIT graph outside of the 95% and 99% normal limits were defined as “5%-OCT defect” and “1%-OCT defect”, respectively. The sensitivity of the TSNIT graph and various OCT parameters for detecting preperimetric localized RNFL defects was determined. The angular width of RNFL defects were also determined by fundus photographs and were defined as “photo defect”.

Results: From 26 eyes, 30 localized RNFL defects were detected in fundus photographs. The sensitivity of the TSNIT graph for detecting preperimetric localized RNFL defects as 5%-OCT or 1%-OCT defect were 50% (15/30) or 30 % (9/30), respectively. For the photographic defects with angular width less than 10°and more than 20°, the OCT sensitivity of 5%-OCT defect was 0%(0/3) and 100% (10/10), respectively. The sensitivity of other OCT RNFL thickness parameters ranged from 0% to 19.2%.

Conclusions: Although the sensitivity of OCT is low for preperimetric localized RNFL defects, the OCT detected all preperimetric localized RNFL defects for the photographic defects with angular width more than 20°.

1-07

Longitudinal Changes In Structure And Function: Results From The Diagnostic Innovations In Glaucoma Study (DIGS)

L.M Zangwill[1], C. Bowd[1], M. Balasubramanian[1], G. Vizzeri[1], N. O'Leary[2], D. Garway-Heath[3], D. Crabb[2], P.A. Sample[1], R.N. Weinreb[1].

Hamilton Glaucoma Center, University of California, San Diego, USA[1]. Glaucoma Research Unit, Moorfields Eye Hospital, London, UK[2]. Optometry and Visual Science, City University, London, UK[3]

Purpose: To determine the agreement between HRT change analysis strategies and standardized assessment of stereophotographs and standard automated perimetry guided progression analysis for detecting change in glaucoma and healthy eyes.

Methods: 240 eyes from 161 DIGS glaucoma patients, suspects and ocular hypertensive participants followed with at least 4 HRT good quality imaging sessions (average follow-up of 4 years) were included in the analysis. Of 240 these, 36 (15%) eyes were classified as progressors by standard automated perimetry guided progression analysis (GPA) likely progression) or standardized, masked stereophotograph assessment. Several HRT progression detection strategies were evaluated including topographic change analysis (TCA) and statistical image mapping (SIM). The cut-offs for 99%, 95% and 90% specificity for these HRT analyses were based on variability in measurements from 1008 permuted longitudinal series derived from 18 healthy eyes imaged > 4 times each (Moorfields data). Each eye contributed 56 pseudo-random longitudinal series to the 1008 total. The specificity of each chosen cut-off was assessed in a separate group of 21 DIGS healthy eyes (imaged > 3 times). We also determined the specificity of the TCA analysis in the 204 DIGS patient eyes that did not progress based on GPA or stereophotography. TCA parameters reported here are: size (CSZ), area (CA) and volume (CVOL) of the largest progressed cluster both inside (ins) and outside (out) of the optic disc margin. All progressed clusters were repeatable according to the repeatability requirements for HRT HEYEX software.

Results: Sensitivities for repeatable progression for TCA parameters CSZ, CA, and CVOL inside the disc of the 18 eyes progressing by photography at 95% specificity cut-offs were 50%, 56%, 44%, and 90% specificity cut-offs were 56%, 67%, 83%, respectively. Sensitivities for repeatable progression for TCA parameters CSZ, CA, and CVOL inside the disc of the 34 eyes progressing by visual fields at 95% specificity cut-offs were 65%, 68%, 41%, and 90% specificity cut-offs were 68%, 76%, 91%, respectively. Including change outside the disc did not improve results. Specificity of these cut-offs tested in 21 DIGS healthy eyes was good- ranging from 81 to 100%. Specificity in the 204 stable eyes was poor, with 86 (42%) of patients not showing progression by CA^{ins} (TCA parameter with highest sensitivity/specificity trade off).

Conclusions: Sensitivity of HRT TCA parameters for detecting progression identified by GPA and stereophotography is fair, while specificity among normal eyes is good. TCA detects change in many patient eyes that appear stable by visual fields and stereophotography that needs further investigation to determine whether these eyes represent early change detection or false positive results.

1-08

Nonlinear And Linear Models For Predicting Structure From Function In Glaucoma

R.S. Harwerth[1], J.L. Wheat[1], M.J. Fredette[2,3], D.R. Anderson[2].

University of Houston, Houston, TX, USA[1]; University of Miami Miller School of Medicine, Miami, FL, USA[2]; Laval University, CEVQ, CHA-CUO, Quebec, Canada[3]

Purpose: Both nonlinear (NLM) and linear (LM) models have been used to correlate clinical assessments of glaucomatous neuropathy by optical coherence tomography (OCT) measures of retinal nerve fiber layer (RNFL) to standard automated perimetry (SAP) measures of visual fields. The two classes of models are based on categorically different assumptions for, 1) the translation of visual sensitivity to retinal ganglion cell (RGC) density and 2) remodelling of the RNFL with age or the stage of glaucoma, but it is uncertain whether the predicted structure-function relationships are substantially different. Therefore, the present study was undertaken to compare a NLM to the LM recently proposed by Hood and Kardon (*Prog Retin Eye Res. 2007;26:688-710*).

Methods: To evaluate the models on a common dimension, the model-predictions of RNFL thickness derived from patients' SAP measures were compared to their OCT-measured RNFL thickness values. The models were compared by their goodness-of-fits to the one-to-one relationship between predicted and measured RNFL thickness. The data for the study were SAP and OCT data for 60 eyes (32 patients) from the University of Houston and 53 eyes (53 patients) from the Bascom Palmer Eye Institute.

Results: Both models captured the relative trend of the unity relationship (r^2 = 0.50 for the NLM and 0.45 for the LM), but the NLM generally produced smaller deviations from an exact fit. The root mean squared deviation (RMSD) for the NLM was almost 50% less than the LM (18.0 mμ for the NLM vs. 26.5 mμ for the LM) and, although the mean residual error (MRE) was larger for the NLM (3.2 mμ for the NLM vs. 1.2 mμ for the LM), the variance between the NLM predictions and observed data was constant with thickness of the RNFL, but increased with RNFL thicknesses for application of the LM.

Conclusions: Both nonlinear and linear models describe a correlated loss of visual sensitivity and thinning of RNFL in glaucoma, but the average residual deviations are smaller with application of a NLM, especially for the early to moderate stages. Thus, the methods of the NLM for transforming OCT and SAP data to a common parameter directly related to RGC densities provides better overall accuracy for inter-test confirmation of neuronal losses.

Support: NIH/NEI grants: RO1 EY01139, T32 EY07024, P30 EY07751, K23 EY018329 and P30 EY014801.

1-09

How Do Psychophysical Estimates Of Ganglion Cell Sampling Density Relate To Structural Measurements At The Optic Nerve Head In The Normal Ageing Eye?

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University of Ulster, Coleraine, Northern Ireland, UK[1], Moorfields Eye Hospital, London, UK[2]

Purpose: To evaluate the relationship between peripheral resolution acuity (and hence estimates of retinal ganglion cell sampling density), retinal nerve fibre layer (RNFL) thickness and neuroretinal rim (NRR) area for particular retinal nerve fibre bundles in normal eyes of different age.

Methods: Peripheral resolution acuity (in c/deg) was measured for 50 subjects between the ages 20-69 years using a Gabor patch at 10deg eccentricity in four retinal locations. Stimuli were superimposed on an achromatic background adapting field of 10cd/m^2. Optic nerve head images were acquired using a HRT and RNFL thickness was determined using a Zeiss Stratus OCT. Structural measurements were evaluated for optic disc segments receiving retinal nerve fibres stimulated during the resolution tests. An average value was determined for structural and functional measurements from the four retinal locations. The relationship between peripheral resolution acuity, NRR area and RNFL thickness was investigated and the effect of age on each parameter was also explored.

Results: Results indicate that subject resolution acuity, NRR area and RNFL thickness are significantly associated with age. (Resolution Acuity: r^2=0.31, p=0.003; NRR area: r^2=0.173, p=0.013; RNFL thickness: r^2=0.141, p=0.009), however there is no significant association between grating resolution acuity and NRR area (r^2= 0.001; p=0.859) or RNFL thickness (r^2= 0.079; p=0.055) at the 0.05 level of significance.

Conclusions: Functional ganglion cell density as measured by grating resolution acuity is not well associated with optic nerve head architecture for normal subjects. Our results suggest that peripheral resolution acuity may be a more accurate predictor of an age-related loss of retinal ganglion cells. Factors which may account for the higher variance in age-related loss of NRR area and RNFL thickness include an increased effect of supporting tissue at the level of the optic nerve head and, for NRR area in particular, a relatively high variance in optic disc shape between individuals.

2-01

Biological Shape Models Of Optic Nerve Topography In Patients With Glaucoma And Healthy Controls

PH Artes[1,3], TF Cootes[2].

Ophthalmology and Visual Sciences, Dalhousie University, Halifax, Canada[1], Faculties of Medicine[2] and Life Sciences[3], University of Manchester, UK

Purpose: Biological Shape Models (Cootes, 1995) capture morphological variation in images of faces, brains, kidneys, and spines. We apply these models to the analysis of optic nerve head (ONH) topographies obtained with the Heidelberg Retina Tomograph.

Methods: Models were constructed independently from two datasets of topography images (Halifax, n=2892; Manchester, n=3455) from patients with glaucoma (n=346) and controls (n=225). Patients and controls were merged, and landmarks such as centre and margins of the ONH were obtained from the contour line. The models expressed the mean 3D shape in each dataset, and individual ONHs were characterised by their deviation from the mean along up to 40 principal components ("modes", collectively referred to as shape vectors).

Results: Subjectively, the models constructed from the two datasets were remarkably similar. The first three modes captured disc size and overall cupping, tilt and horizontal elongation, and location and shape of the cup within the disc, respectively, explaining >80% of the variance. A linear combination of the first 10 modes discriminated between healthy and glaucomatous eyes with 65% sensitivity (95% CI 53-77%, at 90% specificity), similar to the Moorfields Regression Analysis (67% sensitivity between in both datasets). A topological map, constructed from the first 15 modes, reflected the diversity of disc shapes in healthy and glaucomatous eyes.

Conclusions: Biological Shape Models provide a generic and objective analysis of optic nerve head shape. Topological maps constructed from biological shape vectors capture the diversity of optic disc morphology and may provide new insight into the relationship between optic disc structure and visual function in optic neuropathies such as glaucoma. Ultimately, these tools may help to interpret optic nerve head images in clinical practice.

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2-02

Interpretation Of Optic Disc Images For Glaucomatous Damage: Reference Data From Specialists

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Purpose: To describe how specialist clinicians interpret non-stereoscopic optic nerve head (ONH) images for glaucomatous damage.

Methods: ONH images (Topcon TRC-50EX, 20°field of view, 350 x 410 resolution, 24 bit colour) were obtained from 100 patients attending a glaucoma clinic at Manchester Royal Eye Hospital. Patients were included if they had had at least 4 prior visual field (VF) tests (Humphrey Field Analyzer, SITA Std, 24-2). Eyes were selected into the VF Positive (VFP) group (n=20, MD -10.0 to -2.5dB; PSD 3.0 to 15.0dB), or the VF Negative (VFN) group (n=80, MD [of both eyes] better than -1.5dB, PSD below 2.0dB, inter-eye differences <1 dB). Ten specialist clinicians were instructed to grade apparent ONH damage (definitely healthy, probably healthy, not sure, probably damaged, definitely damaged). Clinicians were provided with the inclusion criteria for the sample. Images were displayed for up to 60s but time was unlimited for a forced selection from the 5 categories. Thirty percent (n=24) of VFN and 10% (n=2) of VFP images were randomly repeated. No feedback was provided during the session.

Results: Clinician's responses were combined to produce an "expert panel" ROC curve for detection of VF loss (ROC area, 0.87), sensitivity at 90% specificity was 60% (95% CI, 57-63%). Individual clinician's ROC areas for detection of VF loss ranged from 0.71 to 0.89, and between-clinician rank correlation for grading of damage from 0.47 to 0.80. Clinicians adopted dissimilar response criteria (Friedman test, $p<0.001$). In VFP images, there was no relationship between responses and visual field damage (MD and PSD, $R2=0.05$, $p=0.67$). Median response time per image ranged from 4 to 16s, and 95% of responses were made within 30s.

Conclusions: Whilst the results may underestimate the true diagnostic ability of clinicians (absence of clues such as stereo depth and between-eye differences), they provide a valid reference for other clinicians/trainees. The software is freely available from *www.opticdisc.org.*

2-03

Poster

Performance Of Glaucoma Probability Score Classification (GPSC) In Glaucoma Screening With HRTII: Comparison With Moorfield's Regression Analysis (MRA)

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Purpose: To compare the sensitivity and specificity of Glaucoma probability score classification (GPSC) with Moorfield's regression analysis (MRA) to detect glaucoma in glaucoma screening with HRTII.

Methods: Two hundred and fifty-one subjects (502 eyes) who were suspected to have glaucoma in community health screening were examined by slit lamp biomicroscopic examination, Goldmann applanation tonometry, Humphrey Automated Perimetry Central 30-2 program, gonioscopy and optic nerve head evaluation. We determined the sensitivity and specificity of GPSC and MRA about 327 HRT images, from which possess higher reliability in Humphrey Perimetry and HRT image quality in definitive examination results.

Results: When treating the "borderline" outcomes as test negative, GPSC sensitivity and specificity using Japanese database was 70.5% and 46.6%, MRA sensitivity and specificity was 54.1% and 82.3%. GPSC sensitivity and specificity using Caucasian database was 83.6%and 39.1%, MRA sensitivity and specificity was 55.7% and 80.5%.
When treating the "borderline" outcomes as test positive, GPSC sensitivity and specificity using Japanese database was 80.3% and 35.7%, MRA sensitivity and specificity was 72.1% and 56.8%. GPSC sensitivity and specificity using Caucasian database was 90.2% and 14.3%, MRA sensitivity and specificity was 72.1% and 54.1%.

Conclusion: Sensitivity of GPSC was higher than MRA, but specificity of GPSC was lower than MRA. The screening efficiency did not differ between Japanese and Caucasian database. GPSC could be useful for glaucoma screening because of its higher sensitivity and convenience without drawing the contour line of the disc.

2-04

A New Method For Evaluating Stereometric Data From The Heidelberg Retinal Tomograph (HRT3)

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Purpose: To investigate a novel technique for analyzing HRT3 stereometric parameter output that utilizes a larger, fixed-size contour line.

Methods: HRT3 data from 34 subjects diagnosed with open-angle glaucoma and 33 age-matched controls were analyzed retrospectively. Select stereometric parameter results for previously-drawn standard contours (defining optic nerve head [ONH] margins) were recorded for one randomly selected eye, and compared with results generated by drawing a fixed 1.5mm radius contour centered on the ONH. Moorfields Regression Analysis (MRA) classification (with standard contour) and Glaucoma Probability Scores (GPS) were also recorded. The 1.5 mm contour does not attempt to define ONH boundaries, but instead isolates a portion of the peripapillary retinal nerve fibre layer that incorporates the ONH. Specificities were set at 95%, using one-tailed reference intervals for control distributions. Sensitivities were calculated for each parameter using both of the contour definition methods; methods were then compared using repeated measure chi-squared tests.

Results: For the global stereometric parameters "rim area" and "rim volume" and for their superior-temporal and inferior-temporal equivalents, the 1.5mm contour method demonstrated higher sensitivities than the standard contour method for detecting subjects with a glaucoma diagnosis. Global rim area sensitivities were 85% and 53% respectively ($p<0.01$ for between-method difference). Standard contour sensitivity improved to 68% after accounting for disc area ($p=0.07$). Global rim volume sensitivities were 53% and 24% respectively ($p<0.005$). Sectoral rim area sensitivities were 85% and 59% (superior-temporal, $p<0.05$) and 79% and 53% (inferior-temporal, $p<0.05$). Sectoral rim volume equivalents were 74% and 29% (superior-temporal, $p<0.0005$) and 29% and 9% (inferior-temporal, $p=0.065$). MRA "overall" classification (97% specificity) and GPS global score (95% specificity) sensitivities were 74% and 82% respectively. These were not significantly different from each other, or from the 1.5mm contour method parameters with highest sensitivities.

Conclusions: Stereometric parameter calculation (rim area and rim volume) using a novel contour definition technique showed an improved ability to detect a known disease group, compared with standard contour equivalents.

2-05 Poster

Agreement Of Structural Abnormality By Heidelberg Retina Tomography And Optical Coherence Tomography In Ocular Hypertensive And Glaucomatous Eyes

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Purpose: To evaluate the agreement in classification by Heidelberg Retina Tomograph (HRTIII), Optical Coherence Tomography (OCT3) and visual field (VF) in eyes with ocular hypertension (OHT).

