XTH IPS MEETING PROGRAM AND ABSTRACTS Kyoto, Japan

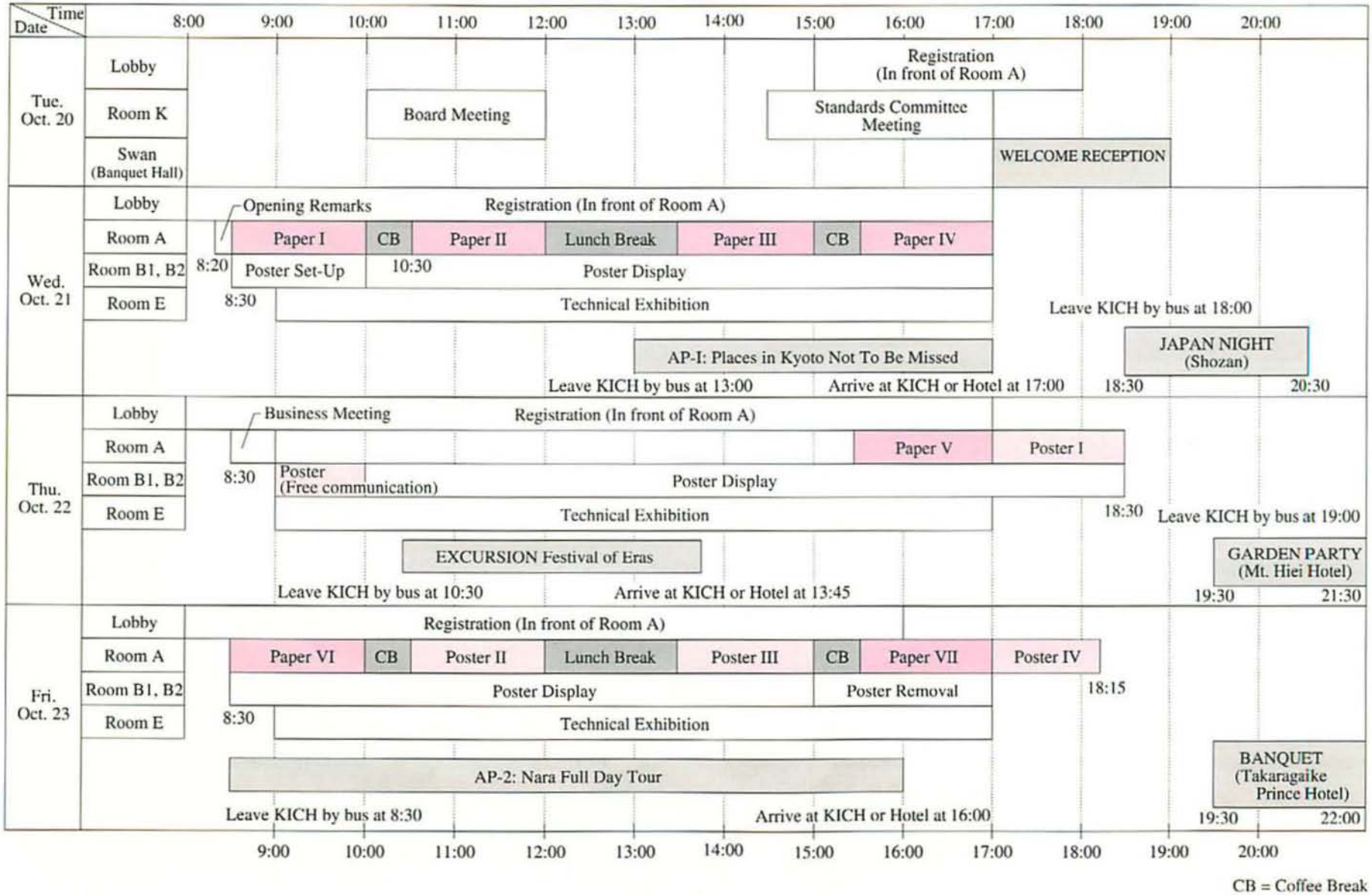
PROGRAM AND ABSTRACTS



Xth International Perimetric Society Meeting

October 20-23, 1992
Kyoto, Japan

Program at a Glance



CB = Coffee Break

PROGRAM AND ABSTRACTS

Xth International Perimetric Society Meeting

IPS

October 20-23, 1992

Kyoto International Conference Hall
Kyoto, Japan

Cover Photo:
Manshu-in Temple was moved to its present location in North Kyoto, from its original location on Mt. Hiei, in 1656. All the buildings as well as the dry garden with its stone bridges and islands, were designed by the son the Imperial Prince, Prince Toshihito (1579 - 1629).

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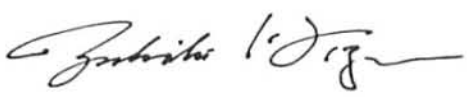
GREETINGS

On behalf of the Organizing Committee, I welcome all of you to Kyoto, the ancient capital of Japan. With the advice and assistance of colleagues from all over the world, we have been able to organize scientific sessions comprised of contributions addressing the most important aspects of on-going research in the field of perimetry and image analysis. I would like to take this opportunity to thank all colleagues for their contributions which have provided us with an excellent scientific program. I am convinced that all participants will learn a great deal from this Congress.

The city of Kyoto is full of traditional and modern Japanese culture and I hope you will be able to take this opportunity to witness the Japanese tradition. I also hope that you will be able to enjoy reunion with many good friends and make new acqaintances during our social events, as we have always done at every IPS Meeting in the past.

We will try our best to make your stay pleasant and we hope that your participation in this Congress will be rewarding and memorable.

Sincerely yours,



Yoshiaki Kitazawa, M.D.
Chairman for the
Organizing Committee of the
Xth International
Perimetric Society Meeting

ORGANIZATION OF THE MEETING

THE INTERNATIONAL PERIMETRIC SOCIETY

The International Perimetric Society (IPS) is the international organization for researchers in perimetry and visual fields. The Society was founded in 1974 and has held its international meetings every second year in the following locations:

1974	Marseilles, France
1976	Tübingen, FRG
1978	Tokyo, Japan
1980	Bristol, UK
1982	Sacramento, California
1984	Santa Margherita Ligure, Italy
1986	Amsterdam, The Netherlands
1988	Vancouver, Canada
1990	Malmö, Sweden

EXECUTIVE COMMITTEE OF THE INTERNATIONAL PERIMETRIC SOCIETY

President	Dr. Anders Heijl	Malmö, Sweden
Vice Presidents	Dr. Mario Zingirian	Genova, Italy
	Dr. Eric Greve	Amsterdam, The Netherlands
Secretary	Dr. Richard Mills	Seattle, U.S.A.
Treasurer	Dr. Fritz Dannheim	Hamburg, Germany
Other Committee Members	Dr. Gordon Douglas	Vancouver, Canada
	Dr. Joseph Flammer	Basel, Switzerland
	Dr. Fumio Furuno	Tokyo, Japan
	Dr. Enrico Gandolfo	Genova, Italy
	Dr. William Hart	St. Louis, U.S.A.
	Dr. Yoshiaki Kitazawa	Gifu, Japan
	Dr. Christine Langerhorst	Amsterdam, The Netherlands
	Dr. Bernard Schwartz	Boston, U.S.A.
	Dr. Michael Wall	Iowa City, U.S.A.
	Dr. John Wild	Birmingham, England
Honorary Members	†Dr. Elfriede Aulhorn	
	Dr. Stephen Drance	
	Dr. Franz Fankhauser	
	Dr. Alan Friedmann	
	†Dr. Hans Goldmann	
	Dr. Heinrich Harms	
	Dr. Harutake Matsuo	

ORGANIZING COMMITTEE OF THE XTH INTERNATIONAL PERIMETRIC SOCIETY MEETING

Chairman	Dr. Yoshiaki Kitazawa	Gifu, Japan
Other Committee Members	Dr. Ikuo Azuma	Osaka, Japan
	Dr. Fumio Furuno	Tokyo, Japan
	Dr. Kazutaka Kani	Otsu, Japan
	Dr. Kenji Kitahara	Tokyo, Japan
	Dr. Hiroshi Kosaki	Osaka, Japan
	Dr. Kuniyoshi Mizokami	Kobe, Japan
	Dr. Toshifumi Otori	Osaka, Japan

MEETING INFORMATION

Period October 20 (Tue.) – October 23 (Fri.), 1992

Venue
Kyoto International Conference Hall (KICH)
Takaragaike, Sakyo-ku
Kyoto 606, JAPAN

Phone: + 81(Japan) 75-791-3111
Fax: + 81(Japan) 75-711-1100
Telex: 5422353 INTHALJ

Secretariat

Before and after the Meeting:
Secretariat
Xth IPS Meeting
c/o JTB Communications, Inc.
New Kyoto Center Bldg. 5F
Shiokoji, Shinmachi, Shimogyo-ku
Kyoto 600, JAPAN

Phone: + 81 (Japan) 75-341-1618
Fax: + 81 (Japan) 75-341-1917

During the Meeting:
Letters and messages to participants during the Meeting should be addressed to the Kyoto International Conference Hall directly (address above).

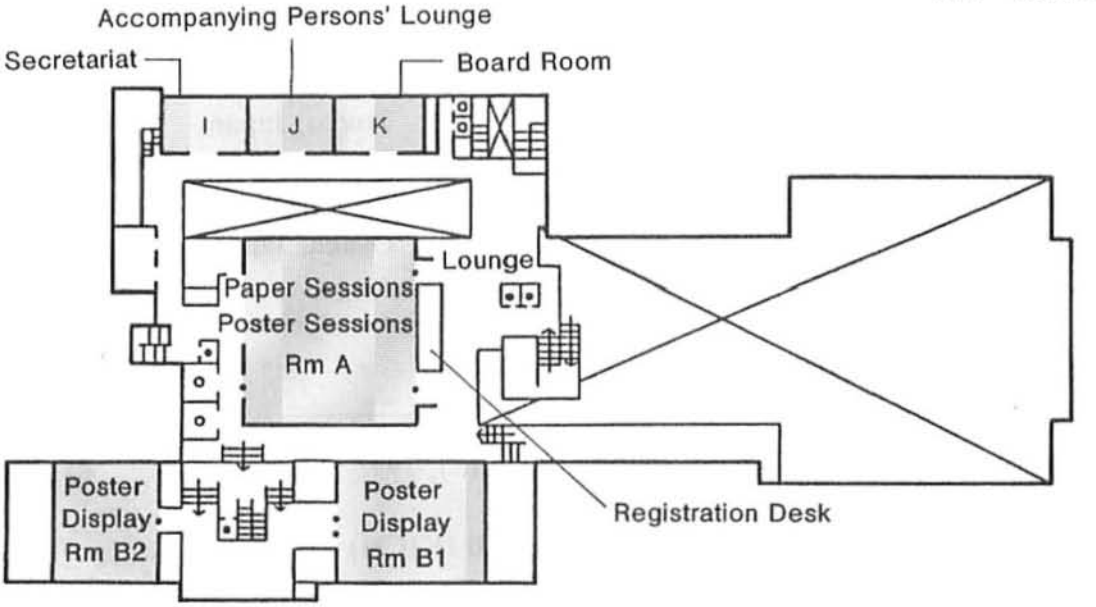
Language The official language of the Meeting is English.
Simultaneous interpretation between English and Japanese will be provided.

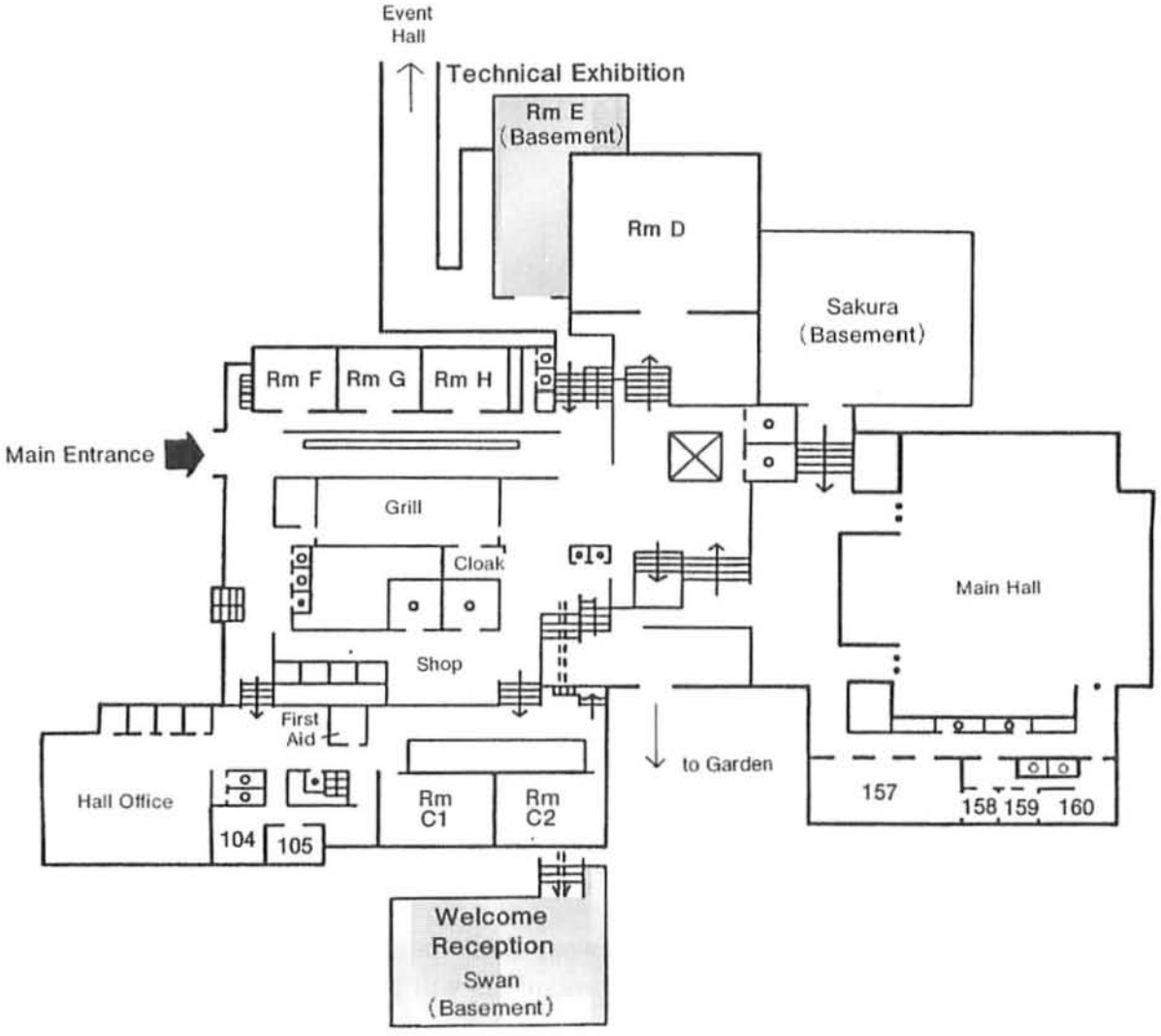
Name Badges Participants are requested to wear their name badges during all Meeting functions. Only registered members will be given access to the conference rooms.

FLOOR GUIDE

KYOTO INTERNATIONAL CONFERENCE HALL

Rm = Room





REGISTRATION

On Site Registration

Please complete your registration form and submit it to the Registration Desk on site. All payments MUST be made IN CASH in JAPANESE YEN. The Secretariat cannot accept any foreign currency, credit cards, bank or traveler's checks.

Registration Fee

	On Site Registration Fee
IPS Member	¥60,000
Non-Member	¥65,000
Resident	¥40,000
Accompanying Person	¥30,000

PLEASE NOTE:
Anyone registering as a resident must submit a letter of verification together with their registration form, to the Registration Desk on site.

Registration Fee Includes:

For IPS Members, Non-Members and Residents—

1)Attendance of all scientific sessions
2)Invitation to the Welcome Reception and Banquet
3)Receipt of Meeting materials including the Program and Abstracts
4)The right to purchase tickets for Japan Night, the Garden Party and Excursion

For Accompanying Persons (spouses, family members and non-professional friends)—

1)Attendance of the Opening Ceremony
2)Invitation to the Welcome Reception, Banquet and Accompanying Persons' Program (AP-1)
3)The right to purchase tickets for Japan Night, the Garden Party, Excursion and Accompanying Persons' Program (AP-2)

Opening Hours of the Registration Desk

Date	Hours
October 20 (Tue.)	15 : 00～18 : 00
October 21 (Wed.)	8 : 00～17 : 00
October 22 (Thu.)	8 : 00～17 : 00
October 23 (Fri.)	8 : 00～16 : 00

TECHNICAL EXHIBITION

An exhibition by commercial organizations, related to perimetric and ophthalmic equipment, pharmaceutical drugs and scientific publications will be held at KICH, the same venue as the Meeting. The exhibition will run from Wednesday, October 21 through Friday, October 23, in Room E.

Exhibition Hours

Date	Hours
October 21 (Wed.)	9:00 ~ 17:00
October 22 (Thu.)	9:00 ~ 17:00
October 23 (Fri.)	9:00 ~ 17:00

LIST OF EXHIBITORS

ALCON JAPAN LIMITED
CANON SALES CO., LTD.
CARL ZEISS CO., LTD.
CHUO SANGIO CO.
HUMPHREY CO., LTD.
INAMI & CO., LTD.
JAPAN FOCUS CO., LTD.
JFC SALES PLAN CO., LTD.
KONAN MEDICAL, INC.
KOWA CO, LTD.
MATSUMOTO MEDICAL INSTRUMENTS, INC. / INTERZEAG AG
NIDEK SALES CO., LTD.
NIKON CORPORATION
OCULUS
OPHTECS CORPORATION
OPHTHALMIC IMAGING SYSTEM, INC. (OIS)
SENKO MEDICAL TRADING CO.
TAKAGI SEIKO CO., LTD.
TOPCON CORPORATION

THE 3rd CONGRESS OF THE JAPANESE GLAUCOMA SOCIETY

Immediately following the Xth IPS Meeting, the Japanese Glaucoma Society will hold its annual meeting at the same venue. The following sessions will be held in Japanese and English with simultaneous interpretation:

Oct. 24 (PM) Round table discussion on Glaucoma Management
Oct. 25 (PM) Invited lectures on optic nerve vasculature, glaucoma surgery and visual physiology are also planned.

SOCIAL PROGRAM

All participants and accompanying persons are invited to attend the following social program, which will provide an opportunity to meet with old friends and become acquainted with new ones.

Reservations:
With the exception of the Welcome Reception, ALL reservations for the following Social Program Events, MUST be confirmed at the General Information Desk on site by 12:00 on the day of the event concerned. Upon confirmation, participants will receive an admission ticket for the event. Please note that admission will NOT be given without this ticket.

Those who have not yet made a reservation may do so at the General Information Desk, however, reservations MUST be made by 12:00 on the day of the event. Please note that payment must be made IN CASH, in JAPANESE YEN.

WELCOME RECEPTION

Date: Tuesday, October 20, 1992
Time: 17 : 00 ~ 19 : 00
Place: Room Swan, Kyoto International Conference Hall
Fee: Free of charge (included in registration fee)
The Meeting will open with the IPS Welcome Reception. A buffet will be served in Room Swan, one of the banquet halls of KICH. Please note that particpants may also register on this day between 15 : 00 and 18 : 00, as well as the following days of the Meeting.

JAPAN NIGHT

Date: Wednesday, October 21, 1992
Time: 18 : 30 ~ 20 : 30, transport will leave KICH at 18 : 00
Place: Shozan
Fee: ¥12,000 per person ***Admission ticket necessary**
Participants will be able to enjoy either a buffet-style meal or food served at traditional style food stalls in a beautiful, traditional Japanese garden setting.

EXCURSION (Festival of Eras)

Date: Thursday, October 22, 1992
Time: 10 : 30 ~ 13 : 45 (Tour bus will leave KICH at 10 : 30)
Fee: ¥3,000 per person ***Admission ticket necessary**
Itinerary: Hotels...Kyoto Imperial Palace...KICH

JIDAI MATSURI (Festival of Eras)
All participants and accompanying persons are cordially invited to see the Jidai Matsuri. It features a unique procession of 2,000 or more people in groups wearing costumes representing the main historical epochs over a period of 1,100 years. This festival is regarded as one of the greatest festivals in Kyoto.

GARDEN PARTY

Date: Thursday, October 22, 1992
Time: 19 : 30 ~ 21 : 30, transport will leave KICH at 19 : 00
Place: Mt. Hiei Hotel
Fee: ¥15,000 per person ***Admission ticket necessary**

This hotel is located on the summit of Mt. Hiei. Enjoy a Barbeque Dinner of famous Ohmi Beef and various sea foods amidst the beautiful night scenery of Kyoto. We recommend bringing a light coat and be prepared for cold weather.

BANQUET

Date: Friday, October 23, 1992
Time: 19 : 30 ~ 22 : 00
Place: Prince Hall, Takaragaike Prince Hotel
Fee: Free of charge (included in registration fee) ***Admission ticket necessary**

The IPS Banquet will be held at the Prince Hotel, one of the finest hotels in Kyoto, located across the street from KICH. The society will also gather for its traditional dinner and national singing.

ACCOMPANYING PERSONS' PROGRAM

Reservations:
Reservations for the Accompanying Persons' Program MUST be confirmed at the JTB Travel Desk, on site, by 17:00 on the day PRIOR to the tour. Should confirmations not be made in time, reservations will be automatically cancelled.
Those who have not yet made a reservation, may do so at the JTB Travel Desk. Please note that payment must be made IN CASH, in JAPANESE YEN.

AP-1 PLACES IN KYOTO NOT TO BE MISSED



Date: Wednesday, October 21, 1992
Time: 13 : 00 ~ 17 : 00
Fee: Free of charge (Included in registration fee)
Itinerary: KICH — Nijo Castle — Golden Pavilion — Ryoanji Temple — Hotel

AP-2 NARA FULL-DAY TOUR



Date: Friday, October 23, 1992
Time: 8 : 30 ~ 16 : 00
Fee: ¥12,500
Itineray: KICH — Byodoin Temple — Todaiji — lunch — Kasuga Shrine — Hotel (Deer Park)

* All tours include an English-speaking guide.

POST MEETING TOURS

Participants and accompanying persons who wish to visit other parts of Japan can join Post Meeting Tours. These tours can be started immediately after the Meeting. All tours will be operated by Japan Travel Bureau, Inc. (JTB).

PT-1 EAST BOUND/ 2 DAYS Departure: Daily

1st day:	Kyoto / Osaka — Toba	visit Mikimoto Pearl Island
2nd day:	Toba — Nagoya — Tokyo	visit Ise Jingu Shrine

Tour Fare: ¥50,300 per person (1 lunch included)/ extra ¥9,100 for single reservations

PT-2 HIROSHIMA AND INLAND SEA/ 2 DAYS Departure: Sunday, October 25, 1992

1st day:	Kyoto — Hiroshima	visit Miyajima, Peace Memorial Park
2nd day:	Hiroshima — Inland Sea — Osaka	board a high speed cruiser to Omishima Island, visit Oyamazumi Shrine and Ikuchijima Island, famous for Kosanji Temple

Tour Fare: ¥99,000 per person (1 lunch included)/ extra ¥4,300 for single reservations

PT-3 NORTHERN KYUSHU/ 5 DAYS Departure: Saturday, October 24, 1992

1st day:	Kyoto — Fukuoka	visit Dazaifu Temmangu Shrine and textile factory
2nd day:	Fukuoka — Beppu	visit Monkey Mountain, Marine Palace Aquarium, and Jigoku (hell) boiling thermal pool
3rd day:	Beppu — Mt. Aso — Kumamoto	drive along the mountain highway to Mt. Aso (the active volcanic crater) visit Kumamoto Castle
4th day:	Kumamoto — Amakusa — Nagasaki	visit Suizenji Park and the five Amakusa Pearl Line Bridges on Shimabara Peninsula
5th day:	Nagasaki — Fukuoka — Osaka / Kyoto	visit Glover Mansion, Peace Park and return to Osaka or Kyoto

Tour fare: ¥248,000 per person (2 lunches included)/ extra ¥22,000 for single reservations

Tour Conditions:

An English-speaking guide for sightseeing and excursions will be provided.
Only a maximum of two normal size pieces of baggage per person will be transfered and handled. Minimum number for operation is 2 persons.

Reservations:

Reservations for Post Meeting Tours MUST be confirmed at the JTB Travel Desk on site by 17:00 on October 23 (Fri.). Those who have not yet made a reservation may do so at the JTB Travel Desk. Please note that payment must be made IN CASH, in JAPANESE YEN.

GENERAL INFORMATION

COMMUNICATION AMONG PARTICIPANTS

A bulletin board will be available for participants' use where telephone or telegram messages may be posted. There will be no paging service.

BUSINESS INFORMATION CENTER

Participants will have access to facsimile machines and photocopiers. Charges will be made accordingly.

MEALS

Meals may be taken at the Meeting site in either of the two restaurants or at the Banquet Hall (Sakura) which will operate on a coupon basis.

REFRESHMENTS

Refreshments will be available throughout the Meeting free of charge, compliments of the Organizing Committee.

FOREIGN EXCHANGE AND TRAVELER'S CHECKS

It is recommended that participants purchase traveler's checks in Japanese yen or U.S. dollars prior to departure. The Secretariat will accept only Japanese yen in CASH on site. Foreign currencies can be exchanged at most banks, the New Tokyo International Airport in Narita, Osaka International Airport, and also at major hotels.

CLIMATE AND CLOTHING

The temperature in Kyoto during the Meeting period will range between 12°C (54°F) at night and 22°C (72°F) in the daytime with an average humidity of 74%. However, the weather is often unpredictable during this season, so light clothing and a sweater or light coat may be necessary. Hotels and buildings are fully air-conditioned.

Informal dress of your preference will be appropriate at all events during the Meeting.

MEDICAL CARE

In case of emergency, dial 110 for police or 119 for the fire department or ambulance, free of charge.

There will be a medical room equipped for first aid purposes at the Meeting site.
Please inquire at the General Information Desk should a need arise.

TAX AND TIPPING

Tipping is not customary in Japan. Instead, a 10 to 15% service charge is added to the bill at hotels and some restaurants. Also, when purchasing goods, a sales tax of 3% will be added to your bill.

TRAVEL INFORMATION

Kyoto, Your Host City

The ancient capital of Japan, Kyoto, is nestled amongst picturesque mountains and calm waters. Since its establishment as the seat of the Imperial Court late in the 8th century, the city has prospered as a center for politics, economy, culture, and the arts. With its innumerable cultural treasures and traditional crafts, Kyoto has always attracted both domestic and foreign visitors. Today it is a modern metropolis with an international flavor, yet nowhere else in Japan can one so readily encounter the past in the midst of an urban culture so clearly preparing for the 21st century.

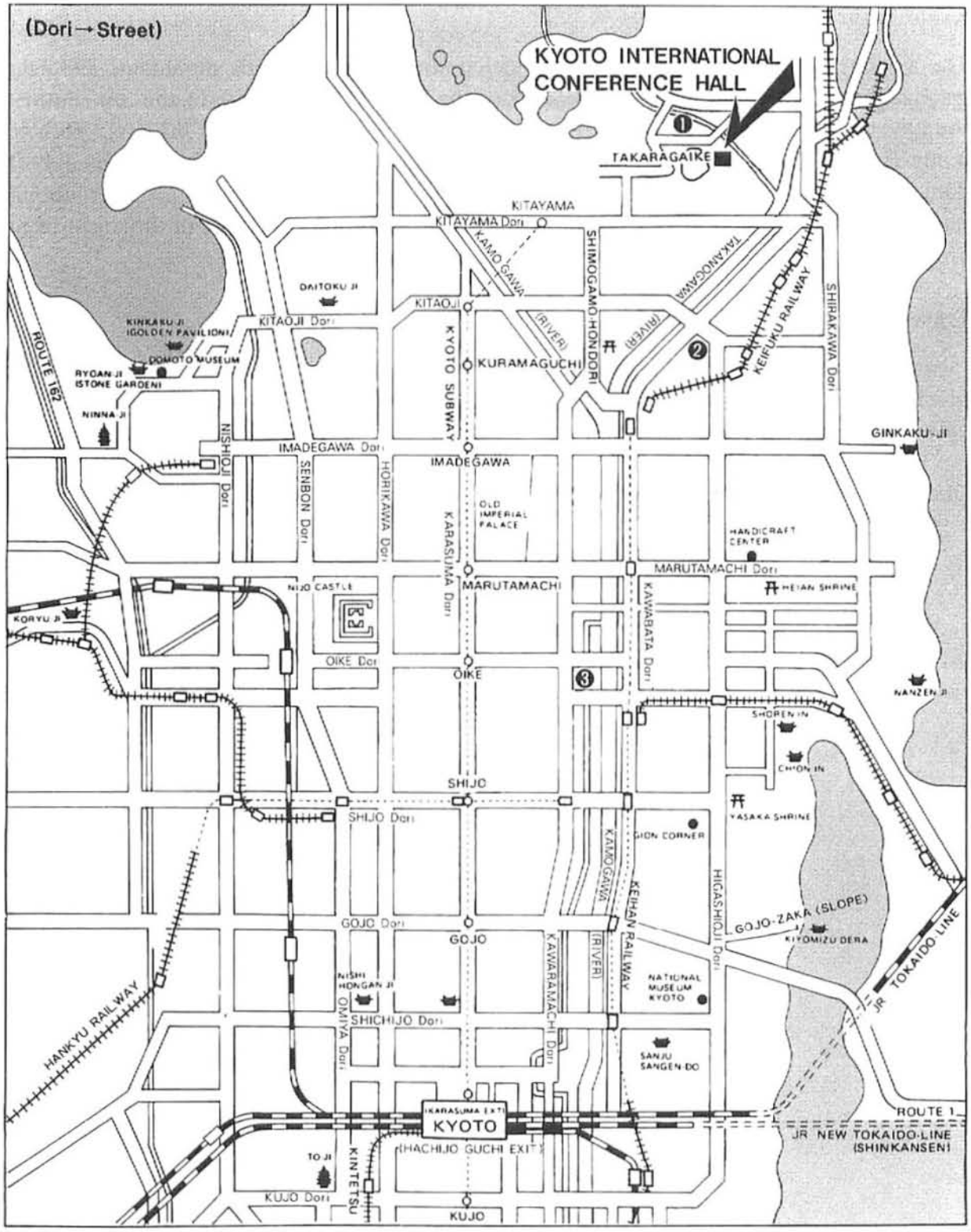
Travel Information Desk

Japan Travel Bureau, who is handling the Accompanying Persons' Program and Post Meeting Tours, will open a travel information desk during the Meeting period. Please inquire about any travel arrangements within Japan.

Opening Hours of the Travel Desk

Date	Hours
October 20 (Tue.)	15:00 ~ 18:00
October 21 (Wed.)	8:00 ~ 17:00
October 22 (Thu.)	8:00 ~ 17:00
October 23 (Fri.)	8:00 ~ 16:00

MAP OF KYOTO



HOTELS IN KYOTO

❶ Takaragaike Prince Hotel ❷ Holiday Inn Kyoto ❸ Kyoto Royal Hotel

SCIENTIFIC PROGRAM

INSTRUCTIONS FOR PRESENTATIONS

ORAL PRESENTATIONS

Audio-visual Equipment

The presentation room will be equipped with

- a microphone at the podium
- two 35 mm (2×2inch) slide projectors
- a projection pointer
- a time indicator

Presentation Time

You have **8 minutes for your presentation** and **5 minutes for discussion**.
On the speaker's podium, you will find a warning lamp which indicates time remaining. Please be aware of the lamp signal while speaking.
Green light: You have one more minute (7 min.)
Red light: Your time is up (8 min.) and discussion opens.
For the smooth progress of the program, it is most essential that each speaker keeps to their allotted time.

Slide Projector

There will be double slide projection for oral presentations. The size of the frame for each slide must be 50mm square and less than 3mm thick. Please avoid using paper frames, if possible. Slides having dimensions other than those specified above will not be accepted.

Slide Reception Desk

You are requested to submit your slides to the Slide Reception Desk at the entrance of the session room at least **30 minutes before the start of the session**. A projector for test-runs will be available at the desk. It is your responsibility to set your slides in the magazine in the right order.

Next Speaker's Seat

The first row of seats in the audience will be reserved for the next speaker. Please note that all speakers are requested to be seated in these seats at least **10 minutes before the start of their presentation**.
Your cooperation for the smooth operation of the session will be most appreciated.

POSTER PRESENTATIONS

Each poster session author will be provided with a horizontal poster board, in Rooms B1 and B2, as illustrated below (1.2×1.8 meters). Authors are responsible for **mounting their material between 15:00 and 17:00 on Oct. 20** and **9:00 and 10:00 on Oct. 21**, and for **removing their material between 15:00 and 17:00 on Oct. 23**. Please be reminded that the Secretariat will NOT be responsible for posters left on the boards after this time.

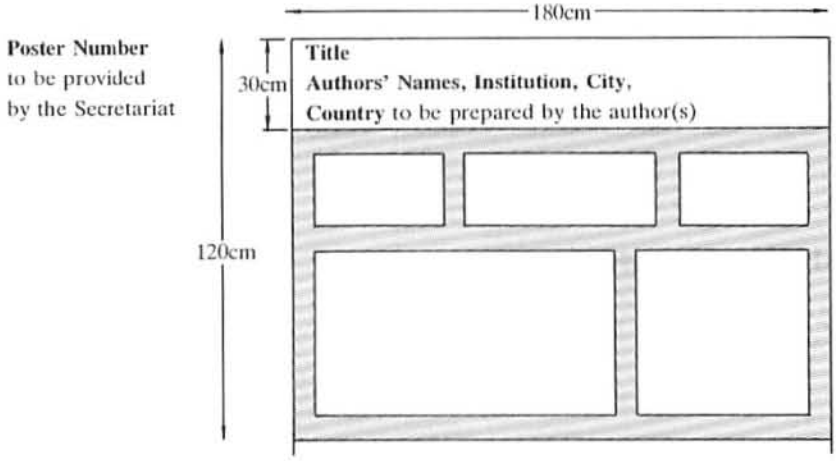
Any photocopies, illustrations or charts, etc., must be prepared in advance, as materials for these purposes will not be available at the Meeting site. The Secretariat will provide a reasonable supply of push pins, thumb tacks, etc., but authors should provide their own if possible.

Each poster paper must have a heading (with letters 2.5 cm (1 inch) high or typed with a large type typewriter in a large font on a dot matrix or laser printer, or photographically enlarged). Material should be displayed in logical sequence (introduction, development, conclusion), and each sheet should be numbered. Since posters will have to be read by attendees from a distance of 1 meter or more, lettering on illustrations should be large and legible.

Authors of posters are requested to be present at their poster to answer questions at the following time:

Poster (Free Communication)
Date: Thursday, October 22
Time: 9:00 AM – 10:00 AM

There will also be four poster discussion sessions on Thursday and Friday. A 2 × 2 inch (5 × 5 cm) slide with title and author should be prepared for the left projector and a summary slide of the main point(s) for the right projector. A maximum of 2 minutes for author comment has been allotted; the rest of the time is for audience discussion.



PROCEEDINGS

Please note that manuscripts for the proceedings MUST be submitted on site, next to the Slide Reception Desk. They should be aproximately 6-15 double spaced pages of 12 point type **including** illustrations and references. Please submit one original manuscript and set of illlustrations, with 3 additional copies of each. The proceedings will be published not earlier than June 15, 1993. If publication elsewhere is anticipated, the article for the proceedings may be in abbreviated form to avoid copyright difficulties.

WEDNESDAY, OCTOBER 21, 1992

8:20AM - 8:30AM **OPENING REMARKS**
Yoshiaki Kitazawa
Chairman of the Xth IPS Meeting

Anders Heijl
President of the IPS

8:30 AM- 10:00 AM **PAPER SESSION I**
Chairperson: T. Otori
Co-Moderators: M. Wall
J. Weber

1) Bilateral Visual Field Improvement Following Optic Nerve Sheath Fenestration in Pseudotumor Cerebri
M. Drake, S. Seiff, and J. Horton

2) Attenuation of the Ipsilateral Eye's Dominance Columns Between 20°-60° in Human Striate Cortex Correlates with the Steeper Nasal Slope of the Hill of Vision
J. Horton

3) Visual Field Indices for Lesions of the Central Visual Pathways
F. Dannheim, T. Damms, and S. Wessel

4) Comparison of the Visual Fields Between Psychosomatic and Psychogenic Visual Disorders in Children
K. Harasawa, H. Suzuki, M. Osako, and A. Hoshika

5) Accuracy of Optic Disc Evaluation and Magnitude of Field Loss in Glaucoma
A. Heijl, and H. Mölder

6) Automated Flicker Perimetry Using Octopus 1-2-3
C. Matsumoto, K. Uyama, S. Okuyama, R. Uyama and T. Otori

10:00AM - 10:30AM **Coffee Break**

Paper Sessions.....Room A

WEDNESDAY, OCTOBER 21, 1992

10:30 AM - 12:00 AM **PAPER SESSION II**
Chairperson: K. Kani
Co-Moderators: S. Nagata
M. Lieberman

1) Comparison of Multiple Stimulus Perimeters with Humphrey and Goldman
M. Brady, W. Sponsel

2) A Multi-fixation Campimeter for the Detection of Glaucomatous Visual Field Loss
B. Damato, E. Mutlukan, and J. Jay

3) Clinical Usefulness of Oculo-Kinetic Perimetry
H. Chuman, N. Nao-i, H. Kubota, and A. Sawada

4) Oculokinetic Perimetry Compared with Standard Perimetric Threshold Testing
C. Langerhorst, J. Felius, and T. van den Berg

5) Clinical Evaluation of OKP
A. Kato, A. Iwase, M. Maeda, Y. Kitazawa, and S. Myers

6) Subjective Detection of Glaucomatous Visual Field Defects Using Home TV Set
M. Adachi, and S. Shirato

7) Preliminary Report of the Use of Laptop Computer Perimetry with a Motion Sensitivity Screening Test to Detect Optic Nerve Disease in Rural West Africa
J. Wu, B. Jones, A. Brown, I. Murdoch, F. Adeniyi, N. Alexander and A. Abiose

12:00AM - 1:30PM **Lunch**

Paper Sessions.....Room A

WEDNESDAY, OCTOBER 21, 1992

1:30 PM- 3:00 PM **PAPER SESSION III**
Chairperson: J. Wild
Co-Moderators: B. Lindblom
K. Mizokami

1) Automated Scotopic Perimetry in Glaucoma
J. Felius, L. de Jong, T. van den Berg, and E. Greve

2) Visability Threshold for Dark Perimetric Stimulus
E. Mutlukan, B. Damato

3) Conversion of Normal Visual Field Data Between the Humphrey-Field-Analyzer 640, the Rodenstock Peristat 433 and the Octopus 1-2-3
P. Vivell, B. Lachenmayr, M. Schaumberger, P. Zimmermann, J. Dietrich, and C. Bain

4) Effects of Stimulus Size on Test-Retest Variability
M. Wall, and R. Kardon

5) Evaluation of Fastpac in a Glaucomatous Population
J. Flanagan, J. Wild, and G. Trope

6) Clinical Value of Fastpac - A Comparative Study with Standard Thresholding Method
A. Iwase, Y. Kitazawa, and Y. Kato

7) Statpac - Fastpac Comparison in Glaucoma
C. O'Brien, D. Poinoosawmy, and J. Wu

3:00PM - 3:30PM **Coffee Break**

Paper Sessions.....Room A

WEDNESDAY, OCTOBER 21, 1992

3:30 PM- 5:00 PM

PAPER SESSION IV
Chairperson: E. Gandolfo
Co-Moderators: J. Flanagan
F. Furuno

1) Weighted vs. Non-weighted Visual Field Indices in Glaucoma
P. Åsman and Anders Heijl

2) Sensitivity and Specificity of Visual Field Indices
M. Zulauf, J. Caprioli, S. Mandava, and T. Zeyen

3) Intra-bracketing Fluctuation: A New Perimetric Index"
M. Zingirian, R. Mattioli, P. Capris, E. Gandolfo, and F. Morescalchi