Methods: 80 eyes of 80 patients with OHT (intraocular pressure >21mmHg), irrespective of optic disc or VF appearance, were selected. Eyes were classified as 'normal', 'borderline', or 'abnormal' according to the result of HRTIII Moorfields regression analysis (MRA) and OCT3 using the worst (as classified by the machine normative database) 30 degrees sector. Abnormal VF was defined as 3 or more contiguous points at $p<0.05$, or 2 or more contiguous points at $p<0.01$ with at least one common lacation, or a 10 bB difference across the nasal horizontal midline at 2 or more adjusent points, or MD < -5dB, on 2 consecutive occasions in a perimetrically expereinced patients.

Results: With glaucomatous optic neuropathy (GON) defined 'borderline' or 'abnormal', 41 of the 80 eyes were classified as GON by both HRTIII and OCT3 (MD: -2.5 +/- 2.6 dB; mean +/- standard deviation); 16 GON by HRTIII but normal by OCT3 (MD: -2.8 +/- 0.7 dB) whilst 3 were GON by OCT3 but normal by HRTIII (MD: -0.67 +/- 1.7 dB). 39 eyes had a reproducible VF defect: 34 were GON by OCT3 and HRTIII; 4 were normal by OCT3 but GON by HRTIII; 3 were normal by HRT but GON by OCT3. In eyes with normal VFs (n=41), 10 were GON by both OCT3 and HRTIII (MD: -0.09 +/- 1.02 dB); 12 eyes were normal by OCT3 but GON by HRTIII (MD: 0.05 +/- 1.1 dB); no eyes were GON by OCT3 but normal by HRTIII; 19 eyes were normal on both OCT3 and HRTIII (MD: -0.06 +/- 0.96 dB).

Conclusions: In eyes with VF loss, both HRT and OCT3 tend to be abnormal. Agreement for abnormality between HRT and OCT was high, especially in eyes with VF loss. HRT, with definitions for abnormality applied, appeared to be more sensitive. In eyes with normal VFs, there was no relationship between HRTIII / OCT3 and MD.

2-06 Poster

Inner Retinal Layer Measurements With Fourier Domain Optical Coherence Tomography And Its Correlation With Optic Disc Topography Measured By Heidelberg Retina Tomography In Glaucomatous Eyes With Hemifield Defects

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Purpose: Unlike the Stratus time-domain optical coherence tomography which allows only total macular thickness measurements, the RTVue (Optovue, Fremont, CA), a Fourier domain optical coherence tomography device (FD-OCT), can provide automatic measurements of inner retinal layer (IRL) thickness, which is the sum of nerve fiber, ganglion cell and innerplexiform layers. In order to evaluate whether the macular IRL is correlated with optic disc topography or not, we analyzed relationship between the IRL thickness in macular region and optic disc topography measured by a Heidelberg Retina Tomograph II (HRT II, Heidelberg Engineering, Germany) in glaucomatous eyes with hemifield defects.

Methods: Fourteen eyes of 14 glaucoma patients with visual field defects located dominantly in either superior or inferior hemifield and with parafoveal scotoma were enrolled. All subjects were scanned with the RTVue's Macular Mapping 7mm (MM7) scan pattern to obtain an IRL thickness map centered on the fovea. At the same session, subjects were also scanned by the HRT II to obtain optic disc topography. Correlation of IRL thickness measurements in the hemisphere corresponding to the hemifield with visual field defects (worse hemisphere) and that corresponding to the hemifield without defects (better hemisphere) with the optic disc topography corresponding to each hemisphere (90 degrees in superior side or 90 degrees in inferior side) was evaluated.

Results: The IRL thickness in the worse hemisphere was significantly correlated with the HRT parameters corresponding to the worse hemisphere; the cup area to disc area ratio ($r = -0.536$, $p = 0.048$), the rim area ($r = 0.581$, $p = 0.029$), the rim volume ($r = 0.653$, $p = 0.011$), the mean retinal nerve fiber thickness ($r = 0.575$, $p = 0.032$), and the cross section area of retinal nerve fiber layer ($r = 0.629$, $p = 0.016$).

Conclusion: The macular IRL thickness mapped by the FD-OCT associated statistically significantly with the HRT parameters.

3-01

Pre-anatomic And Pre-perimetric Glaucoma

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Purpose: To determine the frequency of perimetric and functional defects, avoiding methodological bias towards either of these two diagnostic systems.

Methods: 67 eyes of 67 normal subjects (Group N) and 257 eyes with glaucoma, hypertension or suspected glaucoma (Group G; Average Mean Defect 3.29±5.93 dB) were examined with white/white perimetry (TOP-32; Octopus 311) and with Heidelberg Retina Tomography (HRT III). In normal eyes we calculated the 99% percentile of the two main perimetric (MD and sLV) and morphological indexes (GPS and RB discriminant function value). Using ROC analysis, we estimated cut-off points with a specificity of 95-99% for the four indexes. We then observed how many cases in Group G exceeded these cut-off values.

Results: The 99% percentile for the four indexes in normal subjects was as follows:

	MD	SLV	GPS	RB
PERCENTILE 99%	5.08	3.36	0.87	-0.34

And the results of the ROC analysis were:

	MD	sLV	GPS	RB	MD	sLV	GPS	RB
ROC AREA	0.66	0.75	0.74	0.62				
OPTIMUM CUT OFF	3.7	2.6	0.8	0.2	4.2	3.2	0.9	-0.2
SPECIFICITY	95.5	95.5	95.5	95.5	98.5	98.5	98.5	98.5
SENSITIVITY	24.1	46.7	32.3	27.2	19.8	30.0	21.4	17.9

In Group G, the number of cases with values exceeding the percentiles (PE) or ROC cut-off (CO) values was:

	SOME	MD	sLV	GPS	RB	FOUR	MD+sLV	GPS+RB	MD + sLV + GPS and/or RB	GPS + RB + MD and/or sLV
PE 99%	105	44	72	43	41	10	41	22	24	13
CO 95%	162	62	120	83	69	27	57	47	38	33
CO 99%	121	51	78	55	46	15	44	28	27	19

Conclusions: The frequency of functional defects was higher than that of morphological defects. Diagnostic agreement was higher between functional indexes than morphological indexes. The association between both morphological and one of the functional indexes was less frequent than between both functional and any one anatomic index. Pre-anatomic glaucoma seems more frequent than pre-perimetric glaucoma.

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3-02

The Diagnostic Ability Of Anderson Criteria On Glaucomatous Visual Field Defects In Eyes With Myopic- And Nonmyopic-Type Optic Disc

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Purpose: To evaluate the usefulness of Anderson criteria to detect glaucomatous visual fields defects (VFD) in eyes with myopic- and nonmyopic-type optic disc.

Methods: 113 eyes of 113 consecutive glaucoma patients and/or glaucoma suspect were prospectively enrolled. Inclusion criteria of participants were open angle, refractive error>-6.0diopter, corrected visual acuity>0.7, mean deviation (MD) of Humphrey Field Analyzer (HFA) using the 30-2 SITA program >-6.0dB. All participants underwent fundus photo of the optic nerve head with 30 degree angle .Participants were divided into myopic or nonmyopic eyes depending on disc appearance of fundus photo. The groups, in addition, were subdivided into glaucomatous and nonglaucomatous eyes in the same manner . The classification of the disc was carried out by a glaucoma specialist in masked fashion to the other findings. The definition of abnormal glaucomatous VFD was based on Anderson criteria [abnormal glaucoma hemi field test (GHT), PSD < 5%, and abnormal pattern deviation (PD)]. HFA results of all eyes were analyzed by Anderson criteria. Statistical comparison between four groups was carried out using JMP ver. 6.0.3. Differences among the groups were evaluated using t-test, Pearson correlation coefficient and logistic regression analysis.

Results: Nonglaucomatous and nonmyopic disc (22 eyes), glaucomatous and nonmyopic disc(54eyes),nonglaucomatous and myopic disc(7eyes) ,glaucomatous and myopic disc(30 eyes)were classified. No statistical differences of MD between myopic and nonmyopic-type discs (p=0,3431). Three diagnostic criteria of Anderson showed the useful diagnostic ability of glaucomatous VFD in glaucomatous eyes with nonmyopic disc (PSD; P=0.0135, odds ratio (OR)=3.6. PD; P=0.0010, OR=5.6. GHT; P=0.0204, OR=3.4) but not in eyes with myopic-type optic disc. (PSD; P=0.652, OR=0.7, PD; P=0.904, OR=0.9, GHT; P=0.7817, OR=1.0)

Conclusion: In applying Anderson criteria to diagnose glaucomatous VFD, careful evaluation is required in case of eyes with myopic-type optic disc.

3-03

Test-Retest Differences Of The Visual Field In Retinitis Pigmentosa

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Purpose: To determine the test-retest reliability of automated static perimetry in patients with retinitis pigmentosa.

Methods: Central (30-2) and peripheral (60-4) visual fields were measured in both eyes of 98 retinitis pigmentosa patients using the Humphrey Field Analyzer (Fastpak procedure, Size V target). Two visual field tests were performed within two months. Because visual field deficits in retinitis pigmentosa often consist of ring scotomas and mid-peripheral areas of sensitivity loss, test-retest results were evaluated using the raw sensitivity data, and with removal of points with 0 dB of sensitivity (test and/or retest) to minimize “floor” effects.

Results: Differences between test and retest were an average of 1.93 dB for the central 30-2 visual field and 1.44 dB for the peripheral 60-4 visual field. Removing the 0 dB sensitivity values produced an increase in average test-retest differences for the central visual field to 2.39 dB and an increase in average test-retest differences for the peripheral visual field to 2.54 dB. Removing the 0 dB sensitivity values from the outermost rim of points increases test-retest differences to 3.59 dB for the central visual field and 4.67 dB for the peripheral visual field.

Conclusions: Fastpac visual field testing of the central and peripheral visual field in retinitis pigmentosa produces reliable test results. Increased variability for the outermost locations is most likely related to the edges of ring scotomas and extreme peripheral limits of visual field sensitivity.

3-04

Little Recovery Of Visual Field Defect In The Ischemic Retina In Branch Retinal Artery Occlusion

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Purpose: To study whether the recovery of visual field defect is observed in the long follow-up period in the ischemic retina in eyes with branch retinal artery occlusion (BRAO).

Methods: Perimetric results were reviewed in eyes with BRAO who were studied in the follow-up period longer than 6 months after the onset. We included in the study only eyes with ophthalmoscopic evidence of obvious ischemia demonstrating diffuse whitening in the affected retina, where the baseline Humphrey perimetry showed severe sensitivity loss defined as 5 dB or less in the numeric display of central 30-2 program. We counted the number of test points with severe sensitivity loss at the baseline and the final visit.

Results: Seven eyes, whose follow-up period ranged between 235 and 1827 days, were included in the study. The average of the mean deviation of Humphrey perimetry was -18.2 dB at the baseline and -15.5dB at the final visit. The number of test points with severe sensitivity loss ranged between 13 and 43 (average: 30) at the baseline and between 7 and 60 (average: 29) at the final visit. The number of test points with severe sensitivity loss was more than 2/3 of that at the baseline in 6 eyes out of 7.

Conclusion: The recovery of severe sensitivity loss is rarely seen in the ischemic retina in eyes with BRAO in the long follow-up period.

3-05

Perception Of Metamorphopsia Under Monocular And Binocular Conditions Evaluated By M-CHARTS And AMSLER CHARTS In Patients With Macular Diseases

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Purpose: To report how patients with various macular diseases perceived metamorphopsia monocularly and binocularly evaluated by AMSLER CHARTS and M-CHARTS.

Methods: Forty-four patients with idiopathic epiretinal membrane (ERM), 38 patients with idiopathic macular hole (M-hole), and 17 patients with age-related macular degeneration (AMD) were included. Under monocular and binocular conditions, patient's metamorphopsia was first qualitatively detected by AMSLER CHARTS and was subsequently quantified by M-CHARTS with one straight line and 19 dotted lines with dot intervals between 0.2° to 2.0° visual angles. The minimum visual angle of the dotted line needed for metamorphopsia to disappear was measured and served as patient's M-CHARTS score. Modified Titmus stereo tests were performed on the patients with ERM to determine suppression.

Results: In patients with ERM, the monocular and binocular detection rates were 80% and 27% by AMSLER CHARTS, and were 80% and 14% by M-CHARTS, respectively. In patients with M-hole, those were 100% and 18% by AMSLER CHARTS, and were 100% and 34% by M-CHARTS, respectively. In patients with AMD, those were 100% and 41% by AMSLER CHARTS, and were 89% and 29% by M-CHARTS, respectively. In those affected eyes with the M-CHARTS score less than 0.5, patients with ERM or M-hole did not perceive metamorphopsia binocularly. In those affected eyes with a M-CHARTS score larger than 1.0, the sensitivities for detecting metamorphopsia binocularly in patients with ERM, M-hole, and AMD were 23%, 43%, and 60%, respectively. Suppression was observed in 53% of patients with ERM.

Conclusions: Depending on the severity of metamorphopsia and the disease type, even patients with unilateral macular diseases could perceive metamorphopsia binocularly. Therefore, both monocular perception and binocular perception of metamorphopsia are useful indexes of the QOV of patients with macular diseases.

3-06

Evaluation Of Full-Field Sensitivity Test (FFST) Measures For Clinical Trials And Relationship To Wayfinding

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Purpose: To investigate Full-Field Sensitivity Test (FFST) measures from people with inherited retinal diseases (IRD) for efficacy in clinical trials and for relationship to wayfinding in everyday function.

Methods: FFST outcome measures are proposed for evaluating visual function changes in clinical trials of subjects with IRD (e.g., RP & LCA). The FFST was developed to measure visual field sensitivity in subjects unable to fixate and/or with severe visual field loss. The FFST utilizes full-field stimulus presentation (e.g., Goldmann-Weekers perimeter bowl or colordome ganzfeld by Diagnosys). The Goldmann-Weekers (range of about 60 dB) is close to the luminance range limit for subjects with severe vision loss, including most with LCA. But luminance range is less an issue for the Diagnosys colordome system which can present flashes as bright as 4.5 logtroland-seconds (range of about 90 dB). Thirteen subjects with moderate or worse binocular vision loss due to IRD were assessed by visual acuity, contrast sensitivity, HFA (24-2), and FFST (Diagnosys). The Turano self-report survey assessed wayfinding in activities of daily living.

Results: Testing results found visual acuity from 0.78 to 1.90 logMAR, contrast sensitivity from 0.10 to 1.45 logcontrast, and visual fields less than 20 degrees. FFST thresholds for night-blind RP subjects were 20 to 40 dB higher than normals. LCA thresholds were 60 to 80 dB higher than normals. FFST test-retest variability was from 3 to 6 dB (5% to 10%) while HFA was much greater (5% to 60%). Regression analysis of independent vision loss measures on the Turano Survey overall score found no significant relationship for visual acuity, contrast sensitivity, or FFST thresholds ($p \leq 0.05$).

Conclusions: FFST measures may give significant visual field measures in people with moderate or worse vision loss due to IRD. FFST appears to compensate for eye movements and the normal HFA variability found in people with severe visual field loss. Further study is needed to find relationships between FFST and everyday function such as wayfinding.

3-07 Poster

Central Visual Field Changes In Myopic Glaucoma With Optic Disc Ovality

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Purpose: To evaluate clinical features in myopic glaucomatous eyes with central visual field defects.

Materials and Methods: Ninety four eyes of 94 patients (53 male, 41 female) were compiled with spherical equivalent from -0.5 to -9.0 diopters. Heidelberg Retina Tomograph (HRT) and fundus photography were conducted to calculate optic disc ovality and eyes with optic disc ovality ≦ 0.8 were selected on the rate of horizontal to vertical diameter. Visual field was examined using Goldmann perimeter and Octopus 101 (program M2). We analyzed mean sensitivity (MS) of the central visual field area into 8 divisions on the M2 program.

Results: The mean age of patients was 49.4±10.0 (27~68) years. The average of refraction error was -5.02±2.19 (-0.5~-9.0) diopters. The average of optic disc ovality was 0.717±0.1 (0.500~0.798). Increase optic disc ovality was associated with higher myopia. The average of MS within central 5 degrees was 31.3±2.7 (19.1~34.0)dB. High frequency of decreased sensitivity was observed on upper nasal quadrant within central 5 degrees, and associated with decreased sensitivity from 5 to 10 degrees area.

Conclusion: This study suggested that at the beginning of visual field defects, fixation area within central 5 degrees was not involved and after progression of glaucomatous optic disc changes fixation area might be involved from 5 to 10 degrees, so called Bjerrum area.

3-08 Poster

Scotopic, Mesopic, And Photopic Perimetry In Acute Zonal Occult Outer Retinopathy

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Purpose: To report results of Goldmann perimetry (GP) recorded under scotopic, mesopic, and photopic condition in patients with acute zonal occult outer retinopathy (AZOOR).