4) Priority of Test Locations for Automated Perimetry in Glaucoma
J. Caprioli, T. Zeyen, and M. Zulauf

5) Evaluation of Visual Fields with Clusters of Test Locations"
S. Mandava, M. Zulauf, J. Caprioli, and T. Zeyen

6) Reaction Time in Automatic Perimetry: Its Evaluation in Normals, Hypertensives and Glaucoma Patients
P. Capris, E. Gandolfo, G. Di Lorenzo, G. Ciurlo, and M. Soldati

7) Comparative Study of Visual Field Defects Between Normal-tension Glaucoma (NTG) and High-tension Glaucoma (HTG)
J. Yamagami, M. Araie, S. Shirato, Y. Suzuki and N. Koseki

Paper Sessions.....Room A

THURSDAY, OCTOBER 22, 1992

8:30AM - 9:00AM	**Business Meeting**
9:00AM - 10:00AM	**Poster (Free Communication)**
10:30AM - 1:45PM	**Excursion**
3:30 PM- 5:00 PM	**PAPER SESSION V** **Chairperson: K. Kitahara** **Co-Moderators: S. Shirato** **P. Asman**

1) Are Visual Field Defects in the Lower Hemifield a Risk-factor in POAG?
E. Gramer, G. Althaus, and U. Körner

2) Forecasting Progression of Glaucomatous Visual Field Loss
J. Wild, and M. Hussey

3) The Relationship Between Intraocular Pressure and Visual Field Progression in Glaucoma
B.Chauhan, and S. Drance

4) Progression of Chromatic and Achromatic Sensitivity Loss in Early Glaucoma
H. Abe, S. Hasegawa, M. Takagi, T. Yoshizawa and T. Usui

5) Discrimination between Progression and Non-progression Visual Field Loss in Low-tension Glaucoma"
D. Poinoosawmy, J. Wu, F. Fitzke, and R. Hitchings

6) Analysis of Visual Field Changes Progression in Low Tension Glaucoma
T. Ogawa, H. Suzumura, K. Yabuki, H. Ohkoshi, and T. Hama

7) Intraocular Pressure-dependent Progression of Visual Field Loss in Advanced Primary Open-angle Glaucoma
M. Shirakashi, K. Iwata, S. Sawaguchi, H. Abe, and K. Nanba

Paper Sessions.....Room A

THURSDAY, OCTOBER 22, 1992

5:00 PM- 6:30 PM **POSTER SESSION I**
Chairperson: R. Mills
Co-Moderators: K. Nanba
L. Frisen

1) Discrepancies Between Single Stimulus and Multiple Stimulus Visual Field Examination With the Peritest Semi-Automated Perimeter in Glaucoma Patients
C. Langerhorst, D. Bakker, J. Felius, and T. van den Berg

2) Comparison of Multiple Stimulus Perimeters With Humphrey and Goldmann
M. Brady, and W. Sponsel

3) Optimal Stimulus Parameter Setting in a New Design of Computerized Quantitative Layer-By-Layer Perimetry
T. Bek

4) A New Screening Program in Kowa Automated Perimeter AP 3000
H. Suzumura, N. Endo, K. Harasawa, and T. Murao

5) Reappraisal of Normal Values of Visual Field Using Octopus 1-2-3
S. Okuyama, C. Matsumoto, K. Uyama, and T. Otori

6) Influence of the Occlusion of the Non-Tested Eye on Sensitivity in Automated Perimetry
P. Capris, E. Gandolfo, E. Tarabuso, E. Semino, G. Corallo & G. Fava

7) Effect of Number of Test Points in Automated Perimetry Among Normal Untrained Subjects
N. Fujimoto and E. Adachi-Usami

8) Influence of the Target Size on the Sensitivity of the Central Visual Field in Patients with Glaucoma
K. Uyama, C. Matsumoto, S. Okuyama, and T. Otori

9) Evaluating the Blind Spot Using a Spatially Adaptive Strategy: Optimization by Means of Computerized Simulation
J. Estreicher, A. Safran, C. Mermoud, and T. Liebling

10) A Computer Simulation Method for Examining the Blind Spot
C. Mermoud, A. Safran, J. Estreicher, and T. Liebling

11) A New Instrument for Assessing Visual Disability: The Visual Effectiveness Score for Acuity & Visual Field
M. Lieberman, A. Colenbrander

Poster Session I cont.

12) Visual Field and Invalidity
E. Gandolfo, G. Di Lorenzo, M. Facino, P. Capris, and G. Corallo

13) Computer-Assisted Moving-Eye Campimetry (CAMEC)
B.Damato, E. Mutlukan, J. McGarvie, D. Keating, and A. Evans

14) Clinical Evaluation of Snowfield Screening Perimetry
M. Drake and A. Huang

15) STX Program as a Screening Test for Glaucoma
T. Wang, P. Hung, L. Lin, and T. Ho

16) Perimetric Assessment in an Epidemiology Study: Beaver Dam Eye Study
W. Sponsel, M. Brady, B. Klein, R. Klein, L. Cantor, J. Martone, M. Menage, and J. Nussmeier

17) Detection of Homonymous Visual Field Defects with Flickering Random Dot Pattern
U. Schiefer, M. Kolb, H. Wilhelm, D. Petersen, E. Zrenner, and H. Harms

18) Foveal Sensitivity: Correlation with Central Visual Function
S. Newman, and B. Wnorowski

19) Perimetric and Fluorescein-Angiographic Findings in Carotid Artery Obstructive Disease
D. Ghiglione, L. Borgia, E. Zinicola, P. Capris, P. Allegri, P. Cardillo, and E. Gandolfo

20) Primary Empty Sella Syndrome with Visual Field Defect
H. Matsuo, T. Sugiura, and K. Mizokami

21) Temporal, Wedge-Shaped Visual Field Defect Associated with Optic Nerve Hypoplasia
M. Ozaki, Y. Futami, A. Kobori, and A. Sawada

22) Visual Field Defects in Migraine Patients
R. De Natale, D. Polimeni, M. Narbone, M. Scullica, and M. Pellicanō

23) Perimetry in Psychogenic Visual Disturbances
M. Yamamoto, M. Ohike, H. Shirabe, and K. Suda

Poster Session Discussions.....Room A
Poster Session I Display.....Room B1

FRIDAY, OCTOBER 23, 1992

8:30 AM- 10:00 AM

PAPER SESSION VI
Chairperson: M. Zingirian
Co-Moderators: W. Sponsel
E. Chihara

1) Postural Influence on Visual Fields in Normals, Open-angle, and Normal-tension Glaucomas
A. Lietz. , J. Flammer, D. Stümpfig, P. Hendrickson, and T. Graf

2) Does Glaucomatous Visual Field Loss Continue Despite Surgically Subnormal IOP?
J. Lynn, W. Swanson, R. Fellman, S. Smith

3) **Long-Term Visual Field Follow-up in Betaxolol-and-Timolol-Treated Patients**
A. Graves, G. Cagle, T. McDonald, J. Collignon-Brach, P. Demailly and J. Flammer

4) Timolol vs. Betaxolol: Effects on Visual Function and Ocular Hemodynamics
W. Sponsel, J. Shoemaker, P. Kaufman, F. Blum, M. Brady, K. DePaul, S. Zetlan

5) Side Difference in Intraocular Pressure, High-pass Resolution Perimetry, and Retinal Leukocyte Velocity
P. Wanger

6) Spatial Distribution of Age Effects in High-pass Resolution Perimetry
B. Lindblom

7) Comparative Study of Conventional Light Sense Perimetry (Octopus 1-2-3) and Resolution Perimetry (Frisen)
J. Meyer, and J. Funk

10:00AM - 10:30AM **Coffee Break**

Paper Sessions.....Room A

FRIDAY, OCTOBER 23, 1992

10:30 AM- 12:00 AM **POSTER SESSION II**
Chairperson: A. Heijl
Co-Moderators: T. Yamamoto
B. Damato

1) The Influence of Pre-Receptoral Absorption on Blue/Yellow Automated Perimetry
C. Hudson

2) Blue on Yellow Perimetry: A Five Year Overview
C. Johnson, A. Adams, and E. Casson

3) Learning Effects in Blue-Yellow Automated Perimetry
I. Moss, J. Wild, D. Whitaker

4) Color Visual Fields: A 5 Year Prospective Study in Eyes with Primary Open Angle Glaucoma
P. Sample, G. Martinez, and R. Weinreb

5) General Blue Sensitivity Loss in Normal, Medium and High Pressure Glaucoma
L. de Jong, J. Felius, T. van den Berg, and E. Greve

6) The Effect of Light Scatter on Chromatic Perimetric Sensitivity
I. Moss, J. Wild, and D. Whitaker

7) **The Follow-up of Glaucoma with a Reduced Set of Test Points**
M. Diestelhorst, J. Weber, and A. Gau

8) Point By Point Linear Regression Analysis of Automated Visual Fields in Primary Open Angle Glaucoma
C. O'Brien, and B. Schwartz

9) Is Diffuse Visual Field Loss in Low-Tension Glaucoma a Prognostic Indicator for Progression?
D. Poinoosawmy, J. Sturmer, C. O'Brien, and R. Hitchings

10) Cumulative Defect Curves and Glaucomatous Field Loss
P. Åsman and J. Olsson

11) A Graphical Bar to Visualize the Quantitative Development of Visual Fields
C. Papooulis, and J. Weber

12) "Pericecal Index" in Early Glaucoma Automated Visual Fields
P. Brusini, M. Della, F. Miani, C. Tosoni

Poster Session II cont.

13) A Visual Field Index for Nerve Fibre Bundle Defects
T. Damms, F. Dannheim and S. Ahlers

14) Sectorization of Visual Field in Glaucoma
Y. Suzuki, M. Araie, and Y. Ohashi

15) The Quantification of Congruence Between the Right and Left Visual Field
J.Weber

16) Pointwise Analysis of Serial Visual Fields in Normal Subjects
A. Rudnicka, D. Crabb, and D. Edgar

17) Short Term Fluctuation Versus Bracketing Fluctuation in Normals, Hypertension and Glaucomatous Eyes
R. de Natale, G. Romeo, and F. Famà

18) Perikon PCL 90: A Statistical Program
E. Gandolfo, R. Mattioli, P. Capris, G. Di Lorenzo, M. Zingirian, C. Novaro, and M. Danielli

19) Mathematical Model of the Glaucomatous Visual Field. Evaluation of the 'Delphi' Procedure
M. Gonzalez De La Rosa, C. Mesa Moreno, C. Mantolan Sarmiento, and F. Martin Barrera

20) External Control of Testing and Data Analysis on the Humphrey Field Analyzer
J. Flanagan, and J.W. Cassidy

21) Comparing Long Term Variability Using the Humphrey Field Analyzer and the Ring Perimeter in Glaucomatous and Normal Subjects
P. House, R. Cooper, and M. Bulsara

22) Probability of Global Indices in Low Tension Glaucoma"
C. Hong and K. Song

12:00AM - 1:30PM **Lunch**

Poster Session Discussions.....Room A
Poster Session II Display.....Room B1

FRIDAY, OCTOBER 23, 1992

1:30PM - 3:00PM **POSTER SESSION III**
Chairperson: C. Johnson
Co-Moderators: Y. Yamazaki
C. Langerhorst

1) The Magnitude and Locus of Perimetric Fatigue in Normals and OHTs
C. Hudson, J. Wild, A. Searle, and E. O'Neill

2) Reliability Indices in Automated Perimetry
G. Corallo, E. Gandolfo, A. Magnasco, E. Semino, F. Morescalchi, C. Novaro, and M. Danielli

3) Fixational Instability During Perimetry and the Blindspot Monitor
S. Demirel and A. Vingrys

4) The Effect of Fixation Loss on Perimetric Reliability
A. Vingrys and S. Demirel

5) Performance of Unreliable Patients on Repeat Perimetry"
R. Mills, Y. Li, and B. Trivedi

6) Serial Comparison of Reliability Indices in Conventional and High-Pass Resolution Perimetry in Normal Subjects
R. Mohandas, J. Whelan, B. Chauhan, and T. McCormick

7) A Comparative Study Between High-Pass Resolution Perimetry and Differential Light Sensitivity Perimetry in Glaucoma Patients
Y. Kono, M. Maeda, T. Yamamoto, and Y. Kitazawa

8) High-Pass Resolution Perimetry: Comparison Between "Mean dB Score" and "Neural Capacity" in Glaucoma Diagnosis and Follow-up
P. Wanger and L. Martin-Boglind

9) How Does High-Pass Resolution Perimetry (HRP) Estimate Retinocortical Neural Channels?
L. Frisén

10) Estimation of Receptive Field Area and Density of Human Retina Using Computer Simulation
S. Nagata, M. Takashima, T. Inui, and K. Kani

11) Examination of Receptive Field Using Automatic Perimeter
M. Takashima, S. Nagata and K. Kani

12) Characteristics of Frequency-of-Seeing Curves in Glaucoma
B. Chauhan, J. Tompkins, R. LeBlanc, and T. McCormick

Poster Session III cont.

13) Frequency-of-Seeing; Dependence on Total Deviation
A. Heijl, J. Olsson, B. Bengtsson, and H. Rootzén

14) An Analysis of Spatial Summation Using Humphrey Field Analyzer
N. Iyori, G. Takahashi, N. Koyama, and K. Kitahara

15) Motion Perception in Patients with Ocular Hypertension and Primary Open-angle Glaucoma
S. Moriya, K. Matsuda, and I. Azuma

16) Temporal Modulation Perimetry in Glaucoma and Ocular Hypertension
E. Casson and C. Johnson

17) The Normal Visual Field in Light-Sense, Flicker and Resolution Perimetry
B. Lachenmayr, K. Angstwurm, B. Bachmayer, S. Kojetinsky, and M. Schaumberger

18) Luminance Threshold Flicker Perimetry in Primary Open Angle Glaucoma, Ocular Hypertension and Normal Controls: The Effectof Flicker Frequency
M. Austin, C. O'Brien, and P. Wishart

19) Large Field Sinusoidal Flicker Testing Separates Glaucoma Patients from Normals
A. Béchetoille and B. Boussion

20) Perimetric Studies on Long-Term Hypotensive Glaucomas After Filtering Surgery by Intraoperative Mitomycin Application
P. Hung, T. Ho, J. Hsieh, P. Liu, and Y. Hou

21) A Long-Term Visual Field Evaluation of Glaucoma Patients Topically Treated with Timolol or Carteolol
A. Wegner, I. Ugi, and H. Hofmann

3:00PM - 3:30PM **Coffee Break**

Poster Session Discussions.....Room A
Poster Session III Display.....Room B2

FRIDAY, OCTOBER 23, 1992

3:30 PM- 5:00 PM

PAPER SESSION VII
Chairperson: B. Schwartz
Co-Moderators: M. Drake
G. Tomita

1) Optic Disc Topographic Changes Following Intraocular Pressure Reduction in Normal-tension Glaucoma and Primary Open Angle Glaucoma
S. Sogano, G. Tomita, and Y. Kitazawa

2) Repeatability of the Glaucoma-scope for Optic Nerve Head Analysis
H. Hoskins, J. Hetherington, M. Glenday, S. Samuels, and S. Verdooner

3) **Cluster-Analysis of the Three-Dimensional Optic Disc Topography**
R. Burk, K. Rohrschneider, H. Völcker, and H. Noack

4) Correlation Between Optic Disc Changes and Visual Field Loss in Patients with Unilateral Glaucoma
J. Funk, J. Soriano, and D. Ebner

5) Computerized Image Analysis in the Glaucomatous Optic Disc Color Changes
M. Ito, K. Mizokami

6) Correlation Between Optic Disc Changes and Visual Field Defects in Glaucoma
K. Nanba and K. Iwata

7) Regional Differences of Functional and Structural Changes in Glaucoma
Y. Yamazaki, F. Takahashi, C. Koide, and H. Yamada

Paper Sessions.....Room A

FRIDAY, OCTOBER 23, 1992

5:00PM - 6:15PM

POSTER SESSION IV
Chairperson: F. Dannheim
Co-Moderators: M. Araie
D. Hoskins

1) Correlation of Asymmetric Differences of Visual Fields with Asymmetric Differences in Optic Disc Cupping and Pallor and Retinal Nerve Fiber Layer Thickness in Primary Open Angle Glaucoma
T. Takamoto, B. Schwartz, and V. Nangia

2) Positive Correlation Between Rotation the Disc and Location of Glaucomatous Scotomata
E. Chihara

3) Lateral Differences in Shape and Colour of the Optic Disc - Are There Any Correlations?
H. Zenker, P. Mierdel, E. Marré

4) A Measurement-Value for the Thickness of the Nerve Fiber Layer and the Configuration of the Excavation in Glaucoma Patients - A Clinical Study Using the Laser Tomographic Scanner (LTS)
E. Gramer, H. Maier, and E. Messmer

5) Comparison of Clinical Methods to Detect Structural Damage From Early Glaucoma
D. O'Connor, J. Caprioli, and T. Zeyen

6) Choroidal Plerometry: Clinical Application
G. Lambrou, T. van den Berg, F. Temporelli, and E. Greve

7) Visual-Field Defects and Peripapillary Choroidal Blood Flow in Normal-Tension Glaucoma
C. Prünte, D. Stümpfig, and J. Flammer

8) Comparison of Visual Field Defects and Optic Disc Cupping in Low-Tension Glaucoma and Primary Open Angle Glaucoma
M. Fujii, N. Katsumori, and K. Mizokami

9) Angioscotomas in Automated Perimetry: Diameter and Locations of Neighboring Vessels
A. Safran, A. Halfon, E. Safran, G. van Melle, and C. Mermoud

Poster Session IV cont.

10) Using the High-Pass Resolution Perimeter in Determining the Usefulness of the CPF Lenses in Retinal Dystrophies
K. Oyama, T. Tokuhisa, K. Kitahara, and R. Tamaki

11) A Dissociation of Thresholds Between Goldmann Kinetic Perimetry and High-Pass Resolution Perimetry in Retinitis Pigmentosa
T. Tokuhisa, R. Tamaki, K. Oyama, and K. Kitahara

12) Visual Field and Vitamin A Deficiency
A. Polizzi, M. Bovero, M. Brezzo, R. Gesi, M. Barbetta, E. Gandolfo, and M. Fioretto

13) The Role of Computerized Perimetry in Pre-Operative Examination of Patients with Senile Cataract and Macular Degeneration
M. Rudneva, A. Zolotorevsky, and A. Ismankulov

14) Retinal Toxicity of Silicone Oil Studied by Means of Computerized Perimetry
A. Reibaldi, M. Uva, G. Panta, and D. Randazzo

15) Do Laser Scars Grow in Spite of Successful Laser-coagulation of Subretinal Neovascularizations (SNRV)?
P. Janknecht, J. Soriano, J. Funk, L. Hansen

16) A Touch-screen Multi-stimulus Video-campimeter
E. Mutlukan, D. Keating, B. Damato

17) Preliminary Report on Objective Perimetry by Visual Evoked Potentials
M. Fioretto, G. Fava, C. Burtolo, E. Gandolfo, and M. Zingirian

18) Clinical Evaluation of a New Combined Flicker and Static Perimeter
C. O'Brien, M. Austin P. Wishart, P. Wareing, and P. Hammond

Poster Session Discussions.....Room A
Poster Session IV Display.....Room B2

ABSTRACTS

ABSTRACTS FOR ORAL PAPERS

PAPER SESSION I

CHAIRPERSON: T. OTORI
CO-MODERATORS: M. WALL
J. WEBER

Wed., Oct., 21
8:30 AM – 10:00 AM

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1)

BILATERAL VISUAL FIELD IMPROVEMENT FOLLOWING OPTIC NERVE SHEATH FENESTRATION IN PSEUDOTUMOR CEREBRI

MV. Drake, S.R. Seiff, J. Horton, UCSF, San Francisco CA

Optic nerve sheath fenestration has become an increasingly popular treatment for patients with visual loss due to chronic pseudotumor cerebri. Between November, 1988, and May, 1992, we performed optic nerve sheath fenestration on 16 nerves of 15 patients with this diagnosis. Each patient had pre- and postoperative visual field examinations using the Humphrey Field Analyser and program 30-2. Followup visual field examinations performed two to eight weeks postoperatively showed slight to dramatic improvement in 15 of 16 procedures. The mean preoperative mean difference (MD) was -16.89 (range -3.72 to -30.73) in the ipsolateral eye. The mean postoperative MD in the ipsilateral eye was -9.20 (range -3.87 to -20.66). Interestingly the contralateral eye had clinically significant visual improvement as well. In contralateral eyes the mean preoperative MD was -10.67 (range 3.25 to -23.02) and the mean postoperative MD -5.25 (range +0.34 to -12.03).

Our findings indicate that unilateral optic nerve sheath fenestration is often followed by bilateral visual field improvement.

2)

Attenuation of the Ipsilateral Eye's Dominance Columns Between 20°-60° in Human Striate Cortex Correlates with the Steeper Nasal Slope of the Hill of Vision

Jonathan C. Horton, Dept. of Ophthalmology, UCSF, San Francisco, CA, 94143-0350, USA

Inputs to striate cortex serving each eye are organized into alternating parallel stripes called ocular dominance columns. These columns can be labelled in autopsy tissue by a histochemical reaction for cytochrome oxidase. After loss of vision in one eye, enzyme levels diminish in columns formerly driven by the blind eye, causing a striking pattern of alternating dark and light stripes to emerge in layer IVC of striate cortex. The overall mosaic formed by the columns has been reconstructed in 3 human occipital lobe specimens from serial flattened sections reacted for cytochrome oxidase activity. These reconstructions show that the ocular dominance columns of the ipsilateral eye and the contralateral eye are approximately of equal width in cortex representing the central 20° of the visual hemifield. However, columns of the ipsilateral eye become increasingly attenuated, compared with the columns of the contralateral eye, from the peripheral margin of the optic disc representation (~20°) to the beginning of the monocular crescent representation (~60°), where columns cease altogether. This normal shrinkage of the ipsilateral eye's dominance columns in peripheral binocular cortex correlates with the lower density of retinal ganglion cells in temporal retina compared with nasal retina at eccentricities beyond 20°, and may account for the steeper nasal slope of the hill of vision.

3)

VISUAL FIELD INDICES FOR LESIONS OF THE CENTRAL VISUAL PATHWAYS

F. Dannheim*, T. Damms* & S. Wessel**

* Dept. of Ophthalmology, University of Hamburg ** Dept. of Neurology, Heidberg General Hospital, Hamburg, FRG

The database PERIDATA provides a number of new indices by calculating the conformity of values of sensitivity in confined areas of the central visual field. We applied two of these, one for hemiopic and another one for quadranopic defects, to the OCTOPUS G1 normative population (n=836), and to visual fields in lesions of the chiasm (n=106), the optic tract (n=34), of supra-geniculate lesions (n=36), and fields in optic neuritis (n=75).

The hemi-index was abnormal in 50, the quadrant-index in 53 healthy eyes (specificity 94%). 144 of 150 fields with hemiopic defects due to lesions of the chiasm or further central pathways presented with a pathological hemi-index (sensitivity 96%). All 6 missed fields had only mild hemiopic alterations and a pathological quadrant-index. From 55 abnormal fields in optic neuritis, only 4 showed a moderately elevated hemi-index, whereas 12 had an abnormal quadrant-index due to nasal nerve fibre defects. The separation of the different clinical entities with these indices is demonstrated by ROC curves. The two indices obviously facilitate the interpretation of visual fields.

4)

COMPARISON OF THE VISUAL FIELDS BETWEEN PSYCHOSOMATIC AND PSYCHOGENIC VISUAL DISORDERS IN CHILDREN.

Kayoko Harasawa[1], Hiroko Suzuki[1], Masahiro Osako[1], Akinori Hoshika[2]

[1]Dept. of Ophthalmology, [2]Dept. of Pediatrics, Tokyo Medical College, Tokyo

It is well known that the patient with psychogenic visual disorders (PVD) exhibits characteristic visual fields, but the visual fields of the psychosomatic disorders (PSD) patient without PVD are not well investigated. Twenty-one children with PVD, who had decreased visual acuities and showed 1.0 or more visions with plano or trick lens, and twenty-one children diagnosed as PSD by pediatrician were included in this study, and we performed kinetic and static perimetry on these two groups and compared the results.

At the initial Goldmann perimetry, PVD group (42 eyes) showed 21% contraction, 10% crossed isopters, 7% irregular isopters, 7% mild contraction, 5% spiral isopters, and 50% normal field, whereas PSD group (42 eyes) showed 5% irregular isopters and 95% normal field. Humphrey Field Analyzer program 30-2 or 24-2 was also performed on the patients with normal Goldmann fields (including the fields normalized during follow-up). In seventeen eyes with PVD (9 patients), there were 11 diffuse depression, 4 localized depression, and 2 normals. In thirty-two eyes with PSD (16 patients), there were 19 diffuse depression, 1 localized depression, and 12 normals. All of 8 eyes with PVD, whose Goldmann fields were normalized during follow-up, showed abnormal static fields. The percentage of the visual fields which indicated high fixation losses, false negative, or short-term fluctuation, was greater in PVD group than in PSD group.

Although the PSD group showed 95% normal Goldmann fields, 65% of static fields were abnormal. In the PVD group, even if the Goldmann fields were normalized during follow-up, functional visual field loss in the static fields were very common, and response characteristics were unusual.

5)

ACCURACY OF OPTIC DISC EVALUATION AND MAGNITUDE OF FIELD LOSS IN GLAUCOMA

Anders Heijl and Harras Mölder, Department of Ophthalmology in Malmö
University of Lund, Sweden

We studied the diagnostic power of subjective optic disc evaluation in relation to magnitude of visual field loss in 113 eyes with glaucomatous field defects identified by computerized threshold perimetry. Studied eyes were outside normal limits on the Glaucoma Hemifield Test of the Statpac 2 program. Fourty-two eyes were treated with miotics and 71 were not. Visual acuities were ≥ 0.8. The optic discs were independently classified as normal or glaucomatous by five ophthalmologists in a masked fashion. For analysis, eyes were divided into quartiles according to the extent of field loss as measured by Mean Deviation.

Overall sensitivity for recognizing glaucoma depended significantly on the degree of field loss ($p<0.01$, simple regression analysis), being 83% in the quartile with most pronounced field loss (MD between -25.03 and -15.41) and 64% in the quartile with best MD values (MD between -4.66 and -1.44). Miosis did not influence this relation significantly in multiple linear regression analysis.

Thus there was a considerable percentage of eyes with reproducible glaucomatous field loss which was missed by disc evaluation. Such diagnostic misclassification was most common in the eyes with milder field loss, where 36% were classified as normal on disc inspection alone compared with 17% in the quartile with most advanced loss. We conclude that automated static perimetry and disc inspection are complementary techniques for recognition of early glaucoma.

6)

AUTOMATED FLICKER PERIMETRY USING OCTOPUS 1-2-3

C. Matsumoto, K. Uyama, S. Okuyama, R. Uyama and T. Otori
Department of Ophthalmology, Kinki University School of Medicine, Osaka-Sayama, Japan

It is known that flicker perimetry is more sensitive than light threshold perimetry for detecting early glaucomatous visual field defects. Using the OCTOPUS 1-2-3 and its remote software package, we developed a strategy of automated flicker perimetry for the central 30 degrees visual field on a IBM personal computer. In all of our programs, we used a bracketing method to define cff at each test point. The catch trials for the false-positive and the false-negative answer were tested to evaluate cooperation of the patient. Short-term fluctuation was also tested to examine the reliability of the flicker perimetry. Using this program, we studied the static flicker field of 53 normal subjects and 36 early stage glaucoma patients. The normal static flicker field was found to be almost flat in shape under our examination conditions. The flicker fusion threshold decreased slightly with age. In most of the normal subjects, the catch trials of our automated flicker perimetry were less than 10 %, indicating that patient reliability was almost as good as for OCTOPUS perimetry. Automated flicker perimetry was able to detect early glaucomatous visual field defects which had not been clearly recognized with OCTOPUS perimetry.

CHAIRPERSON: K. KANI
CO-MODERATORS: S. NAGATA
M. LIEBERMAN

Wed., Oct., 21
10:30 AM – 12:00 AM

1)

COMPARISON OF MULTIPLE STIMULUS PERIMETERS WITH HUMPHREY AND GOLDMANN

Mary A. Brady, William E. Sponsel, Indiana University, Indianapolis, IN

Automated perimetry in the United States has been dominated by the Humphrey Visual Field Analyzer, a full-bowl single-stimulus projection perimeter. Testing time is typically 14 minutes per eye in normal eyes. In recent years several high-speed multiple stimulus perimeters (MSPs) have been introduced. These can substantially reduce testing time and encourage fixation by presenting a series of concentrically arranged patterns of 0-4 stimuli. Prior studies with automated MSPs (as well as longstanding European experience with the manually-operated Friedmann Visual Field Analyzer) indicate that typical clinical subjects can perform such testing without difficulty. Each patient response is a forced choice from 16 possible pattern options, minimizing false-positive and -negative responses which confound traditional single-stimulus methods. The Dicon TKS 4000 (Vismed), Henson CFA3000 (Keeler), and Marco MT-336 MSPs are all computerized instruments which can test the central visual field and provide numerical field indices for a normal eye in less than 4 minutes. The number of points tested in each instance exceeds that tested using the 30-2 program, but quantification of threshold values at each stimulus locus is abbreviated relative to the Humphrey full-thresholding strategy. The basis for comparing these instruments with the Humphrey was to compare their output with the prevailing clinical standard. Comparative data analyses and case examples are presented from among 30 glaucomatous patients and 30 age-related normal subjects. Indices from all three MSP's were significantly correlated with the Statpac Global Indices of the Humphrey 30-2 in both normative and glaucomatous populations ($p \leq .01$). Goldmann visual fields were obtained on the same population. Qualitative and quantitative comparison of the MSP's and the Humphrey 30-2 to the Goldmann fields is also presented.

2)

A MULTI-FIXATION CAMPIMETER FOR THE DETECTION OF GLAUCOMATOUS VISUAL FIELD LOSS

Bertil E Damato, Erkan Mutlukan, Jeffrey L Jay
Tennent Institute of Ophthalmology, Glasgow

The multi-fixation glaucoma screening chart is a hand-held tangent screen with a central black test stimulus on a white background and 26-numbered fixation targets located eccentrically. The patient looks at each number in turn so as to position the test stimulus at known points within the central 15 degree visual field. Any numbers associated with disappearance of the stimulus are recorded on a miniature version of the chart on a record sheet. The test is positive if any point is consistently missed.

When 222 eyes of 126 glaucoma patients were examined using a 1.5mm stimulus the OKP test was positive in 40% of eyes with relative scotomas, 81% of eyes with small absolute scotomas separate from the blindspot, and 100% of eyes with more severe visual field loss. In 186 right eyes of normal individuals, the OKP test gave a false positive result in 1% of patients under the age of 60 years, 9% of patients aged 60-70 years and 13% of patients older than 70 years. With a 3mm stimulus, there were no false positive results in 31 normal eyes of individuals over 60 years; However, further evaluation in 144 glaucomatous eyes showed that the sensitivity diminished to 19% in eyes with relative scotomas and 60% of eyes with small absolute scotomas separate from the blindspot. This study indicates the need for improving the stimulus, possibly using a light emitting diode, and to examine the field to 25 degrees. With these improvements, multi-fixation campimetry may be a useful adjunct to ophthalmoscopy and tonometry in the community and other situations which preclude other methods which preclude conventional methods.

3)

CLINICAL USEFULNESS OF OCULO-KINETIC PERIMETRY

Hideki Chuman, Nobuhisa Nao-i, Hidenori Kubota, Atsushi Sawada
Department of Ophthalmology, Miyazaki Medical College,
Miyazaki, Japan

Oculo-kinetic perimetry (OKP), developed by Damato is a new and simple method of visual field examination in which the patient's eye moves during the examination, instead of the target. We performed OKP on glaucoma patients to assess its usefulness in glaucoma screening. OKP could not reveal any abnomality in all the eyes of stage I in Kosaki's classification of glaucomatous visual field. It detected visual field defects in 17% of the eyes of stage IIa, 15% of the eyes of stage IIb and 100 % of the eyes of stage III. The sensitivity of OKP in detecting visual field defects in Bjerrum's area was 15 % in stage II eyes and 100% in stage III eyes. The detecting threshold of OKP is presumably comparable to I-4 or I-3 stimulus of the Goldmann perimeter. OKP is a useful tool for the screening of glaucoma.

4)

OCULOKINETIC PERIMETRY COMPARED WITH STANDARD PERIMETRIC THRESHOLD TESTING

C.T. Langerhorst, Joost Felius, Thomas J.T.P. van den Berg.
University of Amsterdam.

To make a calibration of oculokinetic perimetry (OKP) as developed by Damato in terms of conventional perimetric threshold values, 33 eyes with either glaucoma or ocular hypertension were tested with a standard Humphrey Field Analyzer using the Central 30-2 threshold test and twice with a 26-point OKP chart. The frequency of seeing of the OKP test spot was plotted against 30-2 thresholds. This showed a weak relation between the two tests, even after eyes with poor fixation were omitted. Local adaptation probably caused a number of false positives. False negative data were found to occur preferentially in border areas of visual field defects. The average frequency of seeing curve over all data showed a 50% frequency of seeing for the OKP stimulus at a 15.2 dB equivalent conventional threshold value.

5)

CLINICAL EVALUATION OF OKP

A. Kato*, A. Iwase*, M. Maeda*, Y. Kitazawa*, S. Myers+
*Department of Ophthalmology, Gifu University School of Medicine, Gifu-shi, Japan, +Humphrey Instruments, San Leandro, U.S.A.

Oculokinetic perimetry (OKP) is a simple perimetric screening method developed Damato in which the patient fixates a number of locations in turn, and reports whether a single fixed stimulus can be seen. The technique lends itself to implementation in the simplest of formats, e.g. a white card on which the fixation points and the single stimulus are printed in black ink, and thus might be useful in population studies. We examined 30 normals and 40 glaucoma patients in order to compare OKP screening results with Humphrey threshold perimetry. While OKP detected defects in all glaucomatous eyes with moderate or advanced defects (Aulhorn-Greve's classification: Stage III or worse), more than two thirds of glaucoma eyes with defects demonstrated by Humphrey perimetry failed to show any abnormality using OKP. Relative to Humphrey perimetry, the 50th percentile of loss which could be detected by OKP was 22 dB, and the 95th percentile was 34 dB. The ability of the OKP Glaucoma Screener to detect glaucomatous visual field loss is rather limited.

6)

SUBJECTIVE DETECTION OF GLAUCOMATOUS VISUAL FIELD DEFECTS USING HOME TV SET

Misato Adachi M.D. and Shiroaki Shirato M.D.
Department of Ophthalmology, University of Tokyo School of Medicine

The recognition of their visual field defects (VFD) is important to improve the medical compliance of glaucoma patients. If there is a practicable method for the subjective perception of VFD, it can also be a good screening method for glaucoma, since glaucoma patients generally do not notice their VFD until the advanced stages. We studied the usefulness of the noise-field spontaneously generated on a home television screen for subjective perception of VFD in 300 eyes with primary open angle glaucoma, including 130 normal tension glaucoma and 200 normal eyes. All glaucoma subjects had never perceived their VFD.

In glaucoma eyes, 272 eyes could perceive abnormalities of the noise-field which corresponded to VFD confirmed by static perimetry. In 7 normal eyes abnormality of the noise-field were perceived at the blind spot. The sensitivity and specificity of the test were 92% and 97%, respectively. The time required for testing one eye was 3-5 seconds. The results indicate that the Noise-Field Test using a home television set can be an excellent method for subjective detection of VFD and can be used for glaucoma screening.

7)

PRELIMINARY REPORT OF THE USE OF LAPTOP COMPUTER PERIMETRY WITH A MOTION SENSITIVITY SCREENING TEST TO DETECT OPTIC NERVE DISEASE IN RURAL WEST AFRICA.

JOHN X WU[1,2,3], BR JONES[1,3], A CASSELS BROWN[1,3], I MURDOCH[1,3], F ADENIYI[1,4], N.Alexander[1,3] and A ABIOSE[1,4]

[1]Guinness Eye Unit, Institute of Health, Ahamadu Bello University, Nigeria; [2]Glaucoma Unit, Moorfields Eye Hospital, London; [3]Institute of Ophthalmology, London; [4]National Eye Center, Nigeria.

Following a successful study using laptop computer perimetry with a motion sensitivity screening test(MSST) to detect early glaucoma in U.K.(Wu et al, 1991), a community based survey to detect optic nerve disease (OND) due to onchocerciasis and other causes was conducted in rural Nigeria. We used data from the WHO project ID 870456, based on a sample population of over 4297 aged 15-65 years in Kaduna state, Northern Nigeria. This study consisted of three approaches to screen for OND. The first was called the Basic Eye Examination(BEE) which was performed by 6 trained ophthalmic nurses included visual acuity (using single E optotype at 6 meters), visual field testing using counting fingers field test, 'red dot test card', external eye examination and optic disc evaluation. The second approach, called the Special Eye Examination(SEE) was performed by ophthalmologists on any person with a visual acuity of less than 6/9 or a visual field defect. The SEE consisted of a full complement of diagnostic investigations, including slit lamp biomicroscopy, and Goldmann applanation tonometry, direct and indirect funduscopy, Friedmann field analysis, and fundal fluorescein angiography. The third approach, the MSST, was performed by trained technicians and supervised trained village helpers. From the WHO project population, 1153 villagers were examined by all three approaches in this study. To measure reproducibility, 303 persons were retested using the test after one year. The test is very effective in detecting abnormals. In order to avoid a substantial proportion of "false positives" who don't show any abnormality by the other clinical test in used, adjustments are being made to the criteria used for recognising abnormality. These results will be presented.

Wu X et al:Laptop computer perimetry for glaucoma screening. Invest Ophthalmol & Vis Sci, 1991; 32(4, supl):810.

CHAIRPERSON: J. WILD
CO-MODERATORS: B. LINDBLOM
K. MIZOKAMI

Wed., Oct., 21
1:30 PM – 3:00 PM

1)

AUTOMATED SCOTOPIC PERIMETRY IN GLAUCOMA

Joost Felius[1], Leo A.M.S. de Jong[2], Tom J.T.P. van den Berg[2,3] and Erik L. Greve[1].
[1]Glaucoma Center, Univ. of Amsterdam, [2]Netherlands Ophthalmic Research Institute, [3]Dept. of Medical Physics and Informatics, Univ. of Amsterdam, Amsterdam, The Netherlands.

It is suggested that other mechanisms, than those tested with conventional perimetry, are affected earlier or stronger in glaucoma. See for instance the results of blue-on-yellow perimetry[1]. In view of possible similarities between the short-wavelength-sensitive cone-system and the rod-system, we wanted to investigate in the present study if scotopic perimetric thresholds were affected in early glaucoma. A Humphrey Field Analyzer was used with background illumination switched off. 21 POAGs, 23 glaucoma suspects, and 18 controls participated in this study.

Adaptation curves were measured during 20 minutes of dark adaptation for all subjects on two locations in the visual field (where possible both in healthy areas and in relative defect areas). Adaptation in the POAG group did not seem to be slower than in the control group. Subsequently, visual fields (VF) were assessed under scotopic conditions with Goldmann stimuli III and V, and under standard photopic conditions (10 cd/m^2 background) with stimulus III. Results showed, that scotopic VF's did not differ significantly from photopic VF's. So, scotopic VF's, unlike blue-on-yellow VF's, do not show earlier defects.

[1] Johnson CA, et al. In: Perimetry Update 1988/89, 31-37.