Patients and Methods: Patients were three males and one female who were diagnosed as AZOOR. GP, full-field electroretinograms (ERGs), and multifocal ERGs were performed on all patients. Three types of background luminance were used in GP, namely, 0 cd/m^2 (0 asb, scotopic GP), 10.0 cd/m^2 (31.5 asb, mesopic GP), and 34 cd/m^2 (106.8 asb, photopic GP). Scotopic GP was carried out after 15-minute dark adaptation, and photopic GP was performed after 10-minute light adaptation with a background light of 34 cd/m^2.

Results: All patients had a history of unilateral and sudden visual field abnormality, normal visual acuity, and unremarkable findings of funduscopy. Mesopic GP showed enlargement of the blind spot in all patients. The blind spot shown in photopic GP was much larger than that in mesopic GP, and the blind spot disappeared in scotopic GP in all cases. While the full-field ERG revealed reduced cone responses and normal rod responses, the multifocal ERG showed reduction of response density in the area of the blind spot.

Conclusions: These results suggested localized cone-system dysfunction and normal rod-system function in patients with AZOOR.

3-09 Poster

Objective Visual Field Evaluation Using Multifocal Visual Evoked Potentials In Patients With Intracranial Disease Complicated By Mental Disorder

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Purpose: We investigated whether visual field defects can be objectively evaluated using multifocal visual evoked potentials (mfVEP) in patients with intracranial disease complicated by mental disorder.

Methods: First, to determine normal waves in mfVEP, recording was performed using a VERIS Junior Science (Mayo, Aichi, Japan) in 40 healthy subjects (40 eyes), consisting of 22 males and 18 females aged 20 to 72 (mean age, 45.5 years). Responses from 8 sites in each subject were divided into 4 quadrants (superior and inferior temporal quadrants and superior and inferior nasal quadrants). In each quadrant, two response waves were grouped and averaged, and the peak latency and amplitude were used for assessment. In 3 patients with intracranial disease complicated by mental disorder in whom dynamic or static perimetry was impossible, or reliable data could not be obtained, mfVEP recording was performed, and quadrants showing abnormalities were compared with the sites of intracranial lesions observed by imaging techniques.

Results: In the 40 normal subjects, no significant differences were observed in the peak latency among the 4 quadrants, but the amplitude was significantly higher in the inferior than in the superior semi-field. mfVEP in 3 patients showed abnormal waves, which corresponded to the lesion observed by imaging techniques.

Conclusions: The objective evaluation of visual field defects using mfVEP may be useful in patients with intracranial disease complicated by mental disorder in whom kinetic/static perimetry as a subjective examination is difficult.

4-01

Age-Corrected Normative Data For The Entire (90°) Visual Field, Assessed With Full Threshold Automated Static Perimetry And A Fast Thresholding Algorithm (GATE)

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Purpose: To assess age-corrected normative hills of vision for automated static full-field (90 degree) perimetry, obtained with a conventional and a new strategy (GATE = German Adaptive Threshold Estimation), respectively.

Subjects and Methods: Eighty-one normal subjects, aged from 10 to 79 years were enrolled in this study, which was performed on the new Octopus 900 perimeter (HAAG-STREIT Inc., Koeniz, Switzerland). Eighty-six static stimuli (Goldmann size III = 26´) up to a maximal eccentricity of 80 degrees, with a condensation towards the visual field centre, were presented on a homogeneous background under photopic conditions (luminance level 10 cd/m^2). A conventional (4-2 dB bracketing with two reversals) and a fast thresholding algorithm (GATE: initial step size of 4 dB and at least one reversal) were used. Local differential luminance sensitivity (DLS) values were estimated by applying the maximum likelihood (ML) procedure. A smooth mathematical model was fitted to the data set, allowing to predict the local DLS values for any location of the entire visual field.

Results: The variances of the model fits for the conventional (R^2= 0.75) and for the GATE (R^2 = 0.72) strategy were nearly identical. The residual standard deviation over the entire 90 degree visual field was 2.36 dB for the conventional and 2.52 dB for the GATE strategy, respectively. The number of questions asked (median) was 401 for the conventional and 337 for the GATE strategy in this cohort of normal subjects.

Conclusions: A smooth mathematical model allows for the prediction of local differential luminance thresholds of normal subjects for any location within the entire 90 degree visual field, obtained with the new Octopus 900 perimeter. The new, fast GATE strategy reduces the number of questions asked, compared to a conventional 4-2 dB bracketing algorithm.

4-02 Poster

Quantitative Assessment Of The Visual Field Loss Due To Retinitis Pigmentosa Using Semi-automated Kinetic Perimetry

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Purpose: To quantitatively assess the visual field loss due to retinitis pigmentosa and the retest reliability of visual field examinations, using semi-automated kinetic perimetry (SKP).

Methods: Sixteen patients (six female, ten male; mean age 37 years; range of visual acuity 2/20 to 20/20) with retinitis pigmentosa were monitored over a period of two years. Four visual field examinations with SKP, using the Octopus 101 instrument (Haag-Streit Inc., Koeniz, Switzerland) were performed in each patient. The mean interval between the examinations was eight months (range 6-11 months). Three stimulus conditions (V4e, III3e and I4e) with constant stimulus angular velocity of three degrees per second were used to assess the hill of vision in both eyes of each patient. The individual reaction time was measured by presenting kinetic stimuli (III4e) within intact areas of the central visual field. The area of each isopter was measured and corrected for the individual reaction time.

Results: There were four mild concentric constrictions, six ring scotomas and six advanced concentric constrictions of the visual field. For each subject, neither the mean areas of the isopters nor the individual reaction times differed significantly between the four sessions (ANOVA, $p > 0.4$).

Conclusions: SKP allows for the quantitative measurement of the isopter area. We did not observe any significant progression of the visual field loss in our cohort of 16 patients suffering from retinitis pigmentosa over the (comparatively short) follow-up period of two years.

4-03

Comparison Between Semi-automated Kinetic Perimetry(SKP) And Fully Automated Kinetic Perimetry (AKP = Program K) In Patients With Visual Field Loss

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Purpose: To quantitatively compare the results obtained using a semi-automated kinetic perimetry (SKP) with those obtained using a fully automated kinetic perimetry (AKP=Program K) in patients with visual field (VF) loss.

Subjects and Methods: Twenty-three patients (13 eyes suffering from glaucoma, 5 eyes from retinitis pigmentosa, and 5 eyes from neuro-ophthalmological diseases, with an average age of 60.2±15.4 yrs) were included in this study. One eye of each patient was examined with SKP and Program K. VF loss was assessed by using the following stimulus characteristics: V/4e, III/4e, I/4e, I/3e, I/2e, I/1e and target speeds of 3 and/or 4 degrees/sec, depending on the patient's visual field patterns. In order to compare their location and size, the isopters of SKP and Program K were superimposed. The area of intersection could then be expressed as a percentage of the union area. The area and position of isopters for each stimulus condition were compared between the two methods. Test duration was also evaluated.

Results: Our results indicated that the isopter shape and size of Program K were comparable to those obtained on the same eyes with SKP. The ratio of intersection area to union area for each isopter was 85 % (V/4e), 74 % (III/4e), 65 % (I/4e), 61% (I/3e), 63% (I/2e), and 60% (I /1e). The average ratio of intersection area to union area of all isopters was 68%. The average of examination duration was 9.0±2.9 minutes for SKP and was 13.3±3.9 minutes for Program K.

Conclusions: Program K is a useful fully-automated kinetic perimetric method for assessing visual field loss in clinical practice. Our results of Program K are very comparable to those of semi-automated kinetic perimetry.

4-04
Influence Of Media Opacities On Flicker Perimetry

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Purpose: We have previously reported that CFF threshold values obtained from flicker perimetry were less influenced by media opacities than other contrast based perimetric techniques. In this study, we investigate the influence of media opacities on flicker perimetry using probability values obtained from normative flicker database including 4-zone probability strategy and compare it with 4 other kinds of different types of perimetry.

Methods: Ten eyes of 10 normal subjects, 20 eyes of 20 cataract patients and 7 eyes of 7 glaucoma patients with cataract were tested using Octopus flicker perimety (FP), standard automated perimetry (SAP), blue on yellow perimetry (B/Y) and frequency doubling technology (FDT screener and Matrix). Six kinds of occlusion diffuser were used for normal subjects in order to simulate the media opacities. The influence of media opacities on perimetric values are compared by probability map.

Results: Using SAP, B/Y, FDT and Matrix, the perimetric probability values were significantly affected depending on the density of the occlusion diffusers except for flicker perimetry. In cataract patients and glaucoma patients with cataracts, perimetric values were also significantly affected depending on their corrected visual acuity. However, the CFF values of the flicker perimetry were less affected by cataracts.

Conclusion: All the perimetric methods which change the contrast of the test target for detecting the value were affected by media opacities. The CFF values obtained by flicker perimetry were the least effected by media opacities.

5-01 Poster

A Comparison Of Catch Trial Methods Used In Conventional Perimetry In Glaucoma Patients

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Purpose: To compare the false positive rates between two different methods for estimating false positive catch trials used by the Humphrey Field Analyzer (HFA) in glaucoma patients.

Methods: One eye of 120 Glaucoma patients was tested twice within 2 months with Size III 24-2 SITA Standard and Size V 24-2 Full Threshold perimetric test procedures. False positive (FP) rates were obtained with the response time window method (RTW) used by SITA and the blank presentation (BP) method of the size V full threshold procedure. False negative (FN) catch trial rates were also examined. A repeated measures, 2 x 2 analysis of variance (ANOVA) was used to examine error rates and FP rates for visit 1 and 2 were regressed to investigate their relationship.

Results: Glaucoma patients had higher mean FP rates with RTW than BP on visit 1 (p=0.006, 2.3% vs. 1.68%) and higher mean FN rates as well (p=0.001; 4.1% vs. 1.7%; Table). When comparing visit 2, glaucoma patients had significantly higher FN's rates with RTW than BP (p=0.001; 3.61% vs. 1.22%). Linear regression indicated that, for visit 1 in glaucoma patients, FP rates in RTW accounted for only 6.63% of the variability in BP error rates; and only 3.88% in visit 2. Analysis of patients with FP with both methods shows RTW underestimates the FP rate.

Conclusion: The response time window method is not a good predictor of false positive rates obtained using the blank presentation procedure and underestimates FPs.

Test Catch Trial	Visit 1	Visit 2
Size III FP (RTW)	2.3%	1.7%
FN	4.1%	3.6%
Size V FP (Blanks)	1.7%	2.1%
FN	1.7%	1.2%

5-02

Use Of A Continuous Probability Scale To Display Visual Field Damage

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Purpose: To derive and display the percentile score (1-99) at each perimetric location of a standard automated perimetry (SAP) test to determine if this technique will uncover patterns of loss not visible in standard (Statpac) probability maps.

Methods: We computed continuous scale probability plots from data collected from testing 305 normal participants with SAP using SITA Standard testing with Humphrey Field Analyzer (Model 750) automated perimetry. The thresholds from the results of the healthy subjects were sorted from highest to lowest at each visual field location tested. Empirical percentiles were derived in single increments from the first to the 99th percentile from age-corrected threshold decibel values from normal subjects. Using the statistical programming language R, we displayed the continuous probability plot as a color scale and then interpreted visual field plots from normal subjects and from patients with visual system disorders where the diagnosis was unequivocal.

Results: Added information was achieved in identifying patterns of visual loss by using the 5th-20th percentile range in conjunction with the lower range below the 5th percentile typically used in visual field analysis software. Extent of contiguous regional defects appeared larger using this method. Normals commonly have threshold results within the 5-20 percentile range but test locations usually appeared spatially random throughout the visual field rather than in a pattern.

Conclusions: Continuous scale probability plots are a useful adjunct for interpretation of perimetry results.

5-03 Poster

Area-Threshold Curves Obtained Using Various Objects

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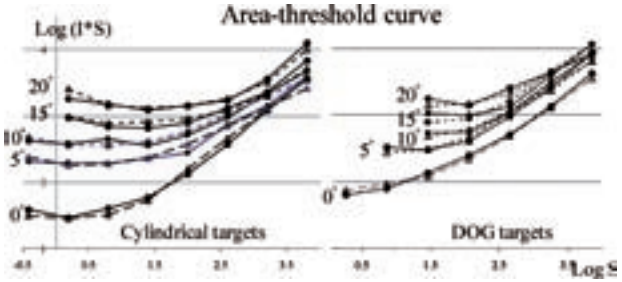
Purpose: Small size targets are useful for detecting slight optic nerve disorder such as preperimetric glaucoma or optic neuropathy. The purpose to this study was to investigate the effect of target area to the threshold in various visual stimulations.

Methods: A fundus oriented perimeter was used, which was developed on VisualBasic .NET. The targets were presented at the 0, 5, 10, 15 and 20 degrees of eccentricity on a 135 degree line. The colors of the visual targets were white, red, green, blue and yellow. The diameters were from 0.75 to 96 minutes of arc. The shapes were round homogenous (cylindrical) and difference of Gaussian (DOG). The threshold was measured by constant method using pulse and ramp stimulations and area-threshold curves were drawn. The computer simulation was done in each area-threshold curve according to the total activity model for increment threshold (TAMIT).

Results: Area-threshold curves obtained using cylindrical and DOG stimulations were shown.
Solid lines indicate actual data and dotted lines, the results of simulation. Only at the 0 degree point the simulation by p-cell fitted and that by m-cell fitted at the other points.

Conclusion: M-cells are predominant in perimetry using white targets, except at the fovea.



5-04 Poster

Influence Of Ocular Optical System Aberrations In Perimetry, Especially For Peripheral Vision Measurement

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Purpose: We investigated point spread function (PSF) of central and peripheral vision in eyes with various optical systems by comparing perimetry measurements of young eyes, eyes with presbyopia, eyes that received laser in situ keratomileusis (LASIK) and eyes with intraocular lenses.

Methods: The subjects were a female in her 20s with uncorrected vision of 1.2, a female in her 20s who had received LASIK, two males with presbyopia in their 40s and 50s, and a female in her 50s with intraocular lenses. Using a PSF-1000 (TOPCON Co.), a different diameter double-pass PSF with 1.3 mm of incidence diameter, 3.0 mm and 4.0 mm of output diameter was measured in 0.25D steps to obtain single-pass PSF. The measurement sites were the center and 10, 20, 30, 40 and 45 degrees horizontally from the temporal and nasal sides.

Results: The astigmatism and coma aberration in the peripheral vision were remarkably larger in the eyes that received LASIK and the eyes with intraocular lenses than in the young or presbyopic eyes, although they all had good vision. Furthermore, the object distance in which the circle of least confusion was obtained was far-off in the temporal sides of the eyes with LASIK and those with intraocular lenses.

Conclusions: In peripheral vision, there were astigmatism and coma aberrations, and the point images that were projected onto the retina differed depending on the measurement sites. It was suggested that the aberration influenced the results of threshold measurements in the peripheral vision.

5-05

How Do Different Test Strategies For Estimating Perimetry Thresholds Behave When The Dynamic Range Of Measurement Varies?

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Background: The Moorfields Motion Displacement Test (MDT) is a perimetric test of motion hyperacuity for glaucoma detection and runs on a standard computer. We have investigated different threshold test procedures for the MDT and this current study was motivated by the characteristically short dynamic measurement range of the current MDT.

Purpose: To examine the effect of the dynamic range of measurements via computer simulation, on the efficiency of estimating thresholds for various test algorithms.

Methods: Various test algorithms were examined: a Bayesian ZEST-type procedure, a modified binary search MOBS-type procedure and standard staircases. The computer simulations were built in part on multi-location MDT measurements from 118 healthy control subjects. In addition, 14 glaucomatous patients and 13 age-matched controls performed a frequency-of-seeing (FOS) experiment of MDT sensitivity with 15 presentations at each displacement magnitude (method of constant stimuli) at 7 locations. FOS data was used to simulate 1000 patient responses to each of the procedures at each of the locations for different dynamic ranges. Each procedure was allowed 3 reversals and starting at the point on the dynamic range closest to the peak of the normative distribution of thresholds for that location. Mean number of responses to termination (test time), bias, precision and efficiency for each test procedure were calculated using the methods of Treutwein 1995 (*Vision Res* 35:2503-22).

Results: In normal subjects, ZEST-type procedures consistently outperform other strategies across different dynamic ranges in terms of efficiency and better test times. In patients, differences in efficiency between strategies is less clear when the dynamic range is narrow, but ZEST outperforms other strategies as the dynamic range widens with significantly reduced test time; the MOBS-type procedures are more precise and less biased than other strategies when the dynamic range is narrow.