2)

VISIBILITY THRESHOLD FOR DARK PERIMETRIC STIMULUS

Erkan Mutlukan, Bertil E Damato
Tennent Institute of Ophthalmology, Glasgow

Dark perimetric stimuli are not conventional but may have advantages over bright stimuli in certain situations. Twenty-five glaucomatous eyes with 6/6 vision were examined with the Humphrey Auto-Perimeter Thresholding Program 30-2 and CAMEC, using dark-on-bright stimuli of four different contrast levels on a cathode ray tube with 10cd/m^2 background luminance. The retinal sensitivity levels in terms of Humphrey dB threshold values required for the awareness of different sizes of dark stimulus (1.8mm^2, 3.1mm^2 and 4.9mm^2) were determined at five eccentricities with a total of 10,400 point-by-point comparisons. Ten eyes were also tested with identical sizes and contrasts of dark stimuli on 100 cd/m^2 background. Lower stimulus contrasts and higher background luminance level required higher retinal sensitivity for dark stimulus detection. Eighty-five per cent decrease in dark stimulus contrast (Weber's) required an average of 8dB higher retinal sensitivity. One log-unit increase in the background luminance raises the threshold for 1.8dB. The calibration of the dark stimuli in this study should allow the development of more sophisticated tests for the detection of glaucoma.

3)

CONVERSION OF NORMAL VISUAL FIELD DATA BETWEEN THE HUMPHREY-FIELD-ANALYZER 640, THE RODENSTOCK PERISTAT 433 AND THE OCTOPUS 1-2-3

Patrick M. Vivell, Bernhard J. Lachenmayr, Markus M. Schaumberger, Peter Zimmermann, Johannes Dietrich, Curtis Bain
University Eye Hospital, Mathildenstr. 8, W-8000 Munich 2, FRG.

120 eyes of 120 normal subjects with age 9 to years 86 (mean 43.7 $\pm$ 18.9 median 44.5 years) were tested with three automated light-sense perimeters: the Humphrey-Field-Analyzer 640 (HFA), the Rodenstock Peristat 433 (PRT) and the Octopus 1-2-3 (OCT). For the Humphrey-Field-Analyzer program 30-2 was used, for the Peristat 433 program GL1 and for the Octopus 1-2-3 the standard program G1X. The tests were performed in random order. Subjects were excluded if they had: corrected visual acuity < 0.8, refractive error $> \pm 5$ dpt sph or 2 dpt cyl, intraocular pressure $>$ 21 mmHg, media opacities, abnormalities of the fundus, severe ocular trauma or any ocular surgeries in their history, family history of glaucoma or any inheritable ocular diseases, history of poorly controlled hypertension, diabetes mellitus, multiple sclerosis, cerebro-vascular attacks, epilepsia or ingestion of any psychopharmaca 24 hours prior to field testing. The pairwise correlation of Mean Sensitivity MS of the central visual field for each instrument shows a statistically highly significant correlation as follows: MS (HFA)/MS (OCT): $r = 0.70761$, $p < 0.0001$; MS (PRT)/MS (HFA): $r = 0.74608$, $p < 0.0001$; MS (PRT)/MS (OCT): $r = 0.64997$, $p < 0.0001$. The results of the present study provide the possibility to convert normal visual field data between the three instruments which is of great clinical importance.

4)

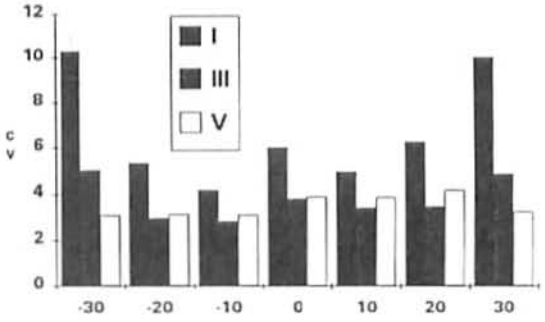
EFFECTS OF STIMULUS SIZE ON TEST-RETEST VARIABILITY

Michael Wall, M.D., Randy Kardon, M.D., University of Iowa, Iowa City, IA USA

Hypothesis: test-retest variability is greater with small targets than with large targets.

A major unsolved problem of automated perimetry is the high test-retest variability. Heijl and colleagues have reported test points with loss of 8 to 18 db had a 95% prediction interval that included the full measurement spectrum of the perimeter (0-40 db). To study the size component of intertest variability, we tested 5 subjects with the Humphrey Visual Field Analyzer using 3 different target sizes - Goldmann sizes I, III and V. Test points were along the horizontal meridian spaced 10 degrees apart from -30 degrees to 30 degrees. Five threshold determinations were performed for each of the three stimulus sizes.

Our results by coefficient of variation (CV see figure) show the highest test-retest variability for size I targets and lower variabilities for sizes III and V . Also, the rise in variability with increasing eccentricity was greatest for the smallest targets.



5)

EVALUATION OF FASTPAC IN A GLAUCOMATOUS POPULATION

John G Flanagan[1,2] John M Wild[3,2] Graham E Trope[4,2]
[1]University of Waterloo, Ontario, Canada. [2]The Toronto Hospital Glaucoma Research Unit, Toronto Hospital General Division, Ontario, Canada. [3]Aston University, Birmingham, United Kingdom. [4]University of Toronto, Ontario, Canada.

A new fast strategy for the estimation of threshold, FASTPAC, has been introduced for the Humphrey Field Analyser. The aim of this study was to evaluate the performance, in a glaucomatous population of FASTPAC compared to the standard 4-2 double staircase strategy.

The sample consisted of 30 glaucoma patients with an age range between 26 and 84 years. One eye of each subject was examined with both strategies using Program 24-2, target size III. The order of the test was randomised and all patients were experienced at automated perimetry. The data was analysed using ANOVA for a two period crossover trial with global index, stimulus presentations and examination time as separate within subject factors and test sequence, age and severity of field loss as between subject factors.

The FASTPAC algorithm demonstrated a 36% saving in examination time ($p < 0.001$); a lower mean defect (0.91 dB) ($p < 0.001$); and a greater short-term fluctuation (0.64 dB) ($p = 0.008$). The differences in mean defect ($p = 0.015$) and short-term fluctuation ($p = 0.033$) became greater with an increase in age. Short-term fluctuation increased with increased severity of the field loss ($p = 0.043$). As the severity of the field loss increased examination time increased for the FASTPAC strategy but became shorter for the standard strategy ($p = 0.033$).

The results indicate that the FASTPAC strategy is of equal sensitivity to the standard strategy in the identification of glaucomatous field loss, reduces the examination time but exhibits a decreased estimate of field severity and a greater intra-test variance.

6)

CLINICAL VALUE OF FASTPAC
A COMPARATIVE STUDY WITH STANDARD THRESHOLDING METHOD

A. Iwase, Y. Kitazawa, Y. Kato
Dept. of Ophthalmology, Gifu Univ. Sch. of Med, Gifu-shi, Japan

Fastpac is a new thresholding algorithm for the Humphrey perimeter which uses 3 dB steps and a single crossing of the threshold. It takes less time than the standard Humphrey thresholding protocol. We tested 4 eyes of 4 ocular hypertensives, and 22 eyes of 22 glaucoma patients; all were experienced and reliable perimetric subjects. On average, Fastpac took 66% of the time required by the standard method; the time difference was greatest in normal fields, and least in patients with more advanced field loss. Across the spectrum of tested subjects, Mean Deviation was larger with Fastpac than with the standard method (−6.2 dB vs −5.3 dB, $p<0.01$); Fastpac's Short Term Fluctuation also was larger (2.4 dB vs 2.0 dB, $p<0.05$). Fastpac substantially shortens examination time in eyes with less advanced field defects. Further studies are needed to determine its place in clinical practice.

7)

STATPAC - FASTPAC COMPARISON IN GLAUCOMA

C O'Brien, D Poinoosawmy, J Wu. Moorfield's Eye Hospital, London

The manufacturers of the Humphrey Field Analyser have introduced a new software programme (Fastpac) designed to shorten the test procedure for thresholding retinal sensitivity in those with normal visual fields. Its performance in patients with visual field defects is unknown.

We examined the right eye in 44 glaucoma patients (who were experienced in perimetry) with both the Fastpac and Statpac programmes at a single visual field examination session; 22 of whom had Fastpac first. We found the dB values for Mean Defect and Corrected PSD of the Statpac were significantly greater than the Fastpac programme ($p = 0.003$ and $p = 0.008$ respectively). There was no difference in the reliability indices or in short-term fluctuation. As expected there was a 35 % reduction in both the number of questions asked and in test time.

Fastpac underestimates MD and CPSD in glaucoma patients, and may lead to errors in the early detection of visual field defects in ocular hypertension.

CHAIRPERSON: E. GANDOLFO
CO-MODERATORS: J. FLANAGAN
F. FURUNO

Wed., Oct., 21
3:30 PM – 5:00 PM

1)

WEIGHTED VS NON-WEIGHTED VISUAL FIELD INDICES IN GLAUCOMA

Peter Åsman and Anders Heijl,

Department of Ophthalmology in Malmö, University of Lund, Sweden.

We devised and compared two visual field models for classification of fields in glaucoma, both based on arcuate cluster analysis and hemifield analysis. The models were constructed with logistic regression analysis in 101 eyes of 101 normal subjects and 101 eyes of 101 patients with glaucoma *(model population)*. The first model was *weighted* according to normal pointwise threshold variability by using probability scores. Clusters were weighted according to cluster variability in different areas of the normal visual field. The second model was *not weighted*, i.e., it was based on deviations from age-corrected normal threshold values and cluster volumes were not weighted. The two models were subsequently tested on an independent material of 163 normal eyes and 76 eyes with glaucoma *(control population)*.

The weighted model gave significantly better classification in the model population (88% sensitivity and 93% specificity as compared with 84% sensitivity and 86% specificity for the non-weighted model, $P < .05$). The weighted model resulted in significantly improved sensitivity and specificity in the control population as seen in ROC-curves. — Accounting for physiologic threshold variability is important in the construction of perimetric analysis aids for detection of glaucoma.

2)

SENSITIVITY AND SPECIFICITY OF VISUAL FIELD INDICES

M.Zulauf, J.Caprioli, S.Mandava, T.G.Zeyen; Yale Eye Ctr.; New Haven, CT 06510;U.S.A.

Global indices may be less sensitive in detecting early defects because the normal values of perimeters set the specificity to 95%, and the subjects of the normal data bases often completed no more than one previous test. The present study revisits this concept and determines the sensitivity and specificity of visual field indices with ROC-curves. 150 visual fields (program G1, Octopus 201) of 75 normal and 75 glaucomatous subjects were studied. The table provides the proposed cutoff values optimized for a high diagnostic precision. The corresponding results based on the currently used normal values are given in parentheses.

Index:	Cutoff value	Sensitivity	Specificity	Diag. Precision
GPI[1]	2.9 (4.0) dB^2	88.0 (80.0) %	88.0 (96.0) %	88.0 (88.0) %
LV_1	5.7 (6.0) dB^2	86.7 (80.0) %	88.0 (89.3) %	87.0 (85.0) %
MD	0.6 (2.0) dB	88.3 (50.7) %	73.3 (96.0) %	83.3 (73.3) %
CLV	2.2 (4.0) dB^2	85.3 (65.3) %	80.0 (94.7) %	82.6 (80.0) %
SF	1.5 (2.0) dB	86.7 (30.7) %	69.3 (90.7) %	78.0 (60.7) %

The proposed cutoff values for MD and SF (0.6 and 1.5 dB, respectively) are markedly different from current normal values and render a considerably improved diagnostic precision. The results may help better evaluate early visual field defects, at least in patients experienced with the test who give reliable responses. The reduced specificity of the proposed cutoff values calls for a careful examination of the optic disc and optical media to avoid a false diagnosis.

Reference: [1] Mandava S, Caprioli J, Zulauf M: A Glaucoma Pattern Index to quantify glaucomatous visual field loss. J. Glaucoma (in press).

3)

INTRA-BRACKETING FLUCTUATION: A NEW PERIMETRIC INDEX

Zingirian M., Mattioli R., Capris P., Gandolfo E., Morescalchi F.
(University Eye Clinic of Genoa, Italy)

The "Bracketing Fluctuation" (BF) is a new perimetric index, which is automatically calculated by the "Perikon PCL 90" in all explored points without extending the examination time. It evaluates the dishomogeneity of the responses obtained during the ascending and descending phases of threshold determination, when the "up & down" strategy is used.

The BF assessment does not require the re-test of single preselected points as it is necessary to determine the Short-term Fluctuation (SF). The BF may be studied in a global manner, like the other indices, but also topographically (bracketing map).

This new index has been calculated in 214 normals and in 101 glaucoma patients. Statistical analysis demonstrated that SF and BF are not age-related (Pearson test). There is a significant correlation between BF and SF (Spearman test) both in normals ($r = 0.564$; $p < 0.0001$) and in glaucoma patients ($r = 0.503$; $p < 0.0001$). In the presence of an unstable glaucomatous damage comparable increases of both indices have been observed (Mann-Withney"U" test).

4)

PRIORITY OF TEST LOCATIONS FOR AUTOMATED PERIMETRY IN GLAUCOMA.

J. Caprioli, T. Zeyen, M. Zulauf. Glaucoma Service; Yale Eye Center;
New Haven, CT USA

We evaluated the relative contributions of individual test locations to the sensitivity and specificity of automated perimetry. The visual fields (Octopus G1) of 100 patients with glaucomatous defects were used to rank the most frequently defective test locations. This sequence was modified so that highly correlated locations were not ranked together. Sensitivity and specificity were measured in a separate database of 70 normal and 70 early glaucomatous fields, and were reapectively 80% and 83% after 13 locations, 90% and 89% after 26 locations, and 100% and 99% with all 59 test locations. Staging of locations tested may be a valuable method to reduce examination time and fatigue effects.

5)

EVALUATION OF VISUAL FIELDS WITH CLUSTERS OF TEST LOCATIONS

S.Mandava, M.Zulauf, J.Caprioli, T.G.Zeyen; Yale Eye Ctr., New Haven CT; U.S.A.

Global indices such as mean defect (MD) are neither sensitive nor specific in detecting early visual field defects because they attenuate localized loss. Single test locations are nonspecific because of their high fluctuation. Clusters of test locations may be a useful compromise between these two extremes by reducing fluctuation and remaining sensitive to localized defects.

The visual fields of 75 glaucomatous patients experienced with automated perimetry and predominantly localized loss (MD < 5 dB, CLV > 10 dB^2) were analyzed by performing cluster analyses on the Pearson correlations of defects in all possible pairs of test locations. Eleven clusters in the G1 visual field were thus defined. In a separate test data set of 70 normal and 70 glaucomatous visual fields with moderate defects (both experienced with automated perimetry), the global mean defects and the local mean defects within the 11 clusters were calculated. A discriminant analysis was performed to compare the global mean defect to the local mean defects in ability to discriminate normal from glaucomatous visual fields. MD had a sensitivity of 83% and a specificity of 87%; the local mean defects had a sensitivity of 90% and a specificity of 93%. Local mean defects within clusters had a better diagnostic precision than the global mean defect in detecting glaucoma and may reduce problems with long-term fluctuation.

6)

REACTION TIME IN AUTOMATIC PERIMETRY: ITS EVALUATION IN NORMALS, HYPERTENSIVES AND GLAUCOMA PATIENTS

Capris P., Gandolfo E., Di Lorenzo G., Ciurlo G., Soldati M.R.
(University Eye Clinic of Genoa, Italy)

In automated perimetry, the "reaction time" is the mean interval between stimulus presentation and patient's response. Such a parameter is always recorded in all perimetric tests carried out by "Perikon PCL 90". We studied "reaction time" during threshold perimetric examination performed in 146 eyes of 3 groups of subjects: normals, hypertensives and glaucoma patiens. All subjects were well trained and homogeneous for age, refractive error and reliability.

The mean "reaction time" was 505 ± 38 msec in mormals, 526 ± 53 msec in hypertensives and 540 ± 51 msec in glaucoma patients. Significant differences (ANOVA test) were present between the first and the second group (normals vs hypertensives; $p = 0.006$) and between the first and the third group (normals vs glaucoma patients; $p = 0.0008$). No statistical significant difference was detected between hypertensives and glaucoma patients.

The studied parametres was not age-related, therefore it probabily represents an index of visual system suffering.

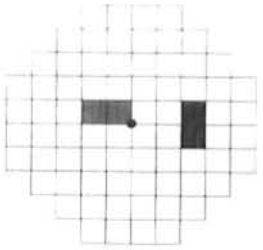
7)

COMPARATIVE STUDY OF VISUAL FIELD DEFECTS BETWEEN NORMAL-TENSION GLAUCOMA (NTG) AND HIGH-TENSION GLAUCOMA (HTG)

Junkichi Yamagami, Makoto Araie, Shiroaki Shirato, Yasuyuki Suzuki, and Nobuyuki Koseki; Department of Ophthalmology, University of Tokyo School of Medicine, Tokyo

We compared the results of visual field examination obtained with Humphrey program 30-2 between 60 eyes of 60 NTG patients (max IOP $\leqq$ 21 mmHg) and 60 eyes of 60 HTG patients (max IOP $\geqq$ 25 mmHg) whose mean deviation (MD) was $>$ -10 dB, using three different methods. Between the NTG and HTG eyes, there were no significant differences in the mean of the MD (-5.56 dB vs -5.42 dB), refraction (-2.4 D vs -2.6 D), visual acuity (1.0 vs 1.1) or age (54.0 yrs. vs 52.7 yrs.) .

The total deviation (TD; STATPAC) was averaged for 70 points excluding the uppermost 4 points to obtain Mean TD. The values of (TD-Mean TD) (method 1) and TD/(Mean TD) (method 2) were compared for each point between NTG and HTG. In method 3, the TD was plotted against MD for each point and the slope of the regression line was compared. These three methods of comparison all revealed that the test points shown right were more severely affected in NTG than in HTG ($p < 0.01$).



CHAIRPERSON: K. KITAHARA
CO-MODERATORS: S. SHIRATO
P. ASMAN

Thu., Oct., 22
3:30 PM – 5:00 PM

1)

ARE VISUAL FIELD DEFECTS IN THE LOWER HEMIFIELD A RISK-FACTOR IN POAG?

E. Gramer, G. Althaus, U. Körner, University Eye Clinic Würzburg, Germany

We examined the influence of the location of scotomas and of the systolic blood pressure on the deterioration of the visual field in primary open angle glaucoma (POAG). In earlier studies we found a low systolic blood pressure and visual field defects in the lower hemifield more frequent in low tension glaucoma than in POAG. Do visual field defects in POAG affecting mostly the lower hemifield point to an insufficient perfusion of the optic nerve head due to a low blood pressure? - Visual fields of 153 eyes (153 patients) with POAG and regulated IOP were examined with Octopus-program 31. The loss per test point in the upper and lower hemifield were calculated. The systolic blood pressure was known and a long term follow-up (3-19 visual field examinations during a period of 1-8 years) was available in all patients. With program Delta we decided in every case whether the visual field showed a tendency to deteriorate or not. 1.) In patients with a systolic blood pressure less than 140 mmHg we found a tendency of visual field defects to deteriorate four times more frequent than in patients with a systolic blood pressure above 140 mmHg. 2.) Location of visual field defects in the upper and lower hemifield correlates significantly to systolic blood pressure (Spearman Rang Correlation, Rho=0.202, $p<0.05$): The lower the systolic blood pressure, the more severe is the visual field defect in the lower compared to the upper hemifield. 3.) In patients with predominant visual field defects in the lower hemifield we found a tendency of visual field defects to deteriorate two times more frequent than in patients with predominant visual field defects in the upper hemifield.

2)

FORECASTING PROGRESSION OF GLAUCOMATOUS VISUAL FIELD LOSS

John M Wild, Michael K Hussey, Aston University, Birmingham, U.K.,
John G Flanagan, University of Waterloo, Ontario, Canada.
Grahan E Trope, University of Toronto, Toronto, Ontario, Canada.

The identification of progression within the glaucomatous visual field is frequently difficult and the current statistical procedures for serial visual field analysis do not appear to provide sufficiently sensitive information.

The aim of the study was to evaluate the suitability of a model to forecast the sensitivity at each stimulus location of the subsequent, N+1, examination. The model was based upon polynomial and multiple regression: sensitivity at each stimulus location was modelled in terms of the respective stimulus coordinates (ie a topographical or shape analysis) and in terms of the sensitivity at each of the previous N, N-1, N-2 etc examinations (ie a longitudinal or time series analysis). Comparison of the forecasted values with the recorded values at any given examination might indicate departures from the expected trend over time. The sample comprised Humphrey Field Analyser Program 30-2 and 24-2 fields from a cohort of 49 patients (mean age 57.1 years SD 13.4) attending a glaucoma clinic. The mean period of follow-up was 37.6 months (SD 10.2 months) and the mean number of previous examinations 7.4 (SD 2.2). The effectiveness of the forecasting procedure was evaluated in terms of the pointwise percentage error between the forecasted and the recorded field.

The precision of the forecast was high in areas of high sensitivity and in areas of deep loss but variable at the edges of focal loss. Stimulus locations manifesting the greatest forecasting error over several visits subsequently exhibited a sustained reduction in sensitivity.

3)

THE RELATIONSHIP BETWEEN INTRAOCULAR PRESSURE AND VISUAL FIELD PROGRESSION IN GLAUCOMA

Balwantray C. Chauhan[1] and Stephen M. Drance[2] Departments of Ophthalmology, [1]Dalhousie University, Halifax and [2]University of British Columbia, Vancouver, Canada

The purpose of this study was to determine the intraocular pressure characteristics in glaucoma suspects and patients whose visual fields were classified as stable or progressing over a long-term follow-up. We present data from 64 patients who received either medical or laser treatment and who were followed for a median of 7.4 years. The visual fields of 27 patients were classified as stable and 37 as progressing using predetermined criteria on either the Tübinger or Goldmann perimeter. Patients with initially normal and initially abnormal fields were analysed separately to avoid bias. There were no significant group differences in the mean, highest or interquartile range of intraocular pressure in the follow-up ($P > 0.05$). The largely overlapping distributions over a wide spectrum of the pressure variables in patients with stable and progressing fields show that intraocular pressure alone cannot separate these two groups of patients. Our study does not suggest that pressure reduction in glaucoma has no beneficial effect, but that there may other factors which determine the fate of the visual field in this disease.

4)

PROGRESSION OF CHROMATIC AND ACHROMATIC SENSITIVITY LOSS IN EARLY GLAUCOMA

Haruki Abe, Shigeru Hasegawa, Mineo Takagi, Toyohisa Yoshizawa and Tomoaki Usui ; Depts. of Ophthalmology, Niigata University School of Medicine, Niigata, Japan

To clarify the time course of chromatic and achromatic luminance sensitivity loss in patients with early glaucoma, we have conducted a prospective longitudinal measurements of spectral increment thresholds of central field by Maxwellian view optical system over five years.

Twelve glaucoma patients and 20 age-matched normal controls were studied by means of spectral increment threshold measurements at fovea with a 1-degree spectral test target flashed either 1 or 25 Hz on a bright white background (annual examination for all five years).

Results of spectral increment threshold measurements showed that progressive deterioration of both sensitivity of 1 Hz and 25 Hz stimulation was detected especially in the range of short wave length. These results suggest that the progressive impairment of chromatic and luminance channels in short wave length may occur in patients with early glaucoma.

5)

Discrimination between progression and non-progression visual field loss in low-tension glaucoma

Darmalingam Poinoosawmy[1], John X Wu[12], Fred Fitzke[2] and Roger A. Hitchings[1]

[1]Glaucoma Unit, Moorfields Eye Hospital & [2]Institute of Ophthalmology, London EC1V. UK.

A follow-up database of 64 eyes(64 low-tension glaucoma patients) with asymmetry of hemi-field defects was used to test the discrimination function in the initially uninvolved horizontal hemi-field (Humphrey Field Analyzer 24-2). The average of follow up was about 3.5 years. Parameters that discriminated best between progression and non-progression were based on age, motion detection threshold(MDT) and light sensitivity loss in terms of mean deviation(MD) and standard deviation(SD). The progression was defined by using pointwise linear regression analysis. Sixty seven percent(43 eyes) had abnormal MDT in their initial normal hemi-fields. Forty three percent(28 eyes) had one or more locations with significant progression ($p < 0.01$). The discriminant function was determined by the standardized canonical discriminant coefficient. The weakest of the parameter to discriminate between progression and non-progression in normal hemi-field was the age(-0.1314). The best of the parameter was SD(0.70). The coefficients of MDT and MD were -0.39 and 0.576, respectively. The authors conclude that (1) quantitative relationship between the visual field progression and MDT are not correlated closely; and (2) the MDT may be useful to monitor visual field progression in the long term but not in the short term.

6)

ANALYSIS OF VISUAL FIELD CHANGES PROGRESSION IN LOW TENSION GLAUCOMA

T.OGAWA,H.SUZUMURA,K.YABUKI,H.OHKOSHI & T.HAMA.

Dept. of Ophthalmology Tokyo Medical College Hospital. Tokyo.

We retrospectively compared the first or second and the last automated perimetry results of LTG patients with over 2 years follow-up. The difference between group with progression of visual field changes and with non-progression was studied.

Patients and methods: Our criteria for diagnosing LTG were 1) intraocular pressures were 21 mmHg or less in all follow-up visits, 2) glaucomatous optic disc cupping, 3) glaucomatous visual field changes, 4) open angle, 5) absence of other pathology accounted for the visual field changes. Among the patients met above criteria, the patients with below 2 years follow-up were excluded. Progression of the visual field changes were determined respectively with the aids of delta program of the Octopus and glaucoma change probability test of the Humphrey Field Analyser.

Results: Twenty six patients (51 eyes) with LTG were included in this study. The mean follow-up period was 49 months, the mean age was 66 years and 17 patients were females. Twenty one eyes (41.2%), 13 patients (50%) showed progression. There was no statistically significant difference between visual field changes progression group and non-progression group with respect to age or maximum and minimun intraocular pressures or its range.

7)

INTRAOCULAR PRESSURE-DEPENDENT PROGRESSION OF VISUAL FIELD LOSS IN ADVANCED PRIMARY OPEN-ANGLE GLAUCOMA

M. Shirakashi, K. Iwata, S. Sawaguchi, H. Abe and K. Nanba
Department of Ophthalmology, Niigata University, Niigata, Japan

Eighty-three eyes in 83 patients with advanced primary open-angle glaucoma (at least one-quarter of the visual field lost on Goldmann perimetry) were followed-up for at least 15 years to study the relationship between intraocular pressure (IOP) control and progression of visual field loss.

Progression of visual field loss occurred in 61 eyes (73%) during the first 5 years, and in 71 eyes (86%) during the 15-year follow-up. During the first 5 years, the mean IOP in eyes with stable visual fields (15.1 ± 2.7 mmHg, n = 22) was significantly lower than that in eyes with progressive visual field loss (19.8 ± 2.7 mmHg, n = 61; $P<0.05$). During the 15-year follow-up, the mean IOP in eyes that remained stable (13.4 ± 1.3 mmHg, n = 12) was significantly lower than that in eyes with visual field loss (19.4 ± 2.6 mmHg, n = 71; $P<0.05$). In eyes that progressed, the mean IOP did not differ significantly between the 5- and 15-year follow-up periods. However, in eyes that remained stable, the mean IOP during the 15-year follow-up was significantly lower than that during the first 5 years ($P<0.05$).

These results suggest that reduction of IOP to less than 15 mmHg may be necessary to arrest further progression of visual field loss in advanced glaucoma.

PAPER SESSION VI

CHAIRPERSON: M. ZINGIRIAN
CO-MODERATORS: W. SPONSEL
E. CHIHARA

Fri., Oct., 23
8:30 AM – 10:00 AM

1)

POSTURAL INFLUENCE ON VISUAL FIELDS IN NORMALS, OPEN-ANGLE-, AND NORMAL-TENSION GLAUCOMAS

A. Lietz, J. Flammer, D. Stümpfig, Ph. Hendrickson, Th. Graf

The effect of body position on blood-pressure and visual fields was studied in 27 normal volunteers, 20 patients with open-angle glaucoma, and 20 patients with normal-tension glaucoma. The visual fields were tested with the swivel-arm perimeter, an Octopus 1-2-3 modified so that visual fields can be measured in every body position.

The normal controls showed a tendency to have better visual fields in the upright- than in the supine position; the patients with open-angle glaucoma showed either no difference or a slight tendency towards improvement when tested while standing; and the normal-tension glaucoma patients showed the opposite tendency, that is, they had better results while supine. This visual field behavior in the normal-tension glaucoma patients was statistically significantly ($p<0,05$) different from the high-tension patients and the normal controls. There was no correlation between respective changes in visual field and in blood pressure.

2)

DOES GLAUCOMATOUS VISUAL FIELD LOSS CONTINUE DESPITE SURGICALLY SUBNORMAL IOP?

John R. Lynn*, William H. Swanson*, Ronald L. Fellman* and Shannon L. Smith*
*Glaucoma Associates of Texas and **Retina Foundation of the Southwest, Dallas

Intraocular pressures in the normal range of 11 to 21 mmHg are safe for humans without glaucoma. Although several studies have shown that 40% or more of patients with glaucoma continue to lose visual field despite IOPs in this normal range, the published rates of loss appear to be lower if the average IOP is below the middle of the normal range. This suggests that subnormal IOPs could be beneficial. However, achievement of subnormal IOPs requires struggles with hypotony which may not be worth the risks and effort. In order to evaluate the usefulness of attaining subnormal IOPs, we examined 250 randomly selected trabeculectomy charts. We found that only 15 eyes of 13 patients had maintained IOPs consistently below 11 mmHg for at least 3 years. Nine of these eyes had Aulhorn stage III or IV glaucoma or showed MDs of 12-24 and CSPDs of 9-15 on automated static perimetry. Three others were diagnosed as having normal pressure (low tension) glaucoma. Seven eyes had been followed with manual Goldmann perimetry (7 to 9 isopters, kinetic and static testing), and eight had been followed with automated static perimetry. We performed a retrospective analysis of visual fields, using 3 published and 2 personal sets of criteria for visual field loss. For one eye there was a progressive decrease in the size of the residual inferior nasal field, possibly due to cataractous lens changes. For the remaining 14 eyes the visual fields remained stable after surgery. These results indicate that the struggles with hypotony may be worth the effort.

3)

LONG-TERM VISUAL FIELD FOLLOW-UP IN BETAXOLOL- AND TIMOLOL-TREATED PATIENTS

A. Graves[1], G. Cagle[1], T. McDonald[1], J. Collignon-Brach[2], P. Demailly[3] & J. Flammer[4]
[1]Alcon Laboratories, Ft. Worth, TX, USA; [2]University of Liege, Belgium;
[3]Hôpital St. Joseph, Paris, France; and [4]University of Basel, Switzerland

The current goal of glaucoma treatment is preservation of visual field. However, most previous investigations of antiglaucoma agents have focused on control of intraocular pressure. Three separate studies were undertaken to examine the long-term effects of beta-blocker treatment on visual fields. Two of these studies were prospective, randomized, parallel comparisons of 0.5% Betaxolol vs. 0.5% Timolol in POAG patients (N=40 and 20, respectively). The third study was a prospective, randomized, parallel comparison of Betaxolol vs. placebo in ocular hypertensive patients (N=130).

Interim reports of the first two studies were recently published. The first study (Messmer, Flammer and Stumpfig, 1991) showed that after 18 months of treatment, the effect on visual field (Octopus G1 program) was better in the betaxolol group than in the timolol group ($p=.041$). The second study (Collignon-Brach, 1992) showed a similar result; after 24 months of treatment, visual field mean sensitivity (Octopus G1 program) was statistically significantly greater in the betaxolol group. In both studies, the more favorable effect of betaxolol on visual field was seen despite a more pronounced IOP reduction in the timolol group.

Follow-up visual field data will be presented for both of these studies, along with interim results for the third study. The observed dissociation of IOP reduction and visual field outcome, and mechanisms which might account for these findings, will be discussed.

4)

TIMOLOL VS. BETAXOLOL: EFFECTS ON VISUAL FUNCTION AND OCULAR HEMODYNAMICS

W.E. Sponsel, J.A. Shoemaker, P.L. Kaufman, F. Blum, M.A. Brady, K.L. DePaul, S.R. Zetlan
I.U. Glaucoma Lab, Indianapolis, IN, & U.W. Department of Ophthalmology, Madison, WI

We obtained visual function (Humphrey & Henson visual fields and Vistech contrast sensitivity) and estimated perimacular leukocyte velocity (LV) assessments (Oculix Blue Field Entoptic Simulation) in a three-year, prospective, non-randomized study of 37 glaucoma patients being treated with topical beta-blockers. Twenty-eight patients were treated with timolol, either alone (N=15) or in combination with other glaucoma drugs (N=13). Seventeen patients were treated with betaxolol; eleven with betaxolol only, and six in combination with other drugs. Eight of the above patients participated in both treatment groups (crossover patients).

Betaxolol-treated patients showed strong associations between the asymmetry (OD minus OS) of LV and that of all visual function parameters (Humphrey MD, $R=0.757$, $p=0.001$; CPSD, $R=0.565$, $p=0.028$; Henson score, $R=0.554$, $p=0.001$; contrast sensitivity at 3cpd, $R=0.712$, $p=0.003$; contrast sensitivity at 6cpd, $R=0.554$, $p=0.037$). Patients receiving timolol showed no such associations ($R=0.249$, $p=0.143$; $R=0.157$, $p=0.508$; $R=0.125$, $p=0.548$; $R=0.39$, $p=0.86$; and $R=0.338$, $p=0.099$, respectively). Differences existed between the two groups in terms of mean age and extent of disease, although these differences did not reach statistical significance. No systemic disease differences were apparent on examination of the clinical records of each group, and the only two subjects on oral medications were members of the crossover group. Thus, the association of better visual function with more rapid leukocyte velocity in betaxolol-treated patients cannot be readily explained by factors other than drug treatment. A prospective randomized study to further evaluate betaxolol vs. timolol effects on ocular hemodynamics and visual function is underway.

5)

SIDE DIFFERENCE IN INTRAOCULAR PRESSURE, HIGH-PASS RESOLUTION PERIMETRY, AND RETINAL LEUCOCYTE VELOCITY.

Peter Wanger, MD PhD, Department of Ophthalmology,
Sabbatsberg Hospital, S-113 82 Stockholm, SWEDEN

High-pass resolution perimetry was performed in 12 subjects with unilaterally increased intraocular pressure. In all hypertensive eyes the mean resolution threshold was higher than in the opposite normotensive eyes, corresponding to an average reduction in functional neural channels of 42%. Retinal leucocyte velocity was measured using the blue field entoptic phenomenon. In 11 of the 12 subjects the retinal leucocyte velocity was lower in the hypertensive than in the opposite normotensive eye. The reduction in leucocyte velocity was approximately 60%.

In eight of nine subjects the side difference in retinal leucocyte velocity persisted two to six weeks after normalization of intraocular pressure with treatment.

The finding indicates that deficient function of retinal ganglion cells is accompanied by reduced retinal blood flow velocity, which not seems immediately related to the increase in intraocular pressure.

6)

SPATIAL DISTRIBUTION OF AGE EFFECTS IN HIGH-PASS RESOLUTION PERIMETRY

Bertil Lindblom, University of Göteborg, Sweden

The effect of ageing on perimetric thresholds was studied in normal eyes using high-pass resolution perimetry (HRP). Visual fields from 157 normal eyes (157 subjects, age range 18 to 84 years) were obtained with the Ophthimus Ring perimeter. The threshold in each test position was plotted against eccentricity given as the polar distance from point of fixation. The spatial distribution of the age-related threshold change was heavily dependent on the measurement scale. When expressed in a resolution scale, thresholds increased with a constant fraction per year of age, regardless of eccentricity. When results were transformed into the often used decibel scale this relationship was lost. The age-related change in resolution thresholds was compatible with a physiological model in which the number of retinal ganglion cells are reduced in proportion to their density.

7)

COMPARATIVE STUDY OF CONVENTIONAL LIGHT SENSE PERIMETRY (OCTOPUS 123) AND RESOLUTION PERIMETRY (FRISEN)

J. H. Meyer, J. Funk; Univ.-Augenklinik, Killianstr. 5, D-7800 Freiburg/Brsg.

We studied the influence of blurring on conventional light sense perimetry and resolution perimetry. Light sense perimetry was performed using the G1 program of the Octopus 123 perimeter, resolution perimetry was done with the "ring"-test, vers. 2.20, Hightech-Vision inc., designed by Frisen.

6 levels corresponding to a visual acuity between 1.6 and handmotions were tested in 10 eyes of 10 healthy subjects. With both perimeters the mean defect increased with decreasing visual acuity. At good visual acuities (1.0-1.6) no changes were found in both resolution perimetry and light sense perimetry. At an acuity of 0.8 the mean defect obtained by light sense perimetry increased slightly, while the mean defects obtained by resolution perimetry increased markedly. At acuity levels below 0.8 the increase of the mean defect using the ring perimetry was much more pronounced than using the light sense perimetry. At the level of handmotions there were only absolute scotoma using the ring perimeter while using the Octopus 1-2-3 a baseline sensitivity was still detectable.

The results mentioned above were compared to the findings in patients with different stages of cataract and glaucoma.

CHAIRPERSON: B. SCHWARTZ
CO-MODERATORS: M. DRAKE
G. TOMITA

Fri., Oct., 23
3:30 PM — 5:00 PM

1)

OPTIC DISC TOPOGRAPHIC CHANGES FOLLOWING INTRAOCULAR PRESSURE REDUCTION IN NORMAL-TENSION GLAUCOMA AND PRIMARY OPEN ANGLE GLAUCOMA.

Shigeyo Sogano, Goji Tomita, Yoshiaki Kitazawa. Department of Ophthalmology, Gifu University School of Medicine, Gifu JAPAN

Optic disc topographic changes after trabeculectomy were compared between 11 eyes of 9 normal-tension glaucomas(NTG) and 11 eyes of 10 primary open angle glaucomas(POAG). The mean age(SD) of NTG and that of POAG was 57.0(9.0)yrs and 55.2(13.1)yrs, respectively. Optic disc measurements were performed useing Rodenstock Optic Nerve Head Analyzer Plus before surgery(time 1) and at 2 months to 6 months after surgery (time 2). The results were as follows:

	NTG			POAG		
Parameters	time 1	time 2	% change	time 1	time 2	% change
IOP	13.8(2.3)	5.0(2.3)	63.7(15.8)	21.4(3.8)	9.8(4.5)	53.8(20.9)
Cup volume	0.6(0.2)	0.4(0.3)	41.0(24.3)	0.6(0.2)	0.4(0.2)	32.9(28.4)
Rim area	0.7(0.5)	1.1(0.7)	91.8(133.6)	0.6(0.4)	0.8(0.6)	56.7(41.1)

There were no statistically siginificant differences in % changes of each parameter between the two groups. These results suggest that the degree of disc topographic changes following intraocular pressure reduction in NTG are identical to that of POAG.

2)

REPEATABILITY OF THE GLAUCOMA-SCOPE™ FOR OPTIC NERVE HEAD ANALYSIS

H. Dunbar Hoskins, MD, John Hetherington, MD and Marianna Glenday, MPH, Foundation for Glaucoma Research, San Francisco, CA.
Steven J. Samuels, PhD, University of California, Davis, CA.
Steven R. Verdooner, Ophthalmic Imaging Systems, Sacramento, CA.

The Glaucoma-Scope™ (GS) is designed to measure the topography of the optic nerve head (ONH). Depth measurements are reported as a grid of 680 numbers. Each number represents the average depth of an area 75μ x 100μ in size (a "cell"). The GS was tested on 11 normal and 14 glaucomatous subjects, all over 40 years of age. Two separate visits were simulated for each patient.

To estimate measurement variability, depth values were analyzed in groups of approximately 25 cells, comprising "areas of interest". A variance components analysis was used to compute the variability of the difference between the depth of an area measured at the first and second visits. The analysis yields the standard deviation of the difference between depth measurements taken within the same visit (S_w) and the standard deviation of the difference between depth measurements taken at separate visits (S_b).

	Area definition	S_w	S_b (microns)
1	Flat area outside ONH	7.0	8.1
2	Flat area within ONH	12.1	13.1
3	Sloped area within ONH	15.8	17.4
4	Area over a vessel	18.8	17.1

3)

CLUSTER-ANALYSIS OF THE THREE-DIMENSIONAL OPTIC DISC TOPOGRAPHY

R.O.W. Burk[1], K. Rohrschneider[1], H.E. Völcker[1], H. Noack[2]
Department of Ophthalmology (1) and Biostatistic (2), University of Heidelberg, Germany

Objectives: 1. Computerized cluster formation of optic nerve heads based on quantitative three-dimensional parameter values, obtained by laser scanning tomography.
2. Description of resulting topographic clusters according to visual fields (VF) and morphological appearence.