Conclusions: Comparative performance of Bayesian ZEST-type, MOBS-type and staircases procedures for estimating thresholds varies with the dynamic range of a perimetric test.

5-06 Poster

Risk Factors For Progressive Visual Field Loss That Threatens Fixation

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Purpose: To evaluate routine ophthalmic data in order to identify clinically useful risk factors for progressive visual field loss that threatens fixation in patients with open angle glaucoma.

Subjects and Methods: Patients with open angle glaucoma who had over 5 years of follow up data available were selected. The power of myopia , DH (disc hemorrhage), PPA (peripapillary atrophy) and intraocular pressure from patients with worsening of the central visual field defect were evaluated.
The central visual field defect is evaluated by total values threshold of four paracentral field locations and sixteen paracentral field of the HFA using 30-2 programs.

Results: One hundred fifty-two eyes of 77 patients were selected. Significant deterioration was found in the severe myopia group(<-6D) at four paracentral field locations(p=0.015) but not sixteen paracentral field locations (p=0.101) in comparison with normal refractive group (-1D<and<+1D). The DH(+) group was associated with increased risk of glaucomatous central visual field defect than the DH(-) group (p=0.0039), but the existence of PPA and intraocular pressure were not risk factor.

Conclusion: It was suggested the risk factors were the power of myopia and the presence of DH causing deterionation of visual field loss that threatened fixation. Glaucoma patients with visual field defects that involved the central visual field are at greater risk of losing visual acuity. Ophthalmologists should pay particular attention to paracentral visual field points in the severe myopia group and the group showing the presence of DH.

6-01 Poster

Comparison Of The Retinal Sensitivities And The Global Indices In SITA Standard And Dynamic Strategies

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Purpose: To compare the retinal sensitivities and the global indices in visual fields with the Humphrey field analyzer (HFA) SITA-standard strategy (SITA-S) and the Octopus Dynamic strategy (Dynamic).

Methods: Sixty nine volunteers (50.9±16.3years) of over 20 years of age without apparent ophthalmic abnormalities were enrolled. Informed consent was fully obtained. Prior to this study, the background luminance, stimulus size and exposure time in the Octopus 101 were manipulated to those in the HFA settings. Number 32 program of the Octopus and the central 30-2 program of the HFA were applied for the examination. In each examination, SITA-S was firstly performed, and after 10 minutes' break, followed by Dynamic. Those eyes with over 0.8 of corrected visual acuity; more than -6.0 diopters of refraction, and those fields with satisfactory levels of reliability in SITA-S and Dynamic were selected for this study. The mean defects (MDf) and square root of loss variances (sLV) based on the age related mean retinal sensitivities (dMS) in Dynamic were calculated and compared to the mean retinal sensitivities (sMS), mean deviation (MD) and pattern standard deviation (PSD) in SITA-S. The signs of MDf, however, were changed to negative value prior to calculation. Statistical analysis was evaluated with JMP6.0.3 and the statistically significant level was assumed to be less than 5%.

Results: One hundred and twenty-six eyes were satisfied the selection criteria in this study. The dMS (26.69 +/-2.43dB) and sMS (28.96+/-2.21dB) showed a significant correlation (r=0.6939, p<0.0001). There was a significant difference between the sLV (2.26+/-0.77dB) and PSD (2.04+/-1.10dB) (p<0.0001), whereas no significant difference was observed between MDf (0.00+/-1.99dB) and MD (-0.40+/-1.59dB).

Conclusion: The differences of the measurement strategies may play a role in the difference of retinal sensitivities and global indices seen in Dynamic and SITA-S.

6-02 Poster

Detectability Of Early Stage Glaucomatous Visual Field Defects In Dynamic And SITA Standard Strategies

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Purpose: To compare the detectability of early stage glaucomatous visual field defects between Octopus Dynamic strategy (Dynamic) and Humphrey SITA-standard strategy(SITA).

Subjects and Methods: After obtaining informed consent, visual fields were examined in primary open angle glaucoma (POAG) and normal tension glaucoma (NTG) patients with Dynamic and SITA on the same day. The order of each examination was randomized with 10 minutes' break. Patients having glaucomatous optic neuropathy with no apparent ocular disorders, undergone automated perimetry twice or more previously, best-corrected visual acuity of 20/25 or better, mean deviation (MD) of -6.0dB or better in both eyes were eligible for this study,. Condition of Dynamic were set as those in SITA, i.e., background luminance (31.4asb.); stimulus duration (0.2sec) ;stimulus size (size III), respectively. Mean defect (MDf), square loot of loss variance (sLV) of Dynamic and MD, pattern standard deviation (PSD) of SITA were evaluated by a glaucoma specialist in independently. The signs of MDf, however, were changed to negative value prior to calculation.

Results: Of 144 eyes of 74 patients examined, 58 eyes of 58 patients (mean age 61.2±8.1 years old, mean spherical equivalent -0.7±2.0D) met the present criterion and included in this analysis. There was no significant difference between MD (-1.28±2.01dB) and MDf (-1.30 ± 2.93dB) (p=0.9142) or PSD (3.44±2.48dB) and sLV (3.79±1.76dB) (p=0.1197). The percentage of diagnostic criterion of abnormal at 5% level was significantly different between SITA and Dynamic in MD (20/58:34.5%) and MDf (11/58:19.0%) (p=0.0390), but not in PSD (21/58:36.2%) and sLV (20/58:34.5%) (p=1.0000).

Conclusion: Comparing between sLV and PSD, there was no difference in the detectability of early stage glaucomatous visual field defects. Therefore, significant difference in percentage of diagnostic criterion in MD and MDf is thought to be influenced by different distribution in normal visual field sensitivity between SITA and Dynamic. When applying SITA strategy, smaller variance in visual field sensitivity may be expected, therefore,
smaller MD and greater PSD would be conceivable.

6-03

Variability With Multisampling Suprathreshold Perimetry And SITA Standard Perimetry In Glaucoma

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Purpose: To compare visual field test-retest variability in stable glaucomatous eyes with Multisampling Suprathreshold (MultiSS) and SITA threshold strategies.

Methods: The central visual fields of 38 glaucomatous eyes from 38 patients were examined on two occasions with the strategies SITA standard 24-2 (Humphrey Field Analyzer) and MultiSS 24-2 (Henson Pro perimeter). The number of defective test locations (max 50, excl blind spot locations) were examined at three cut off levels for SITA (PDP: ≤5%, ≤2% and ≤0.5%) and MultiSS (≥60%, ≥75% and 100% stimuli missed). The 95% range for the differences between replicates and the 95% limits of agreement (visit 2) were used as measures of repeatability and agreement. Spatial overlap (number of common defect locations versus mean number) within and between strategies (visit 2) were also compared.

Results: At the 3 chosen cut off levels the two strategies had similar distributions of missed stimuli (see table, Mean and SD) while the repeatability was larger for MultiSS (see table).

	PDP ≤5% or ≥60% missed			PDP ≤2% or ≥75% missed			PDP ≤0.5% or 100% missed		
	Mean	SD	Repeatability Agreement	Mean	SD	Repeatability Agreement	Mean	SD	Repeatability Agreement
SITA/SITA	16	11	7.9	13	11	7.0	12	11	6.5
MultSS/ MultiSS	14	12	15	12	11	12.4	8	9	9.3
SITA/ MultiSS	15	11	16.7	13	11	14.2	10	10	13.6

Intra strategy overlap was good for both strategies; SITA R^2=0.96, 0.98 and 0.97 for PDP cut offs ≤5%, ≤2% and ≤0.05% respectively: MultiSS R^2=0.93, 0.94, 0.89 for cut offs ≥60%, ≥75% and 100% misses and inter strategy overlap (visit 2) at R^2=0.88, 0.89 and 0.87, respectively.

Conclusions: MultiSS 24-2 is comparable to SITA Standard 24-2 in terms of the number of defective locations at the chosen cut off values but has a larger test-retest variability. The overlap of defective locations was good for both strategies and there is good agreement between the 2 strategies on the location of defects.

6-04 Poster

The Relationships Between Threshold Estimates And Effective Dynamic Ranges Of Standard Automated Perimetry (Size III And V), Motion And Matrix Perimetry

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Purpose: To establish the relationships between threshold estimates of 4 perimetric tests, and to compare the tests' effective dynamic ranges.

Methods: We examined 32 experienced glaucoma patients (median MD -6.7 dB; range -0.1 to -20 dB) and 20 naïve healthy controls five times, once a week for 5 weeks. Participants were examined with: (1) Humphrey Field Analyzer SITA Standard stimulus size Goldmann III (SAP III), (2) HFA Full Threshold Goldmann V, (3) Motion Perimetry, and (4) Matrix perimetry, administered in random order. We explored the relationship between pointwise threshold estimates obtained with the 4 techniques using regression techniques. The lower limit of the effective dynamic range was arbitrarily defined a) as that threshold for which the proportion of retest values with floor effects (thresholds of 0-dB) increased beyond 5%, and b) in which that proportion increased beyond 50%.

Results: In both groups of subjects, the relationship between threshold estimates of all 4 tests was approximately linear over the physiological range of values encountered in controls. However, outside this range the relationships progressively weakened and became difficult to characterize (r-square < 0.1). With SAP III, the proportion of 0-dB estimates (floor effects) increased beyond 5% for thresholds below ~20 dB, and 0-dB estimates were the most frequently encountered retest value for initial estimates below 15 dB. For both definitions of effective dynamic range, the increased stimulus size V expanded the range by approximately 5 dB. However, despite their larger stimuli, Matrix and Motion perimetry showed similar floor effects as SAP III.

Conclusions: The effective dynamic range of visual field tests may be chiefly limited by retest variability rather than by the maximum physical intensity of the stimulus. With standard perimetry, the effective dynamic range is substantially narrower than the nominal range of the dB-scale, but larger stimuli Goldmann V may reduce the incidence of floor effects and thereby increase the effective range.

6-05

Conventional (Octopus G1X) And Flicker Fusion Perimetry (Pulsar) In Glaucoma: A Clinical Comparison

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Purpose: To determine the usefulness of a flicker fusion perimeter (PULSAR) in glaucoma subjects.

Methods: 325 patients including: normal, ocular hypertensive, glaucoma suspects and patients exhibiting mild or moderate POAG, with up to 2.5 years of perimetric exams using both the Octopus 1-2-3 perimeter (G1X program) and a new flicker fusion CRT device (PULSAR) were observed retrospectively. All exams on both devices used the TOP strategy within a 30 degree field. Average test duration was 3 minutes per eye for all exams. 219 eyes of 110 study patients had 3 or more follow-up exams with Pulsar (mean 3.4 tests). Exam results were compared with conventional perimetry.

Results: In all patient groups, 50% of study eyes showed equivalent results between the Octopus 1-2-3 and PULSAR exams. In 45% of all study eyes, the PULSAR exams showed more abnormality than the Octopus 1-2-3. In 5% of all study eyes, the PULSAR exams showed less abnormality than the Octopus 1-2-3. Further medical review of the study eyes which exhibited a difference between the Octopus 1-2-3 and the PULSAR exams were in favour of the PULSAR findings for a majority of cases. Patients' acceptance of this short test with fan-like stimulation was good. The somewhat limited dynamic range excludes follow-up of advanced cases.

Conclusions: Flicker fusion perimetry is useful for early diagnosis and follow-up of mild and moderate glaucoma. Diagnostic classification depends on the applied perimetric method.

6-06 Poster

Pulsar Perimetry In Diagnosis Of Early Glaucoma

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Purpose: To assess the ability of Pulsar perimetry (PP) for detecting early glaucomatous visual field (VF) damage in comparison to FDT, GDxVCC, and HRT.

Method: This multicentre prospective study included: 87 ocular hypertensives (OHT); 71 glaucomatous optic neuropathy (GON) patients; 81 glaucomatous (POAG) patients; and, 90 normals (one eye/patient). All patients underwent SAP, FDT, PP, GDxVCC and HRTII. The area under the ROC curve (AROC) for discriminating between healthy and glaucomatous eyes was calculated for different parameters and compared between instruments. SAP was taken as gold standard in defining POAG. The degree of agreement between the best parameters for each test was assessed using a Kappa test.

Results: The best discriminating parameters (and respective AROCs and best cut-offs for discriminating between normal and POAG eyes) were: loss variance square root (sLV) for PP (.90; >2.4 src); number of areas of the pattern deviation probability plot with p<5% for FDT (.89; >2); NFI for GDxVCC (.79; >27); and Cup Shape Measure for HRT (.82; > -.15). The AROCs for discriminating between normal and GON eyes were respectively .83, .88, .78 and .91. PP was significantly shorter than SAP and FDT (P<0.001). The agreement between the best parameters for each test ranged from .30 to .56 for discriminating between control and POAG eyes; and, from .12 to .36 for discriminating between control and GON eyes (Kappa test).

Conclusions: The Pulsar T30W test appeared to be a rapid and easy perimetric test, showing good ability for detecting eyes with early glaucomatous SAP defects and those with GON. In comparison to FDT, the diagnostic performance of PP was comparable in POAG diagnosis, yet slightly less in GON eyes. Further studies are needed to determine the use of PP in a clinical setting.

6-07

Potential Of Frequency Doubling Technology For Earlier Detection Of Damage Than Standard Automated Perimetry In Glaucoma With Lowered Intraocular Pressure

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Purpose: Standard automated perimetry (SAP) is not selective for a particular ganglion cell type, while frequency doubling technology (FDT) mainly measures M-cell system function, and FDT perimetry reportedly detects functional damage in ocular hypertensive eyes earlier than SAP. We studied whether FDT has potential for earlier detection of functional damage in a SAP-normal field in glaucoma eyes with lowered intraocular pressure (IOP).

Subjects and Methods: A total of 38 eyes of 31 open angle glaucoma (OAG) cases meeting the following criteria were included. 1) Visual field damage determined by Humphrey Field Analyzer (HFA) confined to upper or lower hemifield, 2) Follow-up (F/U) of ≥ 2 years wherein IOP was consistently < 20 mmHg with or without topical medication and ≥ 5 reliable and learning effect-free test results by 30-2 SITA-S program of HFA and N-30 program of FDT are available, 3) No significant media opacities and no incisional ocular surgeries during the F/U. In both of the HFA-normal and -abnormal hemifield, time change in the mean of total deviation values of HFA (HFA-slope) and aging effect-corrected time change in the mean of FDT sensitivity (FDT-slope) were calculated using a linear mixed model.

Results: Age, HFA-MD, F/U period and IOP during F/U averaged 55.2 years, −3.4 dB, 4.9 years and 13.0 mmHg, respectively. HFA-slope was −0.08 (P>0.5) and −0.30 dB/yr (P<0.01), and FDT-slope was −0.18 (P<0.01) and −0.21 dB/yr (P<0.01) in the HFA-normal and -abnormal hemifield, respectively.

Conclusion: In HFA-normal hemifield of current OAG eyes, aging-effect corrected FDT result showed significantly negative time change, while that of HFA did not, which suggests potential of FDT for earlier detection of functional damage than SAP in glaucoma eyes with mean IOP of 13 mmHg. Once the damage reaches a SAP detectable level in these eyes, both aging effect-corrected HFA and FDT results showed significantly negative time change.

6-08

Comparison Of N-30 And 24-2 Threshold Programs Of Frequency Doubling Perimetry For The Evaluation Of Glaucomatous Visual Field Defect Severity

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Purpose: To examine the compatibility and difference between N-30 and 24-2 threshold program of frequency doubling perimetry for the evaluation of glaucomatous visual field defect severity.

Methods: Thirty-eight eyes of 38 patients of early stage of glaucoma or glaucoma suspects were tested with N-30 and 24-2 threshold programs of Humphrey Matrix. According to the N-30 pattern, test points of 24-2 program were clustered. The average threshold values and the number and extent of abnormal points in total and pattern deviation probability plots in each cluster were compared with each other. The results were also compared with those of 24-2 SITA standard program of Humphrey Visual Field Analyzer.

Results: The correlation coefficients between the threshold values of N-30 and the average threshold values of 24-2 programs were ranged 0.34 –0.86 with the high values at temporal superior area and the low values at nasal area. The severity of visual field defects shown in the pattern deviation probability plots agreed well with each other (the correlation coefficients between the ranked severity at the each test points of N-30 pattern and the averaged ranked severity of 24-2 pattern were ranged -0.02 – 0.69), especially at the points of temporal superior and temporal inferior area whereas that in the total deviation probability plots did not agree well (the correlation coefficients between the ranked severity at the each test points of N-30 pattern and the averaged ranked severity of 24-2 pattern were ranged -0.06–0.45).

Conclusions: The severity of glaucomatous visual field defects tested with N-30 and 24-2 threshold program of frequency doubling perimetry corresponds well with each other, especially in the temporal superior area. Compared with the total deviation probability plots, the pattern deviation probability plots showed more consistent results between the programs.