Patients and Methods: 337 optic discs are divided into topographical clusters. The following parameters are evaluated: Disk area, rim area, area ratio, max. cup depth, cup steepness and the height variations along the disc border. The topographical classification is compared to the results of VF obtained by computerized static threshold perimetry (Normal VF: N, n = 180, Glaucomatous field defects: G, n = 99, „Intermediate VF": I, n = 58).

Results: The optimizing criteria (intracluster variances versus intercluster variances, number of clusters) are best met by a seven cluster solution. Three clusters (n = 109, n = 101, n = 13) contain more normal VF (G: 8.3%; 18.8%; 7.7%), two clusters (n = 51, n = 30) show predominantly discs with glaucomatous VF defects (G: 64.7%; 83.3%), two clusters (n = 27, n = 6) demonstrate all groups of VF at equal parts (G: 37%; 33%). The morphological characteristics of the clusters can be described as 1. „normal", 2. „normal, large", 3. „supernormal", 4. „glaucoma-like flat", 5. „glaucoma-like steep", 6. „pseudonormal" und 7. „macropapillary".

Conclusions: Discs with glaucomatous visual field defects (GVFD) can be found within any cluster. However, the likeliness of the presence of GVFD differs considerably among the topographycally defined groups of optic nerve heads.

Supported in part by Deutsche Forschungsgemeinschaft DFG Vo 437/1-1 and Vo 437/1-2

4)

CORRELATION BETWEEN OPTIC DISC CHANGES AND VISUAL FIELD LOSS IN PATIENTS WITH UNILATERAL GLAUCOMA

Funk J, Soriano JM, Ebner D; Universitäts-Augenklinik, Killianstr. 5, D-78 Freiburg, FRG

We studied the optic disc structure (Optic Nerve Head Analyzer) and the visual field parameters (Octopus, program G1) in 50 patients with unilateral glaucoma, using the unaffected eye as a reference. 19 healthy volunteers served as a control group. The intraindividual difference in neuroretinal rim area was plotted versus the intraindividual difference in mean threshold sensitivity.

All patients with unilateral visual field loss showed a smaller rim area in the affected eye, Δ rim beeing >0.1 mm^2 in all cases, >0.4 mm^2 in 50% of all cases. In contrast to that, 40% of all patients with unilateral loss of neuroretinal rim area had a normal visual field in the affected eye. Linear regression of Δ rim area (y) versus Δ mean sensitivity (x) yielded: y=0.01x+0.32 mm2.

Similar results were obtained when cup area or cup/disc ratio were evaluated instead of neuroretinal rim area of glaucoma patients, whereas the normal controls showed only a diffuse spreading of values around y=0, x=0.

Our data confirm previous results showing that changes of the disc structure precede the onset of visual field loss in glaucoma. They also show that , on average, the neuroretinal rim area may decrease by 0.3 - 0.4 mm^2 before a visual field loss occurs.

5)

COMPUTERIZED IMAGE ANALYSIS IN THE GLAUCOMATOUS OPTIC DISC COLOR CHANGES

Miki Ito, Kuniyoshi Mizokami
Dept. of Ophthalmol., Sch. of Med., Kobe University, Kobe, Japan.

The disc rim color changes in 40 eyes with primary open angle glaucoma (POAG) were studied using a computerized color analysis system. It had been already reported that the reproducibility of this system showed a 1.8% intraphotogrphic and a 1.9% interphotographic coefficiency of variation. In this study, the correlation among the changes in neuro-retinal rim color, visual field and cup area to disc area ratio (C/D.A) was evaluated. In 18 eyes at an early stage with total initial loss under 10OdB, the disc color changed correlated both with mean defect increase (r=0.74) and C/D.A enlargement (r=0.47). In 22 eyes at a middle stage with total initial loss over 10OdB, the disc colorvaried correlated with mean defect (r=0.75), but not with C/D.A.

6)

CORRELATION OF OPTIC DISC CHANGES AND VISUAL FIELD DEFECTS IN GLAUCOMA

Katsuhiko Nanba and Kazuo Iwata
Dept of Ophthalmology, Niigata University, School of Medicine, Niigata, Japan

Careful examination to detect any change in the optic disc and visual field during follow-up periods is important for the treatment of glaucoma. To analyze the relationship between optic disc changes and visual field defects, we performed optic disc measurements with the computerized image analysis (Rodenstock Optic Nerve Head Analyzer) and Humphrey perimetry(30-2) for one eye of each of 44 normals, 23 ocular hypertensives(OH) and 66 patients with open angle glaucoma(GL)(with Aulhorn's stages 1 to 5). There were statistically significant correlations between optic disc paramteres and mean deviation in OH and GL(rim area r=0.65, cup volume r=-0.56, cup to disc ratio r=-0.54). There were significant differences in optic disc parameters between NL and OH, while no significant differences were found between GL with stage 3 and 4. Those results show optic disc changes precede visual field defects in eraly stage of glaucoma, while in advanced stages visual field show more changes than the optic disc.

7)

REGIONAL DIFFERENCES OF FUNCTIONAL AND STRUCTUAL CHANGES IN GLAUCOMA

Yoshio Yamazaki[1)], M.D., Fukuko Takahashi[1)], M.D., Chizuru Koide[1)], M.D. and Hiroaki Yamada[2)], Ph.D., Department of Ophthalmology[1)] and Industrial Technology[2)], Nihon University, Tokyo, Japan

The susceptability of superior and inferior laminar zones in the optic nerve head has been demonstrated by previous studies. However, the regional differences of functional and structual changes in glaucoma has not been evaluated. This study was attempted to evaluate the relationship between generalized and localized changes in visual field (VF) and retinal nerve fiber layer (RNFL) abnormalities. Each eyes of one hundred early and moderate glaucoma patients was evaluated in this study. VF and RNFL were divided into six sectors reflected the nerve fiber layer anatomy. VF analysis with 30-2 program of the Humphrey Field Analyzer and RNFL analysis with a red-free fundus photograph by a computerized digital image analysis system were applied in each sector.

The superior and inferior arcuate sectors in VF and RNFL showed significantly diffuse loss than localized loss when compared with the temporal sector.

The regional differences of functional and structual changes may explain the mechanism of the glaucomatous optic nerve damage.

ABSTRACTS FOR POSTERS

POSTER SESSION I

CHAIRPERSON: R. MILLS
CO-MODERATORS: K. NANBA
L. FFRISEN

Thu., Oct., 22
5:00 PM — 6:30 PM

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1)

DISCREPANCIES BETWEEN SINGLE STIMULUS AND MULTIPLE STIMULUS VISUAL FIELD EXAMINATION WITH THE PERITEST SEMI-AUTOMATED PERIMETER IN GLAUCOMA PATIENTS

Christine T. Langerhorst, Douwe Bakker, Joost Felius, Thomas J.T.P. van den Berg.
Department of Ophthalmology, Glaucoma Center, and department of Medical Physics and Informatics of the University of Amsterdam, and the Netherlands Ophthalmic Research Institute.

In a total of 24 randomly selected eyes of glaucoma patients, tested with the automated (single stimulus) and the manual (multiple stimulus) mode of the semi-automated Peritest perimeter, the number and depth of defects were compared as estimated with these two different measurement strategies. It was found that with the manual technique considerably less defects were detected than with the automated strategy.

2)

COMPARISON OF MULTIPLE STIMULUS PERIMETERS WITH HUMPHREY AND GOLDMAN

Mary A. Brady, William E. Sponsel, Indiana University, Indianapolis, IN

Automated perimetry in the United States has been dominated by the Humphrey Visual Field Analyzer, a full-bowl single-stimulus projection perimeter. Testing time is typically 14 minutes per eye in normal eyes. In recent years several high-speed multiple stimulus perimeters (MSPs) have been introduced. These can substantially reduce testing time and encourage fixation by presenting a series of concentrically arranged patterns of 0-4 stimuli. Prior studies with automated MSPs (as well as longstanding European experience with the manually-operated Friedmann Visual Field Analyzer) indicate that typical clinical subjects can perform such testing without difficulty. Each patient response is a forced choice from 16 possible pattern options, minimizing false-positive and -negative responses which confound traditional single-stimulus methods. The Dicon TKS 4000 (Vismed), Henson CFA3000 (Keeler), and Marco MT-336 MSPs are all computerized instruments which can test the central visual field and provide numerical field indices for a normal eye in less than 4 minutes. The number of points tested in each instance exceeds that tested using the 30-2 program, but quantification of threshold values at each stimulus locus is abbreviated relative to the Humphrey full-thresholding strategy. The basis for comparing these instruments with the Humphrey was to compare their output with the prevailing clinical standard. Comparative data analyses and case examples are presented from among 30 glaucomatous patients and 30 age-related normal subjects. Indices from all three MSP's were significantly correlated with the Statpac Global Indices of the Humphrey 30-2 in both normative and glaucomatous populations ($p \leq .01$). Goldman visual fields were obtained on the same population. Qualitative and quantitative comparison of both the MSP's and the Humphrey 30-2 to the Goldman fields is also presented.

3)

OPTIMAL STIMULUS PARAMETER SETTING IN A NEW DESIGN OF COMPUTERIZED QUANTITATIVE LAYER-BY-LAYER PERIMETRY

Toke Bek, University of Aarhus, DENMARK

Quantitative layer-by-layer perimetry is a psychophysical technique originally developed by J. Enoch. The technique estimates characteristics of visual integration supposed to be integrated in specific retinal layers. A new design of quantitative layer-by-layer perimetry was developed by implementing the technique into the existing hardware environment of the computerized perimeter Humphrey Field Analyzer.

In quantitative layer-by-layer perimetry, the psychophysical criterion is the flashing or not flashing of a small test stimulus centered on a larger variable-intensity background field. In order to optimize test reliability, test reproducibility and minimize test duration using this stimulus criterion, test parameters such as stimulus duration, stimulus delay, flash frequency and need for repeated threshold determinations were evaluated. An optimized approach enabled a ten times decrease in test duration as compared to earlier designs of the technique, with repeated threshold determinations in each point allowing treatment of the data in a proper statistical context.

The theoretical and experimental considerations underlying the settlement of these optimal stimulus variables will be presented.

4)

A NEW SCREENING PROGRAM IN KOWA AUTOMATED PERIMETER AP 3000

H. Suzumura, N. Endo, K. Harasawa, and T. Murao
Department of Ophthalmology, Tokyo Medecal College, Tokyo

With the development and progress in automated perimeters, perimetry today is generally performed in the central visual field while the peripheral visual field tends to ignored attention. However clinically, it is desirable for the peripheral visual field to be measured and a isoptometry is useful to measure the peripheral visual field. The Kowa automated perimeter AP 340, developed in 1986, has a program to perform isoptometry. We have developed a new screening program that examines the central visual field by static perimetry and the periphral visual field by isoptometry in the Kowa new automated perimeter AP 3000.

The central static screening testing, which has a radial arrangement of 82 examination points, is performed with a size III stimulus using a three-zone method which is the same as the Goldmann conventional target. The peripheral isoptometric testing is performed with V/4 and I/3 stimuli. The stimulus is exhibited centripetally along the 12 meridians at a speed of 5° /sec. like a stepingstones. The measurement is first performed with isoptometry and then with static perimetry in the central 30° of the visual field without the corrective lens.

The usefulness of this screening program was investigated in normal subjects and the patients with glaucoma, hemianopsia and retinitis pigmentosa and compared with the results of this program and of kinetic perimetry with the Goldmann perimeter. It has shown that this program was useful to detect visual field changes.

5)

REAPPRAISAL OF NORMAL VALUES OF VISUAL FIELD USING OCTOPUS 1-2-3

S. Okuyama, C. Matsumoto, K. Uyama and T. Otori
Department of Ophthalmology, Kinki University School of Medicine, Osaka-Sayama, Japan

We studied the normal values of visual field in normal subjects using the latest model of a direct projection automated perimeter OCTOPUS 1-2-3. Sixty-six Japanese normals (18 - 69 years of age) were tested with the standard program G1X using the target size 3. Our normal subjects had corrected vision of 20/20 or better. Their refraction was within 3 diopters of spherical error and 2 diopters of astigmatism and their intraocular pressure was less than 21 mmHg. Their optical media and fundi were normal. They had neither family history of glaucoma nor systemic diseases that were likely to affect visual functions. In addition, we excluded test results if their false negative responses or false positive responses were greater than 10%. The results of the initial examination were also excluded. Mean sensitivity of our normals was found to decrease linearly with age. Its age slope was -0.42 dB per decade. The sensitivity was lower than the values previously set as normal for young people. The effect of age on the sensitivity in the central area was smaller than that of previous results reported using other automated perimeters. Interindividual fluctuations increased with eccentricity and this increase was more remarkable in old people than in young people.

6)

INFLUENCE OF THE OCCLUSION OF THE NON-TESTED EYE ON SENSITIVITY IN AUTOMATED PERIMETRY

Capris P., Gandolfo E., Tarabuso E., Semino E., Corallo G., Fava G.P.
(University Eye Clinic of Genoa, Italy)

Occlusion of the non-tested eye during perimetric examination may influence the sensitivity level of the other eye. 17 normal subjects underwent automatic threshold static perimetry tests (Perikon PCL 90) under 5 different conditions: 1) binocular vision; 2) monocular vision with a translucent white paper occluder; 3) monocular vision with an opaque occluder; 4) total occlusion with a mirror occluder giving the sensation of seeing the perimetric background; 5) partial occlusion with the same mirror occluder.

Sensitivity in binocular vision was always better than in every monocular condition ($p < 0.00001$), due to summation phemonen (ANOVA test). Significant sensitivity improvement ($p < 0.001$) was present with the translucent occluder in comparison to the opaque one. Sensitivity with the translucent occluder was not significantly different from that obtained in partial binocular occlusion (mirror occluder).
The simple use of a paper occluder does not create important inhibition phenomena as happens with opaque occluder and represents a comfortable, practical and hygienical means for eye occlusion in monocular perimetry.

7)

EFFECT OF NUMBER OF TEST POINTS IN AUTOMATED PERIMETRY AMONG NORMAL UNTRAINED SUBJECTS

Naoya Fujimoto and Emiko Adachi-Usami, Dept. of Ophthalmol., Chiba Univ. School of Med., Chiba, Japan

In the previous study, we found the effect of number of test points in automated perimetry on the mean sensitivity of the well-trained subjects (Am J Ophthalmol 1992). The same procedure was applied for normal untrained subjects in the present study. Using a custom program of the Humphrey Field Analyser, four different programs were made. Twenty subjects had not undergone automated perimetry before this study. The same test points of the four programs used were 8 test points within 3 degrees and 8 test points outside 5 degrees within 9 degrees. The mean sensitivity of each corresponding test points among four programs was compared. We found that the mean sensitivity of the same test points in the program with fewer test points was higher than that in the program with many test points. However, both the position and the number of the same test points altered the effect of number of test points in untrained subjects.

8)

INFLUENCE OF THE TARGET SIZE ON THE SENSITIVITY OF THE CENTRAL VISUAL FIELD IN PATIENTS WITH GLAUCOMA

K. Uyama, C. Matsumoto, S. Okuyama and T. Otori
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We studied the usefulness of the target size 1 in the central 30 degrees of visual field in 30 early glaucoma patients. Quantitative static perimetry was made using the program 32 of the automated perimeter OCTOPUS 201. We examined 30 glaucoma patients and 40 normal subjects under the condition of target sizes 1 and 3. The results obtained were compared with those of the 40 normal subjects based on our own criteria. For standardizing the normal sensitivity of each test point under the condition of target sizes 1 and 3, we divided the visual field of program 32 into three zones(within 10 degrees, between 10 degrees and 20 degrees and between 20 degrees and 30 degrees). In the case where the sensitivity of each test point of a glaucoma patient was more than 2S.D.+1dB lower than the average sensitivity of normal subjects, we classified it as the abnormal sensitivity in each zone of each target size.

In 21 out of 30 eyes, the target size 1 was more sensitive in detecting glaucomatous visual field defects than the target size 3. From these results, it was concluded that the target size 1 was more sensitive in detecting early glaucomatous visual field defects than the target size 3.

9)

EVALUATING THE BLIND SPOT USING A SPATIALLY ADAPTIVE STRATEGY: OPTIMIZATION BY MEANS OF COMPUTERIZED SIMULATION

J. Estreicher, A. B. Safran*, C. Mermoud*, and T. M. Liebling**
Centre d'Informatique Hospitalière, and *Unité de Neuro-ophtalmologie, Hôpital Cantonal Universitaire, Geneva, and **Ecole Polytechnique Fédérale, Lausanne, Switzerland.

A strategy for relatively fast and precise measurement of the blind spot has been proposed. It delineates the blind spot, by detecting its borders in 6 different locations. This study was undertaken to investigate the possibility of further reducing the duration of the procedure, keeping with the basic principles of this strategy. For optimizing the strategy, we developed a method using computerized simulation to generate blind spot and to test a number of measurement algorithms in various clinical conditions.

A comparative study of various algorithms for threshold determination was conducted, in terms of number of required questions at each step of the procedure, keeping in mind the necessity of preserving a sufficient precision for the procedure. Attempts were also made to replace various stages of the procedure by an extrapolative calculation. Robustness of the system was assessed by simulating answers from poorly collaborative subjects.

It was found that the optimization obtained in this study using both a combination of different algorithms according to the stages of the procedure and an extrapolative calculation reduced the time needed to measure the blind spot without reducing the accuracy of the method. (Swiss National Fund for Scientific Research, grant # 32.27842.89.)

10)

A COMPUTER SIMULATION METHOD FOR EXAMINING THE BLIND SPOT

C. Mermoud, A. B. Safran, J. Estreicher*, and T. M. Liebling**
Unité de Neuro-ophtalmologie, and *Centre d'Informatique Hospitalière, Hôpital Cantonal Universitaire, Geneva, and **Ecole Polytechnique Fédérale, Lausanne, Switzerland.

We have developed a new spatially adaptive strategy for measuring the blind spot. In order to optimize this procedure, computer simulation tests must be performed to compare various algorithms. Therefore, we developed a simulation method which takes into account (1) the problems involved in generating blind spots which are comparable to those in the test subjects, (2) the developement of a psychometric function adapted to investigation of the blind spot, and (3) adjustment of the parameters of this function in the specific context of the blind spot.

Blind spots were generated in a random manner, according to a normal distribution based on previous observations in normal subjects. A new psychometric function was defined to take into account the probability of the subject perceiving a stimulus of constant intensity moving in a two-dimensional space, that is on a surface. We adjusted the parameters of this new psychometric function by analysing the observations made on a series of normal subjects, taking into account both fluctuations in the measurement values of the blind spot and frequency of subject errors.

11)

A NEW INSTRUMENT FOR ASSESSING VISUAL DISABILITY: THE VISUAL EFFECTIVENESS SCORE FOR ACUITY & VISUAL FIELD

MARC F. LIEBERMAN MD & AUGUST COLENBRANDER MD
California Pacific Medical Center • San Francisco, California

A novel scoring system has been developed that allows for designating visual acuity and visual field capacities on a 100-point scale; the score is compatible with the ICD-9-CM classification of visual loss. This is offered to replace the current AMA standards, which are awkward and dated in concept and design.

The proposed visual field scale was designed to integrate with the decimal-based Visual Acuity Measurement Standard established by the International Council of Ophthalmology; it maintains established equivalencies (*e.g.* 20/200 = 20° field) and follows established classifications of visual loss. The calculation is based on 10 meridians (4 in the upper field, 6 in the lower field) with an average value of 10 points each. The central 10° field is assigned 50 points (one point for each 2°); the peripheral field is assigned 50 points (one point for each 10°). The calculation can be performed with an "AMA-type" formula or with an "Esterman-type" overlay grid. The total score = (2x binocular score + OD score + OS score)/4.

Comparisons to the AMA "visual efficiency scale" and to the "Esterman grid" are provided. Adaptation to computerized perimetry is simple; we will illustrate Goldmann and Humphrey examples, with the appropriate conversion factors.