7-01

Comparison Of Analysis Methods For Progression Of Visual Field Defect

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Purpose: To compare the analysis methods for progression of visual field damage in patients with normal-tension glaucoma (NTG).

Methods: Ninety-two eyes with 92 NTG patients were followed up for more than 2 years with topical antiglaucoma medication. We retrospectively reviewed the clinical records and the results of Humphrey visual field examination for all patients, and evaluate the progression of visual field damage based on glaucoma change probability analysis (GCPA) using STATPAC2 software. The linear regression analysis for mean deviation (MD) and pattern standard deviation (PSD) was performed. If the slopes of linear regression showed the statistically significant negative, it was defined that the visual fields showed the tendency of progression. If the three or more points showed significant depression from the baseline in two consecutive total deviation (TD) maps using GCPA, it was defined that the localized progression was occurred when the first perimetric abnormality was detected. We also analyzed the relationship between the visual field progression and the clinical factors using multiple logistic models.

Results: Thirteen eyes showed significant progression in MD slope, 17 eyes revealed significant progression in PSD slope, and 42 eyes reached the end-points of the localized progression. The changes of MD slope were significantly associated with disc hemorrhage (p=0.026) and mean IOP during follow-up period (p=0.034), the changes of PSD slope with disc hemorrhage (p=0.009) and baseline corrected PSD (p=0.008). The localized progression was significantly associated with IOP fluctuation of diurnal tension curve (p=0.017).

Conclusion: The evaluation for progression of visual field and the prognostic factors for progression differed according to the analysis methods and definition of the progression.

7-02

Detection Of Local Visual Field Deterioration In Patients With Diffuse Improvement Using Cluster Trends Analysis

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Purpose: To detect the local visual field (VF) loss progression in patients with diffuse improvement, such as long term learning effect, using cluster-trends analysis.

Methods: One hundred and fifty three follow-up series of the reliable VF test results using Octopus program G2 normal strategy in each eye with glaucoma, glaucoma suspect or ocular hypertension were included. The results of the initial test in each eye or the test results with higher than 15% of false positive responses or higher than 20% of false negative responses were excluded. Each VF series included six or more test results. Their follow-up periods were 5 years or more. The trends of the global visual field indices, the absolute and the shift-corrected cluster defects in each cluster of G2 test points were analyzed by Octopus Field Analysis (OFA) version 2.2.

Results: Mean defect (MD) of the initial test of each VF series ranged between -2.9 and 14.6 dB (mean: 3.0 dB, SD 3.2 dB). MD slope by linear regression of each series ranged from -0.9 to 1.0 dB/year (mean and median: 0.0 dB/year, minus: deterioration, plus: improvement). Twenty four eyes (16%) had statistically significant MD slope (p<0.05, two-sided) and 14 eyes of them (9%) showed significantly improving MD (range: 0.2 - 1.0 dB/year) with improving diffuse defect. Five eyes (3%) with significantly improving MD had a few significantly deteriorating clusters with trend analysis of shift-corrected defects in cluster, and one of them had one significantly deteriorating cluster with trend analysis of absolute defects in cluster (p<0.05, two-sided).

Conclusions: Cases with long term improvement of MD are not unusual. The trend analysis of shift-corrected defects in cluster is useful to detect local VF deterioration in such cases.

7-03

Poster

The Influence Of Initial Visual Field Sensitivity On The Rate Of Visual Field Loss Over Time In Glaucoma Patients

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Purpose: To study the influence of mean sensitivity of whole central visual field and seven different regions of the field at the beginning of the study on the slope of regression line of visual field over time in patients with primary open angle glaucoma.

Methods: A minimum of five visual fields were performed with an Octopus 500EZ using program G1 (threshold strategy) over a mean of four year period in 64 patients (114 eyes) with primary open angle glaucoma. The rate of change of the whole central visual field and each of seven regions of the field were measured by linear regression analysis of the mean sensitivity value (dB) versus time (months), The mean sensitivity of the whole central visual field as well as of the each field region at the beginning of the study (initial sensitivity) was correlated with the slope of the regression line of the corresponding field region. Spearman rang correlation coefficient and the Spearman probability p value were calculated.

Results: The initial mean sensitivity of the whole central visual field was 19.22±6.39dB. The highest mean sensitivity was recorded in central region (22.49±6.57dB), whereas the lowest mean sensitivity were found in nasal (17.64±8.01dB) and upper nasal (17.68±7.64) regions. The slope of the regression line for the whole visual field during the mean follow- up period (48.85±17.84 months) was -0.02± 0.09 dB/months. The slopes had negative values in all seven regions of the visual field. Correlations between the initial mean sensitivity and the slope of the linear regression line in each field region were negative (negative value of Spearman correlation coefficient) as well, indicating that lower initial sensitivity was associated with higher rate of visual field loss. The best correlations between the initial mean sensitivity and slope of visual field were determined in regions with lowest mean sensitivity: in upper nasal region (Spearman r =-0.181, p = 0.053) and in nasal region Spearman r = -0.173, p = 0.065).

Conclusion: The study shows that lower mean sensitivity value of visual field, especially in nasal and upper nasal visual field regions carries the grater risk for progressive loss of visual field over time in glaucoma patients.

7-04

Specificity Of The Program Threshold Noiseless Trend (TNT) For Perimetric Progression Analysis

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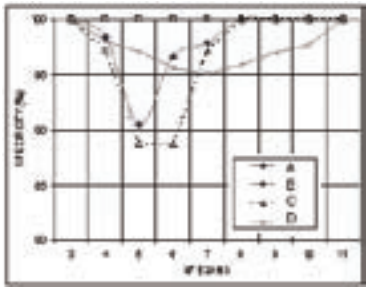
Purpose: To evaluate the specificity of TNT using four procedures.

Methods: A.- In 63 eyes with ocular hypertension, whose last examination showed no perimetric or morphological defects, we performed a mean 7.70 ± 1.71 follow up examinations during 2.2 ± 0.6 years. B.- In 81 glaucomatous eyes examined twice with a Bracketing strategy (Octopus 1-2-3 perimeter) we calculated mean threshold value and long-term fluctuation. We simulated 12 different visual fields, adding a random component to simulate an equivalent fluctuation of amplitude. C.- 72 glaucomatous eyes, with and without progression, were examined 7.76 ± 1.25 times during 4.88 ± 1.39 years using Humphrey-Sita Standard strategy. Visual field tests were randomly disordered and analyzed using TNT. D.- 1221 eyes were examined 7.19 ± 3.5 times during 3.50 ± 1.45 years (10,407 visual fields) using TOP-G1 program. We detected progression in 204 eyes using TNT. They were re-evaluated after random disordering of visual field tests.

Results: The four procedures indicated specificity over 95% as from the seventh examination; this reduced to 90% in model C with 6 examinations, and in models A and C with 5 examinations.



Conclusion: The specificity of TNT may be considered to be over 95% with a large number of examinations, and 90-100% with fewer examinations.

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7-05

Sensitivity Performs Better Than Slope At Predicting Future Progression In Early Glaucoma

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Purpose: To use visual fields to predict future visual field progression in early glaucoma.

Methods: Visual fields were analysed from both eyes of 69 patients with suspected or early glaucoma (mean deviation at study entry no worse than -6dB). All patients had undergone at least one previous visual field test per eye prior to study entry. Each eye had an unbroken sequence of nine fields, approximately annually. Global indices (mean sensitivity [MS], age-corrected mean deviation [MD] and pattern standard deviation [PSD]) at the fourth test, averages of those global indices over the first four tests, and the rate of change of MS over the first four tests ('initial slope'), were independently used to predict the MS averaged over the subsequent five tests ('subsequent sensitivity') and the rate of change of MS over those five tests ('subsequent slope').

Results: The correlation between initial and subsequent slopes was 0.25. The subsequent slope was better correlated with global indices at the fourth test, including MS (correlation r = 0.36), MD (r=0.34) or PSD (r=-0.42); and also with those global indices averaged over the first four tests (MS r=0.34, MD r=0.38, PSD r=-0.37). Similarly, the subsequent sensitivity was better predicted by the MS at the fourth test (r=0.88) or averaged over the first four tests (r=0.89), or the other global indices, than by the initial slope (r=0.27). When test locations were considered individually, subsequent slope was again better correlated with initial sensitivity (r=0.12) than with initial slope (r=0.02).

Conclusions: Change in sensitivity over an initial period is not a good predictor of future change in this population. This may be due to extended learning effects; alternatively, it may be indicative that the rate of progression is not constant over long periods of time in early glaucoma.

8-01

Assessing The Utility Of A Combined Suprathreshold/ Threshold Procedure For Retesting Visual Fields

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Purpose: Turpin et al (IOVS, 2007:48:1627-1634) described a combined suprathreshold/threshold perimetric algorithm (REMU) designed for retesting visual fields. The REMU procedure incorporates information from prior visual field tests. Its performance has been explored thoroughly via computer simulation, predicting improved accuracy and repeatability of sensitivity estimates in abnormal regions of visual field. By combining suprathreshold and threshold approaches, REMU uses fewer test presentations for locations of normal sensitivity, allowing more presentations to be spent in locations of reduced sensitivity. The current study tested the simulation predictions regarding the variability of sensitivity estimates in human observers.

Methods: Software was developed to enable custom algorithms to be implemented on a Humphrey Field Analyzer 1. Two procedures were implemented: 1) a ZEST procedure using a bimodal probability density function (pdf); 2) REMU. REMU applies suprathreshold screening (2 presentations), then if the screen is failed, runs a ZEST procedure commencing with a Gaussian pdf centred 2dB below the failed screening value. Eleven people with stable visual field loss, due to glaucoma, and 8 people with normal visual fields participated. Subjects attended 3 test visits, scheduled 1 week apart. At each visit, one eye was tested with ZEST, REMU and SITA Standard (Humphrey Field Analyzer II). All tests used the 24-2 field pattern, with the order of testing randomised across observers to balance fatigue.

Results: On average, the REMU procedure required 25% fewer stimulus presentations than ZEST ($p<0.001$). For each location and each test procedure, the median of the sensitivities returned at the three test visits was taken as the best available estimate (BAE) of sensitivity. The distribution of errors from the BAE was determined. REMU had fewer errors greater than 4dB than the other methods ($p<0.05$). For BAE between 5 and 20dB, the proportion of total errors that was greater than 4dB was: REMU 32%; ZEST 45%; SITA 41%.

Conclusions: This study has validated the REMU concept, as predicted by computer simulation, in human observers.

8-02 Poster

Trial Model Of Perimeter For Measuring Binocular And Monocular Visual Fields Separately While Opening Both Eyes

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Purpose: To report a trial model of perimeter which is for measuring not only the binocular visual field but also the separate visual field of the left and right eyes in one measurement although both eyes are opened during measurement.

Methods: The device consists of a PC, LCD monitor, and chin-rest. Targets are displayed on the monitor whose background is white. Each target of red, green, and grey is randomly displayed once at each measuring point. At the center of the monitor, a fixation point of black cross is displayed. A subject is asked to wear red and green filters, one on each eye, and press a button in hand to respond when he/she sees a target.

Results: An eye covered with the red (green) filter recognizes the green (red) target as grey, but it is not recognized by the other eye with the green (red) filter. The fixation point is black, so it is recognizable and fixed binocularly. Consequently, the visual field of the left and right eyes can be recorded separately while opening both eyes. Binocular visual field is also recordable as the displayed grey target is recognized by both eyes. This means that only one measurement is necessary for separately recording the binocular visual field and the visual field of each eye. It is easy to maintain the fixation vision as both eyes are used during recording, and it takes short time as only one measurement is necessary to test each eye and both eyes. This is well accepted by subjects as they feel less tired and the test results are easier to understand compared to other perimeter tests.

Conclusion: This device has very simple structures and can be provided at a moderate price. The test methods are straightforward and require short time; therefore, this is a useful screening test that helps people understand visual field abnormality such as glaucoma and detects visual field abnormality at the initial visit.

8-03 Poster

Trial Model For Measuring Retinal Function By Using Sense Of Color And Form

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Purpose: The usability of the Suzuki's Eye Check Chart that uses sense of color and form has introduced in the International Visual Field & maging Symposium of 2004 in Spain, and this time we would like to introduce a trial model of quantitative perimeter that uses sense of color and form.

Methods: This device comprises a PC, LCD monitor, button, chin rest, and camera for monitoring fixation targets. Targets that have different colors from the background were displayed around the fixation target at the center of digital monitor. Contrasts of background and target color were changed and displayed at each testing point, and subjects' responses were recorded for determining the threshold value of each point. With this device, the color of background or target, or the shape of target can be changed arbitrarily. The device can also be used as a flicker perimeter by changing a way for displaying targets, and it is intended to be used for some disorders, especially glaucoma.

Results: When a combination of orange (background) and yellow green (target) was used for glaucoma, visual field defect that conforms with the optic layer defect could be obtained on a grand scale compared to the convenntional perimeter. In retinitis pigmentosa and branch retinal vein occulusion, the obtained results were different depending on color combinations. By using the form sense targets, the subjects were able to become aware of visual field defect during the test.

Conclusion: As different combinations of colors and senses of form are used, a possibility for testing the retinal functions becomes higher than that of conventional perimeter. Different combinations of colors and senses of form should be examined in the future.

8-04 Poster

Measurement Of Thresholds In Normal Subjects Using Fundus-Oriented Small-Target Perimetry

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Purpose: Standard automated perimetry (SAP) may fail to detect early glaucomatous abnormalities due to the sparse test points and large target sizes. We developed a new, automatic, fundus-oriented small-target perimetry and have been studying its ability to detect visual field abnormalities in patients with localized retinal nerve fiber layer (RNFL) defects and normal SAP. To decrease the influence of eccentricity using small target sizes, we evaluated the thresholds of different target sizes in normal subjects using fundus-oriented perimetrey.

Methods: Fifty eyes of 50 normal subjects, aged 20-65years(mean43.9 ±13.7years) underwent SAP and fundus-oriented perimetry. The perimetry is composed of two liquid crystal monitors. A fundus photo is presented upside-down on the examiner's screen corresponding to visual field. Test points are selected in the fundus image displayed on the examiner's monitor. Sixteen test points were located at the position of eccentricity: 5.10.15,and 20 degrees from the fovea at 45° above and below the horizontal line in each retinal quadrant. Each point of thresholds were determined using 4 target sizes: target size of 2.9minutes, target size of X cells, target size of Y cells (target size increases with eccentricity depending on the receptive field of X cells or Y cells, respectively), and target size of 24 minutes (GoldmannIII). Background luminance was 10 asb, exposure duration was 100 ms, and target color was white.

Results: Mean threshold became higher as age and eccentricity increase in each target size. Effect of eccentricity was greatest in target size of 2.9 minutes, and smallest in target size of Y cells (2.9min: y=28.8-0.63x, X cells: y=26.3-0.12x, Y cells: y=30.5-0.07x, 24min: y=39.3-0.32x).

Conclusions: Target size depending on receptive field may be useful to decrease the effect of eccentricity using fundus-oriented small-target perimerty.

8-05 Poster

The Magnitude Of Stereopsis In Peripheral Visual Fields

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Purpose: In visual field tests, long measurement times disturb to get the true visual fields. We investigated a new method of visual field test using stereopsis. As a previous stage to use clinically, we measured magnitude of stereopsis of peripheral visual fields using a new device which was developed to test binocular visual functions.

Methods: Thirty two healthy young volunteers which have stereopsis better than 100 sec. of arc. by Titmus stereo tests and normal visual fields were enrolled in this study. Subject is able to experience a visual perception like that our stay in space of visual images, which is 3D Hemispherical Visual Display System "CyberDome" (Matsushita Electric Works, Japan). Visual images of right and left eye are projected to superimpose on a hemispherical screen, allowing test images to be seen independently by each eye with polarizing glasses. When the subject fixed central visual target, binocular disparity of stereopsis target was varied (7200, 3600, 1800, 840, 420 sec. of arc.). Stereopsis targets produced randomly on 10°, 20° and 30° for upper, lower, right and left in visual fields.

Results: The magnitude of stereopsis was fall so much as away from central visual target in upper, lower, right and left (10°: 427±52 sec. of arc., 20°: 485±305 sec. of arc., 30°: 1230±1546 sec. of arc.). The peripheral stereopsis in 10° and 20° were no significant among all four directions. In 30°, lower visual field was better than the others ($p<0.01$).

Conclusions: In this study, we suggested that the peripheral stereopsis were 10°: 427 sec. of arc., 20°: 485 sec. of arc., 30°: 1230 sec. of arc. and fall remarkably on 30°. Furthermore, the stereopsis on lower visual field was better than the other visual fields.

8-06 Poster

The Effect Of Correction For Central Refractive Error On Thresholds For The Moorfields Motion Displacement Test (MDT)

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Purpose: It is standard practice to use a near correction (central vision) for perimetry, but this makes no allowance for peripheral refractive error. This study investigates the effect of central refractive error correction on motion displacement thresholds in normal subjects using the new 32-location Moorfields Motion Displacement Test (MDT). Each location corresponds to a test location of the Humphrey 24-2.

Methods: MDT thresholds (1-1 staircase) were measured on a standard 20-inch computer monitor at a test distance of 30 cm, with the head supported on a chin-rest. Seventy five control subjects (IOP <22mmHg, normal HRT by Moorfields regression; reliable standard automated perimetry; age - mean 62, range 24 to 82 years; near refractive correction - mean +2.50, range -4.00 to +6.00 DSph) underwent a baseline MDT, with near optical correction. This was followed by two randomized repeat tests with and without optical correction. Thresholds of the repeat aided and unaided tests were compared using a non-parametric Wilcoxon test.

Results: Across all MDT locations there was no significant effect of refractive correction on thresholds. However, the thresholds of the four locations within 3 degrees of central fixation were elevated without correction ($p<0.002$), and the thresholds of the remaining 28 peripheral locations were lower without correction ($p<0.001$).

Conclusions: The findings of this study are consistent with the variation of peripheral refraction with eccentricity. Results show that on a location-by-location basis there are small differences between MDT thresholds with the use of optical correction. As thresholds are lower in the periphery without correction, it is appropriate to perform the MDT without correction to detect the majority of glaucomatous defects. This is important in the prospective role of the Moorfields MDT as a screening test in the community, where there is a lack of time and equipment to achieve near refractive correction.

8-07 Poster

A New Short-Wavelength Automated Perimetry With Flicker Target

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Purpose: We investigated the retinal sensitivity in normal subjects using 3 programs; a short-wavelength automated perimetry (SWAP), a flicker automated perimetry (FAP) and a SWAP with flicker (SWAP-F) using a new perimetry for retinal function developed by Suzuki et al.

Methods: Thirty eyes of 30 normal volunteers whose age ranged from 20 to 30 years were enrolled in this study after informed consent. The retinal sensitivity was measured with SWAP which was performed with a yellow background (78.3 cd / m^2) and blue targets, with FAP with a white background (80.6 cd / m^2) and black targets and with SWAP-F with the same settings as SWAP with a fixed 10 Hz flicker target. The stimulus target of all programs was a check pattern. Fifty-six test points were included except Mariotte blind spot within 21°, and divided into four concentric zones as follows; zone 1 (within central 3° area), zone 2 (within central 9° area except inner zone 1), zone 3 (within central 15° area except inner 2 zones), and zone 4 (within 21° area except inner 3 zones). We evaluated the averaged sensitivity in each zone and compared the results among 3 programs.

Results: The sensitivity with SWAP-F was significantly lower than that with SWAP in zone 3 and 4 ($p < 0.05$), whereas there was no significant difference in the sensitivity between with SWAP and FAP in each zone.

Conclusions: Our results showed that there were differences in the retinal sensitivity according to the programs. Especially it was an interesting phenomenon that the sensitivity in so-called Bjerrum area measured with SWAP-F was low. Further investigation on SWAP-F should be elucidated.

8-08

The Heidelberg Edge Perimeter: A New Method For Visual Field Assessment

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Purpose: To introduce the design principles, scientific rationale and preliminary clinical data for the Heidelberg Edge Perimeter (HEP).

Methods: HEP uses flicker defined form (FDF) to generate the stimuli used to evaluate the visual field. FDF was generated by flickering random dots of 0.34° at 15Hz against a mean luminance background ($50cdm^{-2}$). Dots within the 5°stimulus were flickered in counterphase to background dots. The random dot background had a density of 3.5 dots per degree. A preliminary normal database of 100 volunteers was used to establish preliminary confidence intervals to define normality and limits for threshold estimation algorithms. Test-retest characteristics were established using 30 patients with glaucoma, and compared to SITA-SAP and Matrix. Combination Structure-Function Maps were generated using HEP and the HRT. Clinical trials will be presented that establish the effect of optical blur, random dot density and organization, temporal frequency and stimulus size.

Results: HEP performance improved with higher contrast, a greater random dot density, greater background element organization and mid-peripheral viewing. It is robust to < 6D of optical blur and is dependent on target area rather than contour. The coefficient of repeatability was 6.86dB for FDF, 7.82dB for SITA-SAP and 10.29dB for the Matrix.

Conclusions: The Heidelberg Edge Perimeter used flicker defined form, a magnocellularly driven illusion, to efficiently measure the central visual field. Preliminary clinical trials indicate: i. Good test-retest characteristics, ii. Ability to detect early glaucoma and iii. Deeper and larger defects (frequently) than standard automated perimetry.

8-09 Poster

Glaucomatous Visual Field In “Pupil Perimetry”

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Akita University, Akita, Japan[1], Matsushita Electric Works, Ltd., Osaka, Japan[2]

Purpose: In an attempt to measure the visual field objectively, we have developed “pupil perimetry”, which monitors the pupil light reflex in response to perimetiric light stimuli. The purpose of this study was to ascertain if pupil perimetry revealed similar defects as standard threshold perimetry in patients with glaucoma and in normal subjects.

Methods: An infrared pupillometer was linked to an automated perimeter (Kowa AP-3000) to record 76 pupil contractions at each perimetric location which were comparable to that of the HFA 30-2 program. We also developed another type of pupil perimetry which records 64 pupil contractions within 30 degree with large stimulus size of 5 degrees. Visual field obtained by pupil perimetry is expressed by mapping the change of the pupil area at each target location within the field. 4 patients with glaucoma were investigated. Visual field were measured by HFA 30-2 program and two types of pupil perimetry.

Results: Visual field obtained from the two types of pupil perimetry were relatively comparable with those obtained from Humphrey perimetry (SITA standard program). However, visual field obtained from pupil perimetry and Humphrey perimetry where MD was better than -10dB were not similar.

Conclusion: Pupil perimetry seems to be useful to measure visual field objectively.

8-10 Poster

Utility Of Pupil Perimetry In Glaucoma

K Asakawa, N Shoji, A Tanakadate, H Ishikawa.

Kitasato University Graduate School, Sagamihara, Japan

Purpose: To evaluate the correlation between visual field defects and pupil constriction and to investigate the optimal measurement conditions for detection of early glaucomatous field loss.

Methods: We evaluated the correlation between visual field defects, as measured with the Humphrey Field Analyzer, and those evaluated with Pupil Perimeter, which measures the rate of pupil constriction induced by a light reflex. Twenty-eight patients ranging in age from 31 to 80 years were included. Patient cases included normal-tension glaucoma, primary open-angle glaucoma, and secondary glaucoma. As a preliminary study, we examined the relationship between the size of a light stimulus and pupil constriction in order to evaluate the optimal measurement conditions. A light stimulus with a size of either 64 mm^2 or 4 mm^2 was presented at each of the 76 test locations while using the 30-2 program with a 6 apostilb background.

Result: Not every patient showed a good correlation between the results for the pupil field and the light threshold. While the pupil perimetry was well matched in glaucoma with absolute scotoma, various patterns were exhibited for the 64 mm^2 stimulus size in cases with localized visual field loss and early glaucoma. However, when the light stimulus size was 4 mm^2, detection for early glaucoma in the pupil field improved, with worsening of the matching defects as compared to that seen before the change.

Conclusion: Past reports have provided details on the variability and difficulty in measuring localized visual field loss, which limits the use of pupil perimetry in a clinical setting. In the current study, after changes in the light stimulus were made, early glaucoma detection improved, while matching defects worsened due to the Stiles-Crawford effect. However, another positive aspect of the current results is that by using anatomical differences, it might be possible to detect glaucomatous field loss earlier than the threshold perimetry changes. Further studies are needed to elucidate the exact mechanism responsible for the differences noted between the pupil and threshold fields, and to establish clinical criteria for glaucoma.

8-11 Poster

The Head Mount Diplay Type Pupil Perimeter

F Maeda[1], K Tanzawa[1], T Yoneda[1], Y Hashimoto[1], S Fukushima[2], S Inakagata[2], K Kani[1], A Tabuchi[1].

Department of Sensory Science, Kawasaki University of Medical Welfare, Kurashiki, Japan[1], Matsushita Electric Works, Ltd, Kadoma, Japan[2]

Purpose: We devised a new type of pupil perimeter using a head mount display (HMD) system to record pupil light reflexes simultaneously for each eye and to analyze relative afferent pupillary defect (RAPD).

Methods: The HMD system consisted of a headset and a control unit. A liquid crystal display (2-inch: 45×34 deg) for generating visual stimulus images and an infrared CCD camera for recording pupil responses were included in the headset. The perimeter can independently stimulate the right and left eyes and record pupil responses with 30 Hz for 30 seconds.
As the stimulation, we use a unique stimulus pattern which Y Chen, et al (2005) designed for screening of glaucoma. The patterns of the most likely regions for small visual field defects, and also the boundaries of larger defects, tended to reflect, approximately, the retinal nerve fiber bundle layout for detecting Bjerrum scotoma, paracentral scotoma, and nasal step.

Results: The HMD type pupil perimeter could measure pupillary light reflexes simultaneously for each eye. We could also analyze relative afferent pupillary defect (RAPD) in early glaucoma patients.

Conclusions: This HMD type pupil perimeter should contribute to the saving of space and to easy measurement of the pupil perimetry of aged people and bedridden patients.

8-12 Poster

Evaluating Pupil Light Reflexes With Color Stimuli

K Tanzawa, F Maeda, T Yoneda, O Mayumi, K Kani, A Tabuchi.

Department of Sensory Science, Kawasaki University of Medical Welfare, Kurashiki, Japan

Purpose: We evaluated the pupil light reflexes caused by four-color stimuli in each eccentricity of the visual field, and also measured the subjective threshold with color stimuli.

Methods: The subjects of the first experiment were 15 normal adult volunteers (22.5 ± 1.4 years) with no ophthalmologic disease except for refractive errors. The stimuli were generated by our newly devised pupil perimeter using a liquid crystal display. The stimulus parameters were set at an intensity of 100 cd/m^2, a diameter of 4 degrees, a duration time of 200 msec and with the colors of white, red, green and blue. Stimulus locations were on the superior meridians of 45 and 135 degrees at eccentricities of 0, 5, 10, 15 and 20 degrees. The diameter of the pupil was measured for the evaluation of the light reflexes, and the papillary contraction ratio: PCR= {pupil diameter of pre-stimuli – pupil diameter of post-stimuli) / pupil diameter of pre-stimuli} ×100 (%) was calculated. The subjects of second experiment were 10 normal adult volunteers (22.1 ± 2.2 years) with the same conditions used with the first subjects. The stimuli were generated by another newly devised perimeter using a liquid crystal display. The stimulus parameters were a diameter of 0.096 degrees and a duration of 100 msec. The background and stimulus locations were the same as those in the first experiment. The threshold was evaluated by the bracketing method.

Results: The PCR elicited by the blue stimulus were significantly higher than those caused by the white, red and green stimuli at each eccentricity (Wilcoxon signed-rank test, $P < 0.01$). There were no significant differences among the PCRs caused by white, red and green stimulation. In addition, no strong tendency in the subjective threshold was shown among the four- color stimuli.

Conclusion: We conclude that the higher PCR caused by blue stimulation within 20 degrees could be a feature of pupil light reflexes.

8-13

Higher Resolution Pupillographic Multifocal Perimetry

T Maddess, AC James, M Kolic, XL Goh.

ARC Centre of Excellence in Vision Science, CVS, Australian National University, Canberra, Australia

Purpose: To investigate 4 variants of multifocal pupillographic perimetry in glaucoma that displayed 24 or 44 regions per eye.

Methods: We tested 43 normal and 44 glaucoma subjects. Glaucoma patients had moderate to severe fields in at least one eye. All subjects were examined with HFA achromatic, SWAP and Matrix 24-2 perimetry, Stratus OCT, slit lamp and tonometry. Informed written consent was obtained from all subjects under ANU ethics approval 238/04. Multifocal stimuli were presented concurrently to both eyes, having 24 or 44 independent test regions/eye in a dartboard layout, extending to 30 deg eccentricity. Four stimulus variants were examined in which stimuli were presented at 4/s, 1/s, or 1/4s, each stimulus persisting for 33 ms. Maximum and background luminances were 10 and 290 cd/m^2. All stimuli were yellow. Recording duration was 4 minutes, divided into 8 segments of 30s. Pupil diameter was monitored by video cameras under infrared illumination. Data from fixation losses and blinks was automatically excluded. Up to 15% data loss from blinks and fixation losses were permitted before a 30s segment was repeated. Measures of field loss examined the N-worst amplitudes, areas under the response, response delays, or pair-wise linear combinations of those.

Results: For these simple measures linear discriminant functions produced areas under ROC curves (AUCs) of 0.80 for the 44 region 1/s stimulus for severe fields, and 0.73 for mild fields. AUCs were consistently smaller for the 24 region, and slower 44 region, stimuli.

Conclusions: The simple N-worst measures basically examined the sum of the N-worst response measures regardless of where in the field they occurred, and were appropriate for comparing the relative performance of the 24 and 44 region methods. Having 44 regions per eye may improve the scope for detecting clusters of damage, which as not been examined so far. The method eliminates problems associated with false positive and negative errors, and fixation losses found in conventional perimetry, all of which effectively lower sensitivity and specificity.

Carl Zeiss Meditec Co., Ltd.

Chairperson: *Aiko Iwase*

New Generation In Structure And Function For Glaucoma Management — The New Humphrey Visual Field Analyzer With Guided Progression Analysis And Newly Featured Optical Coherence Tomographers, Stratus OCT And Cirrus HD-OCT

Aiko Iwase

Department of Ophthalmology,Tajimi Municipal Hospital
Health Center, Department of Health and Welfare, Tajimi City Office
Gifu University Graduate School of Medicine

Needless to say that Perimetry is an indispensable methodology in detecting and monitoring functional abnormalities due to anatomical abnormalities of the visual system. Especially in the management of glaucoma in which life-long treatment is necessary, we must chose therapeutic means most suitable for each glaucoma eye taking the visual field status, IOP and other relating factors into consideration. However it is still not easy to judge whether visual field is really abnormal or not, or it is really deteriorating or not. Furthermore, our decision must be made based on not only the current status of visual field such as the sensitivity of each test points and global visual field indexes, but also the presumed future trend of change in the visual field. It is our pleasure to have two important speakers here, Dr.Andres Heijl and Dr. Vincent Michael Patella , both have been leading the international Perimetry Society (IPS) for a long time. Dr. Heijl has contributed a lot to development of many programs for Humphrey Visual Field Analyzer ® (HFA) such as STATPAC and SITA, which are nowadays essential in Perimetry. In addition, he recently has developed a new ability of analysis for Glaucoma progression for HFA. He will provide us with brand new information on this new software. Dr. Patella, who has brought a lot of ideas in Perimetry since the first HFA was introduced from Humphrey in the market, has been also contributing to imaging diagnosis for Glaucoma application in terms of Structural and Functional analysis in Glaucoma. He will speak about new features recently introduced by Carl Zeiss Meditec for their two Optical Coherence Tomographers. I am sure the audience can fully enjoy their lectures in the first morning of the IPS meeting 2008 at Nara.

New Glaucoma Applications For Optical Coherence Tomography

Vincent Michael Patella

Carl Zeiss Meditec (CZM)

Given the limited correlations found between currently available structural and functional glaucoma diagnostic measurements, it is important to consider data from both when making therapeutic decisions.

CZM's recently introduced high definition Spectral Domain OCT (SDOCT) is able to produce three dimensional solid images of retinal structures with an axial resolution of approximately 5 microns. Software containing normative significance limits for peripapillary retinal nerve fiber layer thickness is now available. We will discuss how the normative limits were established and how they may be used clinically. Case examples will be presented.

Progression analysis software for the Stratus OCT also is now available. Case examples will be presented.

Effective Use Of Perimetry In Glaucoma Management

Anders Heijl

Department of Ophthalmology, Malmö University Hospital, Lund University

Target pressures in glaucoma are just guesses that should be used only for the first 2-3 years after diagnosis. After that enough perimetric data should have been assembled to tailor the needs of each indivual patient. In this presentation I will show data from EMGT demonstrating the crucial effect of the frequency of perimetric examinations to demonstrate disease progression within a reasonable time frame. A recently published recommendation similarly demonstrates the importance of frequent perrimetry to identify patients with rapidly progressive disease. The new GPA2 program of the Humphrey perimeter is the best tool to rapidly assess glaucoma rate-of-progression.

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The Role And Potential Of Kinetic Perimetry – Current And Future Developments

Ulrich Schiefer

Centre for Ophthalmology / Institute for Ophthalmic Research, University of Tuebingen, Germany

Kinetic perimetry is the psychophysical method of choice for the delineation of advanced visual field loss, particularly that exhibiting a steeply sloping border, such as hemianopia, concentric constriction, severe arcuate loss and altitudinal defects. Under these circumstances this technique is more efficient than automated static perimetry, as it is directly aiming at edge detection of such defects and therefore is less time-consuming and less tiring for both the patient and the technician. Kinetic perimetry is also used in patients who are unsuited to the requirements of automated static threshold perimetry and for the determination of functional integrity in medico-legal cases.
The outcome of kinetic perimetry with the conventional Goldmann instrument has several inherent examiner- and instrument-related shortcomings, such as a deficient auto-calibration and a lack of standardization of the examination procedure, e.g. with respect to stimulus velocity.
Semi-automated kinetic perimetry (SKP) with the OCTOPUS 101 or the OCTOPUS 900 perimeter (HAAG-STREIT, Koeniz, Switzerland) reduces the dependency on a technician to a minimum. It permits computer-controlled presentation of the stimulus along a so-called vector in any direction of the entire field at predefined and constant angular velocities. The start and finish point for the stimulus vector is prespecified by the examiner. The response from the patient is corrected for the individual reaction time (RT), and the area for any given RT-corrected isopter can be automatically calculated by the software. The results can be related to age- and RT-corrected reference limits for normality for any selected stimulus condition. The individual set of vectors can be stored and recalled for follow-up examinations.
An interactive, computer-based teaching procedure (*K*-Train) is based on the original user interface of the SKP feature and incorporates an evaluation system for scoring the quality of the individual kinetic perimetric examination. The score is assessed by the ratio of the intersection area and union area of the trainee´s result and the related trainer-defined original isopter.

Fully Automated Kinetic Perimetry With Computer-Simulated Virtual Patients

Chota Matsumoto

Department of Ophthalmology, Kinki University School of Medicine, Osaka, Japan

Currently, static perimetry has become the mainstream due to the spread of automated perimeters. On the other hand, Goldmann kinetic perimetry still remains an important method to evaluate the visual field patterns of patients with advanced glaucoma or other retinal and neurological diseases. However, manual kinetic results can be considerably influenced by the examiner's skill and may vary significantly between facilities. From the revolutionary Perimetron to the Octopus 101 kinetic program and Humphrey kinetic test, various types of automated perimeters have been developed for kinetic perimetry. In spite of that, automated kinetic perimetry continues to be problematic in its accuracy due to variation in patient responses and limitations in isopter drawing.

We have recently developed a fully automated kinetic algorithm (Program K) that utilizes the external angles of patient's response points to estimate isopter patterns. Furthermore, this program also includes algorithms for detecting blind spots and scotoma. We tested this algorithm on 100 virtual patients simulated on the Octopus K-Train. Our results indicated that the isopter shapes and sizes depicted by Program K were comparable to those by digitized Goldmann manual kinetic perimetry.

In this seminar, the application of Program K to the virtual patients will be demonstrated.

Topcon Corporation

Chairperson: *Makoto Araie*

Three-Dimensional Visualization And Thickness Mapping Of RNFL Using SD OCT

Yijun Huang

Topcon Medical Systems, Inc

Accurate assessment of Retinal Nerve Fiber Layer (RNFL) provides important structural information for diagnosing and managing patients with glaucoma. Using spectral domain OCT technology, new instruments have been developed to facilitate rapid and dense scanning of a large retinal area, and hold the promise of improving accuracy for clinical diagnosis of glaucomatous eyes. 3D OCT-1000 (TOPCON) was introduced to the ophthalmic marketplace two years ago. With the guidance and inputs from glaucoma specialists, we have developed several tools to aid better imaging and analysis of the RNFL structure.

We developed a ray-casting technique to allow 3D volumetric visualization of OCT dataset. With this technique, the RNFL structure can be enhanced visually as RNFL is the most interior highly reflective layer in the retina. Preliminary clinical studies have shown that this visualization method provides higher sensitivity than disc photography in discriminating glaucomatous eyes.

In addition to direct visualization, RNFL thickness mapping from the 3D OCT dataset can be accomplished using automatic layer detection algorithms. Registered point-to-point with color disc photos, it provides useful assessment to the overall RNFL assessment at the peripapillary area at any given locations. Transitional TSNIT curve can be extracted from the 3D dataset. Furthermore, a larger mosaic-like mapping of RNFL thickness can be realized by analyzing OCT datasets from multiple retinal locations, which may provide useful information on the glaucomatous damage when connecting from the optic disc to the fovea. Similarly, by registering OCT datasets from multiple visits, a point-to-point thickness comparison is possible to allow precise longitudinal analysis of the disease progression.

Santen Pharmaceutical Co., Ltd.

Chairperson: *Chota Matsumoto*

Changes Of The Visual System In A Monkey Model Of Glaucoma – Structural Changes In Retina And Optic Nerve Head

Masaaki Sasaoka

Research & Development Center, Santen Pharmaceutical Co., Ltd.

How best to develop remedies or reveal pathophysiology for eye diseases that may lead to blindness, such as glaucoma and diabetic retinopathy, is a problem that urgently requires a solution. With these diseases, a monkey model is particularly useful since humans and monkeys are very similar in various aspects of visual functions such as color vision. The laser-induced high intraocular pressure (IOP) model is a common model for ophthalmologic research, especially in glaucoma, and their visual field can evaluate at the moment. Following Dr. Harwerth's group, we also established a system for precise measurement of a monkey's visual field. We found the monkey visual field had similar characteristics to those of human's and then we examined visual field changes in high IOP monkeys. At the same time, we also examined the changes in optic disk structure by means of scanning laser ophthalmoscope (Heidelberg Retina Tonograph), and in retinal nerve fiber layer thickness using a scanning laser polarimeter (GDx) in high IOP monkeys. Finally, we examined retinal ganglion cell (RGC) numbers in high IOP monkeys where the visual field was measured. From the analysis between visual field sensitivity and RGC numbers, we found exact losses of RGC in visual field losses in the same monkeys, similar to Dr. Harwerth's reports. In this seminar, I would like to summarize and introduce our current and previous investigations about these ocular and visual field changes in high IOP monkeys, and I hope that these observations will provide useful information to elucidate the pathophysiology of glaucoma.

Changes Of The Visual System In A Monkey Model Of Glaucoma – Lateral Geniculate Nucleus And Visual Cortex

Ronald S. Harwerth

College of Optometry, University of Houston

Purpose: Glaucoma is an optic neuropathy caused by the death of retinal ganglion cells, but recent studies have shown that there are also signs of neuropathy in higher brain centers, especially the lateral geniculate nucleus (LGN) and striate cortex (V1). Such alterations suggest an activity-dependent reduction in neuronal function that should be correlated to the losses in visual sensitivity from glaucoma. The purpose of this presentation is to describe the correlation of visual losses and proximal metabolic alterations that are caused by experimental glaucoma.
Methods: The metabolic activities of neurons in the magnocellular and parvocellular pathways were analyzed in tissue from monkeys with visual field defects caused by laser-induced, elevated intraocular pressures. Visual fields were assessed behaviorally by standard clinical perimetry. The effects on the metabolism of neurons that were topographically related to perimetry defects were determined by cytochrome oxidase histochemistry.
Results: The results of the studies demonstrated that the average decibel-losses in visual sensitivity were correlated to the percentage reductions in cytochrome oxidase activity for both the parvo- and mango-cellular divisions of the retinal-geniculate pathway. While a given level of visual field defect was indicative of a larger reduction in metabolism of neurons in the mango- than the parvo-cellular pathway, because the best-fit functions intersected the axes of the X-Y coordinates close to their origins, these data do not provide evidence of an alteration in LGN physiology preceding the visual field defects.
Conclusions: The results do not support alternative perimetry stimuli based on mango/parvo distinctions to improve the accuracy of clinical perimetry for the early detection of glaucoma. Rather, the principal findings are in agreement with structure-function models that small ensembles of afferent neurons with the highest sensitivity for the stimulus determine visual thresholds, while the density of cytochrome oxidase reactivity is determined by the combined activity of all of the neurons in the sampled site.

2008. 05. 23 Luncheon Seminar II 12:10-13:00

Alcon Japan Ltd.

Chairperson: *Yoshiaki Kitazawa*

Normal Tension Glaucoma: Clinical Challenges And New Therapeutic Concepts

David S. Greenfield

University of Miami Miller School of Medicine
Bascom Palmer Eye Institute

Normal-tension glaucoma (NTG) is an open-angle subgroup in which untreated intraocular pressure (IOP) is always in the statistically normal (mean 15.9+2.9 mmHg) range, usually < 21 mmHg. Population-based studies demonstrate that low-pressure glaucoma represents 20% to 39% of patients with open-angle glaucoma in the United States and Europe and as high as 90% of patients in Japan. The underlying pathophysiologic mechanisms of glaucomatous neurodegeneration are incompletely understood.

Various non-glaucomatous disorders may produce optic disc cupping and visual field disturbances that resemble the clinical profile of NTG and it is important that clinicians recognize them. These disorders include hereditary optic neuropathy, antecedent optic nerve infarction, trauma, syphilis, demyelinating optic neuritis, fusiform enlargement of the intracranial carotid artery, and intraorbital and intracranial mass lesions. In addition, vascular risk factors have been well described in NTG and include migraine headache and disc hemorrhage, peripheral vasospasm, systemic hypotension or previous hemodynamic crisis, nocturnal dips in blood pressure, reduced orbital blood flow velocity and cranial magnetic resonance imaging abnormalities suggestive of ischemia. These observations have led many to pursue ancillary diagnostic tests in the evaluation of NTG such as carotid Doppler and laboratory examination to exclude the possibility of co-morbid conditions such as carotid stenosis, arteritis, hyperviscosity syndromes, and anemia.

IOP is the most important risk factor for disease onset and progression, and is currently the only factor amenable to modification by the clinician. IOP lowering has been proven to be of therapeutic benefit in NTG. Yet, IOP has not been demonstrated to be an independent risk factor for progression in untreated NTG, some eyes progress despite significant IOP lowering, and other eyes do not progress despite observation without treatment.

Achieving adequate target IOP is critical in preventing glaucomatous progression. New IOP-lowering therapies have emerged that provide considerably greater IOP lowering efficacy than those employed in the collaborative NTG study. This presentation will review critical concepts in achieving target IOP, favorable balance in risk-benefit ratio, and emphasize the importance of maintaining ocular surface health.

2008. 05. 24 Luncheon Seminar III 12:35-13:25

Pfizer Japan Inc.

Chairperson: *Yoshiaki Kitazawa*

Detection Of, Magnitude Of And Risk Factors For Progression In The Early Manifest Glaucoma Trial

Anders Heijl

Department of Ophthalmology, Lund University, Malmö University Hospital, Malmö, Sweden

The Early Manifest Glaucoma Trial started in 1992 and the patients are still followed. EMGT has demonstrated strong effects from pressure lowering therapy, but also that after long follow-up the majority of patients progress, even those who were treated from the start of the trial. EMGT has shown that inter-patient variability of rate-of-progression varies very much and, has also provided data on the natural history of glaucoma visual field progression. Progression rates differ considerably between primary open angle glaucoma, exfoliation glaucoma and normal tension glaucoma.

EMGT used Glaucoma Change Probability Maps to determine visual field progression. Recent comparisons between the progression criteria of EMGT, AGIS and CIGTS show that EMGT criteria can demonstrate progression much sooner and with higher sensitivity than those used in the AGIS and CIGTS studies. In fact only about 2 dB mean progression was needed to reach definite progression using EMGT criteria, indicating that with frequent visual field testing very little field deterioration is needed before definite progression can be ascertained.

In EMGT IOP, age, the amount of visual field damage and disk haemorrhages are all independent risk factors for glaucoma progression. IOP fluctuations, on the other hand, were not an independent risk factor. In recent analyses of longer follow-up data, systemic factors and CCT come out as significant factors, and differences appear between high and normal tension glaucoma.

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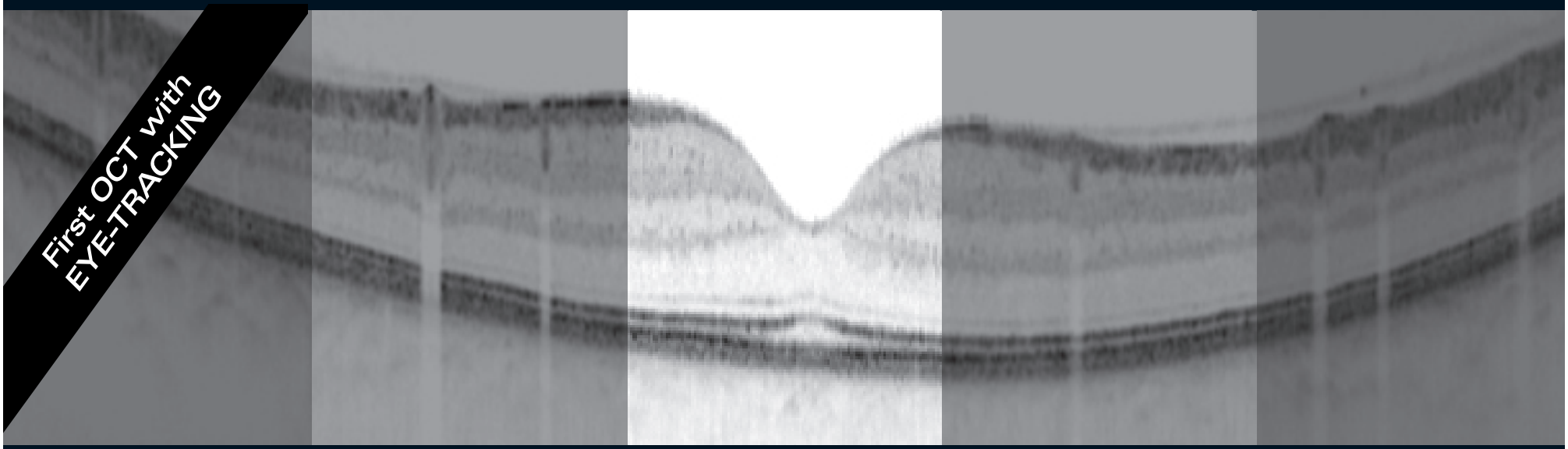

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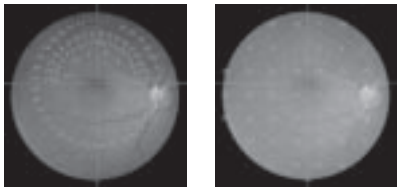

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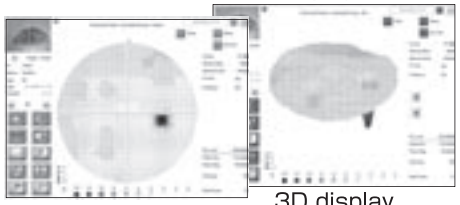

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3D display

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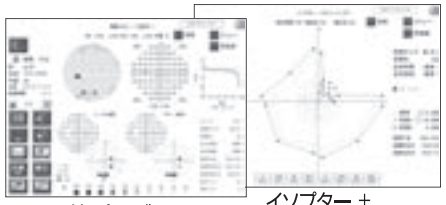

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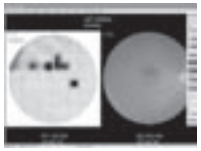

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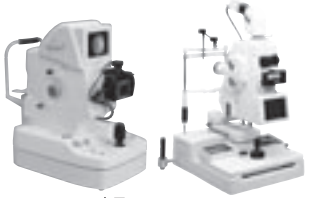

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Indicated for the treatment of elevated intraocular pressure (IOP) in glaucoma patients

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latanoprost ophthalmic solution

Designated drug. Prescription drug[note1)]

Listed on the NHI reimbursement pricelist

note1) Caution : Use only pursuant to the prescription of a physician, etc

Please refer to the package insert for further prescribing information, precautions for use including dosage, administration, warning, contraindications.

Manufactured by

Pfizer Japan Inc.

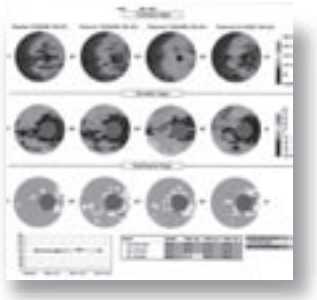
3-22-7 Yoyogi, Shibuya-ku, Tokyo 151-8589, Japan
For more information : Please contact Customer Support

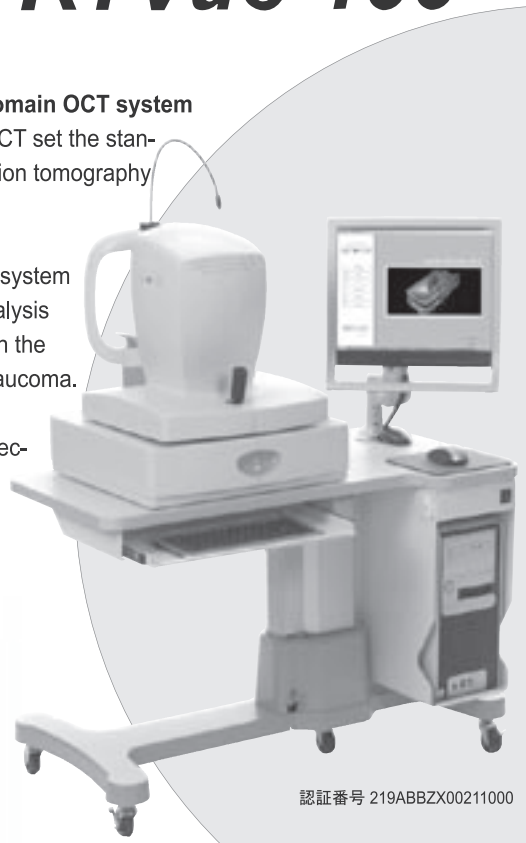
February 2008

Fourier-domain OCT *RTVue-100*

As the first Fourier/spectral-domain OCT system in the US, the **RTVue-100** FD-OCT set the standard for high-speed, high-resolution tomography Scanning.

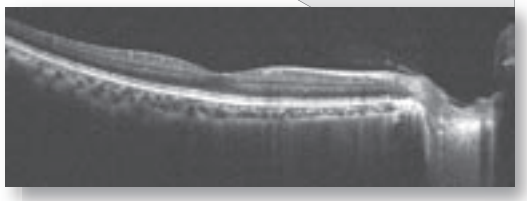
One of the unique feature of this system is the GCC (MM7) Normative analysis in detecting significant changes in the ganglion cells associated with glaucoma. The "Deviation from Normal" and "Significance" analysis offers detection with very high sensitivity and Specificity.





認証番号 219ABBZX00211000

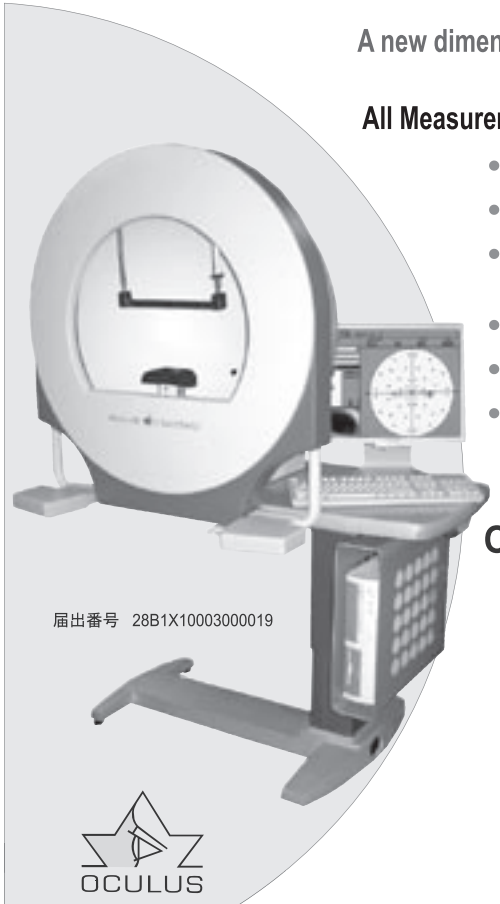
The **RTVue-100** system provides 5 micron depth and 15 micron transverse resolutuion allowing evaluation and quantification of fine detail in retina layers.



optovue

Oculus TWINFIELD

A new dimension in visual field measurement



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OCULUS

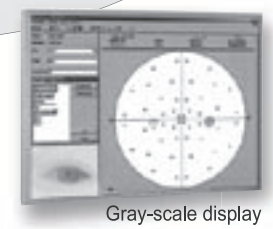
All Measurement Principles in a singl Device

- **Static Perimetry**
- **Kinetic Perimetry**
- **Static & kinetic** (= Combination of static and kientic strategies in one program)
- **Goldmann Standard**
- **Color Perimetry**
- **CLIP** (= Continuous Light Increment Perimetry)

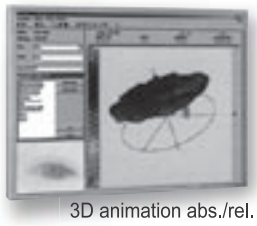
Oculus CENTERFIELD

The ergonomic, compact design and the uncomplicated test procedures

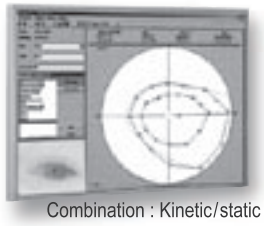
届出番号 28B1X10003000048



Gray-scale display

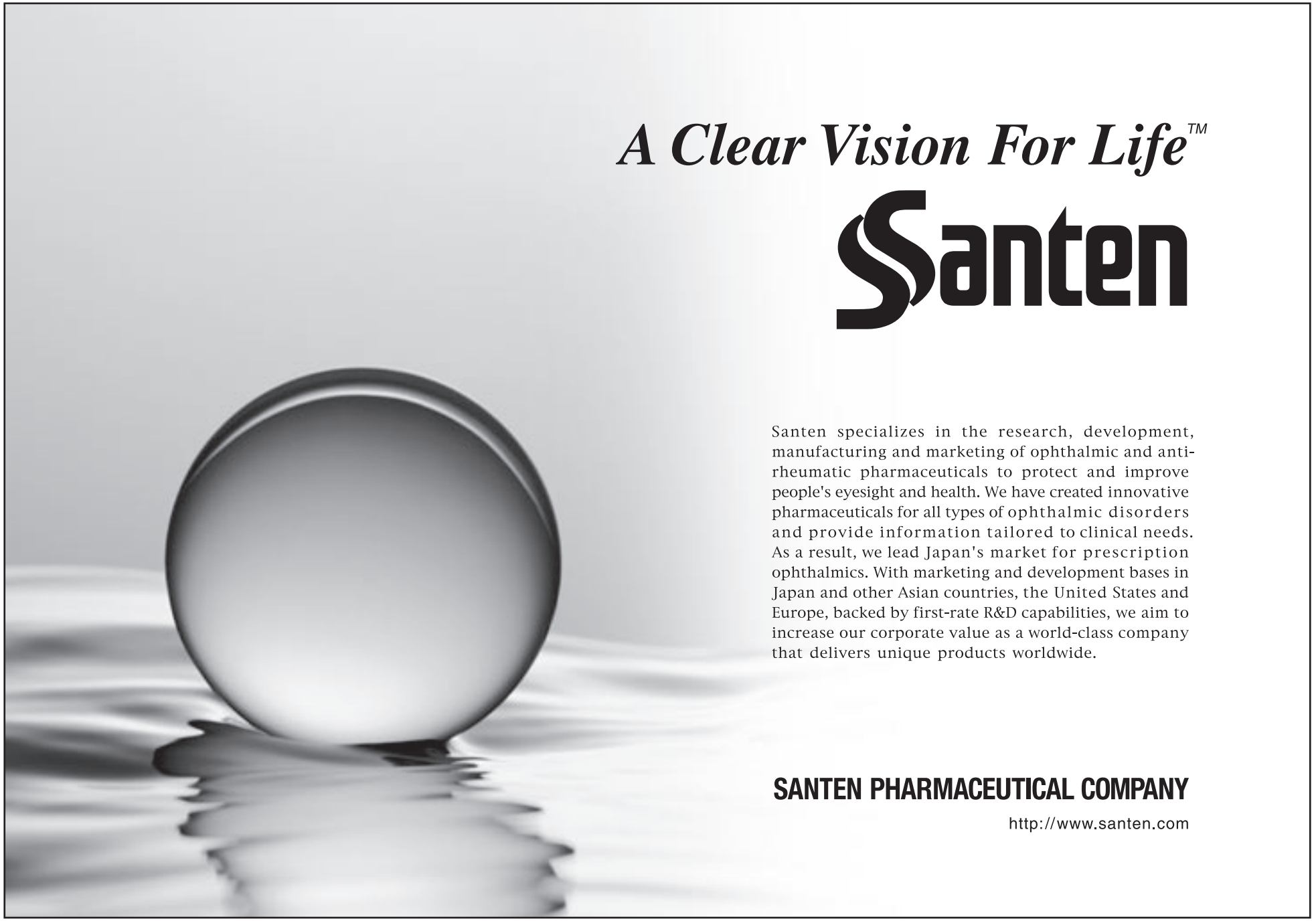


3D animation abs./rel.



Combination : Kinetic/static

製造販売業者 CSC CHUO SANGIO COMPANY 4 - 7 KAGURACHO NISHINOMIYA 662-0977 TEL 0798-26-7889 FAX 0798-26-7858 www.chuosangio.co.jp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For Glaucoma and Ocular Hypertension
Prostaglandin F2α derivative

TRAVATANZ™ Ophthalmic Solution 0.004%

Travoprost Ophthalmic Solution

Listed in the NHI reimbursement price

NEW

Designated drug
Prescription-only drug

[CONTRAINDICATIONS (This drug is contraindicated in the following patients)]
Patients with hypersensitivity to any component of this drug

[INDICATION(S)]
Glaucoma and Ocular Hypertension

[DOSAGE AND ADMINISTRATION]
One drop in the affected eye(s) once daily.

Precautions for dosage and administration:
Do not exceed once daily since it has been shown that more frequent administration may decrease the intraocular pressure lowering effect.

[PRECAUTIONS]

1. Careful Administration (This drug should be administered with care in the following patients.)

(1) **Patients with aphakia or intraocular lens inserted in the eye** [Macular edema including cystoid macular edema and reduction of visual acuity related to the edema may occur.]

(2) **Patients with intraocular inflammation (iritis, uveitis)** [IOP increase may occur.]

(3) **Pregnant women, maternity, nursing mothers etc.** [Refer to the section of "Use during Pregnancy, Delivery, or Lactation"]

2. Important Precaution(s)

(1) Administration of this drug may change eye color due to pigmentation(increase in melanin) in the iris and periorbital tissue or growth of eyelashes. These changes occur slowly with continuation of administration, and no further change has been observed after discontinuation of administration. It is reported that the changes in the periorbital tissue and eyelashes may resolved gradually or be reduced after discontinuation of administration, whereas the changes in iris color have been reported that the changes would not be resolved after discontinuation of administration. Iris color changes may be more noticeable in patient with mixed colored iris, however it has also been observed in patients with monochromatic brown eyes (more frequently observed in Japanese). In particular, patients who are expected to receive treatment in only one eye should be informed that difference in the color of the iris may occur between right and left eyes. The long-term information about these symptoms is currently unknown, thus examine patients regularly and observe sufficiently. In administration, patients should be well informed of the possible of these symptoms, and patient should be instructed to wipe off well or wash the face if the solution adheres to periorbital skin in order to prevent or to reduce the color change in the eyelid and eyelash changes.

(2) Patient may develop corneal epithelial disorder (superficial punctuate keratitis, filamentary keratitis, corneal erosion) during administration of this drug, and should be sufficiently instructed to immediately consult, if subjective symptoms such as smarting sensation, itching sensation, or eye pain continue.

(3) There has been no case of the treatment in patients with glaucoma-closed angle, and therefore such patients should be treated with special care.

(4) Patient may find their vision temporarily blurred just after the use of this drug, and therefore should be advised not to operate machinery or drive the car until the symptom is recovered.

3. Adverse Reactions

The clinical study of Travoprost ophthalmic solution (preparation containing benzalkonium chloride)

The adverse reactions occurred in 40.2% (51/127) of patient in the clinical study with Japanese patients conducted prior to approval. Major adverse reactions included ocular hyperemia (22.0%), skin discoloration (7.1%), eye pruritus (6.3%), hair disorder (3.9%), iris discoloration (3.1%), eye discomfort (2.4%), keratitis (2.4%), discharge eye (1.6%), eye pain (1.6%), corneal erosion (1.6%), blepharitis (1.6%), and blurred vision (1.6%).

The adverse reactions occurred in 46.1% (298/646) of patients in the clinical study with non-Japanese patients conducted prior to approval. Major adverse reactions included ocular hyperemia (36.4%), eye pruritus (5.6%), eye discomfort (5.0%), eye pain (2.9%), iris discoloration (2.3%), foreign body sensation in eyes (2.2%), dry eye (1.9%), and keratitis (1.5%).

The clinical study of this drug

In the clinical study conducted using foreigner patients before approval to verify the bioequivalence, adverse reactions occurred in 22.1% (76/344). Major adverse reactions included ocular hyperemia (6.1%), eye pruritus (5.2%), eye discomfort (3.8%), foreign body sensation in eyes (2.6%), dry eye (1.7%), eye pain (1.7%), and keratitis (1.2%).

(1) Clinically Significant Adverse Reactions

Iris pigmentation (2.5%) : Iris pigmentation might appear and therefore patients should be examined periodically, and if iris pigmentation is observed, need to be discontinued with the treatment depending on the patient's general clinical condition.

Information about the drug not allowed to be prescribed for the long term
This product is not allowed to be prescribed over the amount of 14 days at once for new drug in compliance with the Notification No.107 by the Ministry of Health, Labor and Welfare of Japan (issued on 6 March 2006).

※For further precautions and others please review product information.

Marketing Authorization Holder (Importer) [REQUESTS FOR LITERATURE SHOULD BE MADE TO]
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Alcon JAPAN

prepared : February 2008

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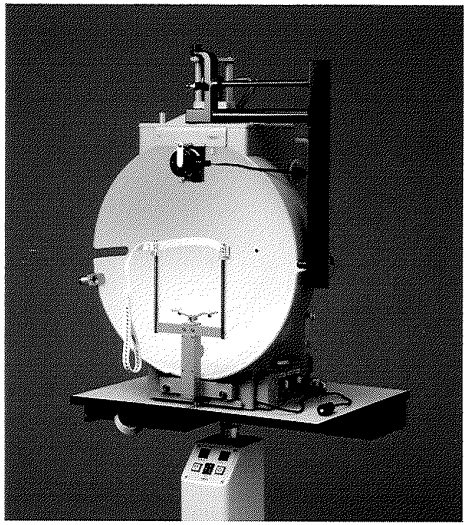

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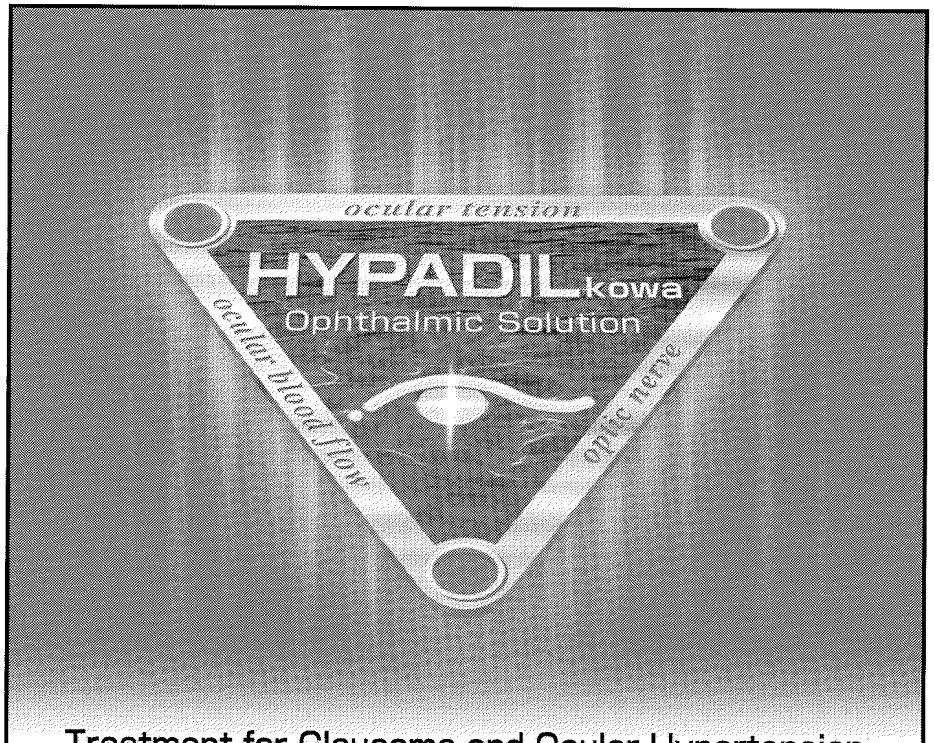

Treatment for Glaucoma and Ocular Hypertension

HYPADIL kowa Ophthalmic Solution 0.25%

Designated drug〔Nipradilol Eye Drop〕NHI drug price listing

Please refer to the Package Insertions for Indications,Dosage and Administration, and Precautions for Use including Contraindications.

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