12)

VISUAL FIELD AND INVALIDITY

Gandolfo E., Di Lorenzo G., Facino M., Capris P., Corallo G.
(University Eye Clinic of Genoa, Italy)

The invalidity percentage attributed to visual field (V.F.) loss considerably varies from country to country and it may also vary within the same country depending from the origin of the V.F. damage (i.e. war event, work accident, occupational disease, etc.).

Such results have been obtained from the analysis of the answers collected by means of a "questionnaire" sent to many "National Ophthalmological Societies" and to the members of the "IPS Study Groups" involved in "Standards" and "Ergoperimetry".

In order to obtain a standardization in this field, the Authors, on the basis of their own experience and thanks to the suggestions of the colleagues consulted trough the above mentioned questionnaire, propose new rules for the percentual assessment of V.F. and the evaluation of the consequent invalidity.

13)

COMPUTER-ASSISTED MOVING-EYE CAMPIMETRY (CAMEC)

Bertil E Damato[1], Erkan Mutlukan[1], Jim McGarvie[2], David Keating[1], Aled Evans[2]
1. University of Glasgow 2. West of Scotland Health Boards Department of Clinical Physics and Bio-Engineering, Glasgow.

Computer-Assisted Moving-Eye Campimetry (CAMEC) operates on an IBM desk-top computer and uses a randomly moving fixation target, which must be kept within the circle by the patient, by means of a joystick, for stimuli to be presented. Awareness of the stimuli is recorded by the patient pressing a button on the joystick. The speed of the test is automatically adjusted according to the patient's ability and instructions and corrections are given by means of computer speech. Results are printed, stored on disk, and presented on the computer screen and will shortly be fed to a neural network for diagnostic capability.

The results of CAMEC were correlated with those of Goldmann perimetry in 69 patients with neurological visual field defects. The results of the two techniques were identical in 49% of eyes and similar in 33% of eyes. The ability of CAMEC to detect the normal blindspot was evaluated in 26 healthy children (age 4-10 years, mean 5.8). The blindspot was detected in 25 patients with CAMEC and in 19 patients with the Dicon 3000 autoperimeter. The performance was superior with CAMEC than the Dicon with the blindspot being detected in 57% of 364 trials with CAMEC and in 25% of 338 trials with Dicon (Wilcoxon matched pairs test, $p < 0.01$).

CAMEC may be helpful in the community, in paediatric ophthalmology, and in other situations where conventional methods are not generally applicable.

14)

CLINICAL EVALUATION OF SNOWFIELD SCREENING PERIMETRY

M.V. Drake, A. Huang, UCSF/Beckman Vision Center, San Francisco

Automated perimetry is performed for screening or quantitative purposes. The goal of a screening examination is to quickly determine whether an abnormality exists. For the most part screening tests are modified, abbreviated versions of quantitative tests. Because of these modifications the tests are faster, but they are usually less specific and less sensitive than the corresponding quantitative test. The automated Tubingen perimeter (TEC Inc., Tubingen, Germany) uses a novel approach to screening. It uses a random rapidly flickering white noise ("snowfield") pattern on a video display monitor. The patient is able to quickly detect his or her field defect which appears as a lack of the white noise pattern in the affected area. The patient is able to immediately report that the field is abnormal and to direct the operator to focus quantitative testing on the areas of defect. The theoretical benefits of this program are the speed with which defects can be identified, the potential sensitivity for subtle neurological defects, and the ability to help direct subsequent quantitative testing to regions of particular interest. Our initial clinical experience with this method will be presented with a report of limitations of sensitivity and specificity when testing patients with mild to severe glaucomatous and neurological visual field defects.

15)

STX PROGRAM AS A SCREENING TEST FOR GLAUCOMA

Tsing-Hong Wang, Por-Tying Hung, Luke L.K. Lin, Tzyy-Chang Ho
Department of Ophthalmology, National Taiwan University Hospital
Taipei, Taiwan, ROC

The STX program of Octopus 1-2-3(Interzeag/Switzerland) tests 59 location in the central 30 field. All 59 test locations are tested once using the two-level strategy to classify every point as "normal", "relative defect" and "absolute defect" in that location. The relative and absolute defect were added as the total defect. We set the criteria for an abnormal STX test as the total defect was more or equal to 5 points, regardless of its location. We examined 31 glaucoma patients and 36 normal patients. The definite examination included disc stereophotography (Topcon TRC-SS stereo fundus camera) and visual field (VF) by Octopus program 32. Every three to six months, VF examination was repeated for the patients with initial abnormal VF results. After two year follow up, we found the STX program had the sensitivity of 87% and specificity of 91% as an initial screening test.

16)

PERIMETRIC ASSESSMENT IN AN EPIDEMIOLOGY STUDY:BEAVER DAM EYE STUDY

William E. Sponsel, Mary A. Brady, Barbara E. Klein, Ronald Klein, Louis B. Cantor, James F. Marlone, Mitchell J. Menage,Julie M. Nussmeier , University of Wisconsin, Madison, WI, Indiana University, Indianapolis, IN, Project Orbis, NY.

The Henson CFA3000 multiple stimulus perimeter (Keeler) is a computerized suprathreshold multiple-stimulus perimeter able to screen the central visual field and provide a pass/fail index in approximately 1 minute (26-point screening program). A screening failure can be extended to a 132-point multiple-stimulus suprathreshold assessment of the central visual field in which quantification of missed points is provided in approximately 4 minutes per eye.

4,703 residents of Beaver Dam, WI were screened with the Henson perimeter as a part of the Beaver Dam Eye Study. The fields were subsequently graded by four independent clinicians. Disparate gradings were arbitrated with a 3 out of 4 algorithm. Of the 851, 132-point testings graded for which 3:1 concordance among graders was obtained, 298 were judged to be within normal limits. 119 were graded as outside normal limits but not necessitating medical treatment. 350 were graded as mild to moderate consistent with nerve fiber defect requiring medical treatment. 39 were graded as consistent with severe nerve fiber defect. 5 visual fields were attributed to neurological pathology. 11 were graded as outside normal limits explainable by factors other than nerve fiber defect or neurological disease (i.e. lens opacity, retinal disease, artifact). Examples of Henson fields obtained within each of the 6 categories are presented. This research was carried out under NEI Grant #E406594.

17)

DETECTION OF HOMONYMOUS VISUAL FIELD DEFECTS WITH FLICKERING RANDOM DOT PATTERN

U. Schiefer [1], M. Kolb [1], H. Wilhelm [1], D. Petersen [2], E. Zrenner [1], H. Harms [1]

[1] University Eye Hospital, Dept. II, Schleichstr. 12, W-7400 Tübingen, Germany

[2] Radiological Clinic of the University, Dept. of Neuroradiology, Hoppe-Seyler-Str. 3, W-7400 Tübingen, Germany

Patients with circumscribed visual field defects caused by lesions of the *third neuron* are able to perceive their scotomas immediately while looking at randomly distributed black and white squares (12′ x 12′) flickering with high frequency (≈ 30 Hz) resulting in a stimulus field comparable to the white-noise field on a TV screen. However, this method was thought to be much less sensitive in detecting *isolated supra-geniculate lesions*, especially if these occurred more than two years ago.

In this study we examined 80 patients (37 male, 43 female) suffering from a homonymous hemianopia of various origin, detected by conventional perimetry (automated grid perimetry with Tübingen Automatic Perimeter [TAP] or in some cases kinetic perimetry with Tübingen Manual Perimeter [TMP]) or by the white-noise field of the Tübingen Electronic Campimeter [TEC]. – Evaluating the examinations of *each eye separately*, 39 cases showed pathological results in conventional perimetry while white-noise field campimetry was normal. The opposite constellation occured very rarely (only in 2 of altogether 158 examinations). In 117 cases, both methods concordantly showed pathological results. Thus, *74 %* of all hemianopic visual field defects, detected with conventional perimetry, were perceived in white-noise field campimetry.

In 10 of altogether 80 patients the lesion of the visual pathway had occured 2 years or more before examination, leading to a homonymous hemianopia, clearly detectable with conventional perimetry. Even then, in white-noise field campimetry 8 of these patients perceived their homonymous defects as well.

18)

FOVEAL SENSITIVITY: CORRELATION WITH CENTRAL VISUAL FUNCTION

Steven A. Newman M.D. and Brian R. Wnorowski M.D.

Foveal sensitivity tends to parallel Snellen visual acuity. Relative disparity between these two measures may be related to the pathophysiology. We retrospectively reviewed 800 automated visual field exams done by the retinal, corneal and neuroophthalmic service at UVA over the last year. Inclusion criteria: < 20/50 Va, foveal sensitivity < 30. Exclusion criteria: poor reliability coefficient, more than a single pathophysiology. 22 visual field exams qualified for the optic neuropathy group and 19 exams qualified for the retinal-anterior segment pathology group. The average visual acuity in the first group was 20/60 and average foveal sensitivity was 21.6. For the second group the average visual acuity was 20/100 and the average foveal sensitivity was 25.6. Thus despite a worse average visual acuity the retinal/ant segment group had a significantly higher aveage foveal sensitivity than the optic neuropathy. Foveal sensitivity tends to depressed to a greater degree in optic neuropathies then in other causes of visual loss. This relative involvement may occur to an increased degree in certain forms of optic neuropathy. Measured foveal sensitivity may prove a partially independent variable in the assessment of patients with pathology involving the anterior visual pathways.

19)

PERIMETRIC AND FLUORESCEIN-ANGIOGRAPHIC FINDINGS IN CAROTID ARTERY OBSTRUCTIVE DISEASE

Ghiglione D., Borgia L., Zinicola E., Capris P., Allegri P. Cardillo Piccolino F., Gandolfo E. (University Eye Clinic of Genoa, Italy)

35 patients with carotid stenosis were studied by means of perimetry and fluorescein angiography.

The patients were divided into two groups on the basis of supra-aortic trunks echo-doppler results:
1) stenosis > 80% (haemodinamically significant);
2) stenosis < 80% (haemodinamically significant).

The following perimetric findings were detected: depression of sensitivity, nerve fibers bundle, quadrantanopic and hemianopic defects. Fluorescein angiography showed: longer arm-retina and artero-venous circulation time, choroidal filling defects, papillary staining, chronic ischemic retinopathy and arterial occlusions.

Our study has made it possible to individuate perimetric and angiographic alterations which differentiate the two groups of patients in a statistical significant manner.

20)

PRIMARY EMPTY SELLA SYNDROME WITH VISUAL FIELD DEFECT

Hirofumi Matsuo, Torao Sugiura, Kuniyoshi Mizokami
Department of Ophthalmology, Kobe Univ., Kobe, Japan

In recent years , primary empty sella syndrome (PESS) is reported to demonstrate many patterns of visual field defects including bitemporal hemianopsia, homonymous hemianopsia, and glaucoma-like visual field defect. In this study, we evaluated visual fields and optic disc appearances in 8 cases with PESS. Eight eyes out of 16 had visual field defects ; 4 eyes in 2 cases showed glaucoma-like visual field defects, 2 eyes in 1 case showed bitemporal hemianopsia, and 2 eyes in 2 cases presented irregular visual field defects. Four eyes with glaucoma-like visual field defects had large cupping of the optic disc and normal intraocular pressure, while the other eyes had no abnomalities in optic disc appearences. MRI-CT scans of the optic nerve , chiasma , and sella turcica were also performed in attempt to reveal what caused optic disc changes in these cases. The coexistence of PESS and glaucomatous optic disc change with glaucomatous visual field defect may suggest that PESS can be the cause of glaucoma-like optic nerve damage.

21)

TEMPORAL, WEDGE-SHAPED VISUAL FIELD DEFECT ASSOCIATED WITH OPTIC NERVE HYPOPLASIA

Mineo Ozaki, M.D., Yosuke Futami, M.D., Akira Kobori, M.D., Atsushi Sawada, M.D. Department of Ophthalmology, Miyazaki Medical College, Miyazaki, Japan

We report two patients with temporal, wedge-shaped visual field defects associated with optic nerve hypoplasia. One of the two cases was a 22-year-old woman who suddenly noticed temporal blurring in her left eye. On examination, her corrected visual acuity, pupillary light-reaction and intraocular pressure were normal in both eyes. Goldmann perimetry revealed a wedge-shaped visual field defect that broke out temporally from the blind spot in her left eye. The left optic disc was small in size and was sharply demarcated. Red-free fundus photographs showed nerve fiber bundle defect in the nasal sector of the left optic disc. Follow-up visual field examination showed identical findings. We concluded that the nasal hypoplasia of the optic disc was the cause of her temporal, wedge-shaped visual field defect which the patient accidentally noticed.

22)

VISUAL FIELD DEFECTS IN MIGRAINE PATIENTS

R.De Natale, D. Polimeni, MC. Narbone, MG. Scullica, M. Pellicanò. Ophthalmology Institute, University of Messina, Policlinico G. Martino, 98100 Messina Italy

Visual field defects, together with diplopia, blurring vision are often referred by patients during attacks of migraine. Previous studies reported the influence of age and disease duration on the outcome of this symptom without studing which type of migraine and if its frequency plays a role in this visual function loss.

38 patients affected by migraine, diagnosed by a neurologist, including forms with and without "aura" have been studied. An Octopus 2000R computerized perimeter with program G1 has been used to examine the visual field.

In our study patient's age and duration of disease did not show a significant correlation with visual field loss, while migraine attacks frequency showed a significant correlation. The mean defect of the V.F. was indeed greater in those patients with higher frequency of migraine attacks.

Migraine recognizes a vascular disregulation as an important patogenetic factor. V.F. loss described in this disease may be considered very close to thos described in certain vascular conditions of the eye.

23)

PERIMETRY IN PSYCHOGENIC VISUAL DISTURBANCES

Misao Yamamoto, Masakatsu Ohike, Hiroko Shirabe and Kazuyo Suda
Department of Ophthalmology, School of Medicine, Kobe University
Kobe

In perimetry performed on children with psychogenic visual disturbances, it has been reported that spiraling fields, concentric contraction and tubular fields are seen. In the present study, normal visual fields were obtained in all cases by kinetic perimetry (Goldmann) starting from the minimum targets in 11 patients with psychogenic visual disturbances who showed visual fields abnormalities in other hospitals. However, when Humphery static perimetry was performed simultaneously, contradictry results with sporadic scotomas within the range which was seen well in kinetic perimetry were obtained. These results differed from the conventional concept, and appear to be one of the characteristics of psychogenic visual disturbances.

CHAIRPERSON: A. HEIJL
CO-MODERATORS: T. YAMAMOTO
B. DAMATO

Fri., Oct., 23
10:30 AM – 12:00 AM

1)

THE INFLUENCE OF PRE-RECEPTORAL ABSORPTION ON BLUE/YELLOW AUTOMATED PERIMETRY.

Chris Hudson and John M. Wild. Aston University, Birmingham, UK.

Blue/yellow perimetry attempts to isolate the SWS or blue sensitive pathway by the use of a blue stimulus on a high luminance yellow background. An increase in SWS increment thresholds has been demonstrated prior to any such increase by conventional perimetry in ocular hypertension, glaucoma and diabetes. The contribution of pre-receptoral absorption to the attenuation of SWS increment thresholds, particularly that of macular pigment, has received relatively litttle attention. The aim of the study was to determine the effect of lenticular absorption (LA) and macular pigment absorption (MPA) on the SWS perimetric profile in the normal eye

A Humphrey Field Analyzer 630 adapted for blue/yellow perimetry was further modified for the assessment of LA and MPA. The sample comprised 10 normal young subjects and 10 normal elderly subjects. One eye of each subject was randomly assessed. All subjects, previously trained in automated perimetry, undertook at least one training session in the psychophysical techniques employed. LA was assessed by obtaining scotopic threshold measurements at 15° eccentricity for stimuli to which rhodopsin is equally sensitive (ie 410 & 560nm). The difference in threshold between these two wavelengths was taken as a measure of LA. MPA was assessed by comparing green cone sensitivity at the fovea and parafovea to spectral stimuli which are maximally (ie 460nm) and minimally (ie 580nm) absorbed. Normalising this data with respect to 580nm determined the optical density of macular pigment. LA was greater for the elderly group ($p<0.001$) and exhibited a lack of homogeneity within the lens of individual subjects. MPA showed no statistically significant difference between the two groups but exhibited greatest attenuation at the fovea ($p<0.001$). The influence of these artefacts on SWS perimetric thresholds will be discussed.

2)

BLUE ON YELLOW PERIMETRY: A FIVE YEAR OVERVIEW

Chris A. Johnson, Anthony J. Adams and E. J. Casson
Optics and Visual Assessment Lab, University of California, Davis

Blue-on-yellow perimetry is a technique that isolates and measures the sensitivity of short-wavelength-sensitive mechanisms throughout the visual field by means of a modified Humphrey Visual Field Analyzer. Over the past five years, we have conducted a prospective longitudinal study of age-matched normal control subjects, ocular hypertensives and patients with early glaucomatous visual field loss with standard (white-on-white) automated perimetry and blue-on-yellow perimetry. This paper presents an overview and summary of our current findings for blue-on-yellow perimetry in ocular hypertension and glaucoma. To date, we have found that glaucoma-related blue-on-yellow visual field deficits are more frequent and are larger than standard white-on-white deficits, that blue-on yellow deficits exhibit a nerve fiber bundle-type pattern, that blue-on-yellow deficits are predictive of both the development and progression of standard white-on-white defects, and that blue-on-yellow losses occur 3 to 5 years prior to white-on-white deficits. The clinical utility, advantages and disadvantages of blue-on-yellow perimetry for glaucoma detection and evaluation will be discussed. At the present time, it appears that blue-on-yellow perimetry represents the best psychophysical method of detecting early glaucomatous damage.

3)

LEARNING EFFECTS IN BLUE-YELLOW AUTOMATED PERIMETRY

Ian D. Moss, John M. Wild, David Whitaker
Department of Vision Sciences, Aston University, Birmingham, UK

The existence of a within- and between- examination improvement in automated perimetric sensitivity is well documented for standard white stimuli which depend upon luminance detection mechanisms. The study investigated the learning effect for the stimulus parameters necessary to isolate the short wavelength sensitive (SWS) mechanism ie. a narrow band blue target (OCLI blue dichroic) superimposed on a broadband yellow (Schott OG530) background.

The sample comprised two groups of age matched clinically normal observers (Mean 67.1 years SD 7.2) conforming to rigid inclusion criteria. One group (N=10) were naive to any form of automated perimetric examination, the other (N=10) were familiar to standard white stimulus threshold perimetry yet naive to blue-yellow perimetry.

Using a modified Humphrey Field Analyser 640, blue-yellow perimetry was performed using Program 30-2 on each eye on three consecutive days and at one week after the initial examination.

Comparisons of sensitivity between and within the groups were analysed in terms of global mean sensitivity, hemifield analysis and on a pointwise basis.

Results reveal differences in the change in sensitivity over time within both groups, suggesting that the change in subjective criteria over time differs between standard and chromatic perimetry.

4)

COLOR VISUAL FIELDS: A 5 YEAR PROSPECTIVE STUDY IN EYES WITH PRIMARY OPEN ANGLE GLAUCOMA

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Glaucoma Research Center, Ophthalmology, University of California at San Diego,
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A modified Humphrey Visual Field Analyzer was used to assess short-wavelength sensitivity throughout the central 25^{o} field in 110 eyes with primary open angle glaucoma, 55 eyes suspect for glaucoma, and 100 normal control eyes. Color visual fields were corrected for lens density and comparisons between subject groups were age-matched. Results were consistent with our previous report on considerably fewer eyes. Color visual fields were abnormal in nearly 47% (26 of 55) of the the suspect eyes. In 5 of these eyes which later converted to a diagnosis of glaucoma, a high percentage (4 of 5) had diffuse loss (more than 20 defective points) on color fields before localized deficits were seen on standard fields. Nearly half of the remaining suspects with abnormal fields (10 of 21) had a diffuse component to their loss. This was most prevalent in the suspect group considered at high risk due to increased intraocular pressure (IOP) and glaucomatous disc. The correlation between mean defect and IOP was not significant. In glaucoma eyes color fields showed more extensive deficits and in many cases detected progression of loss before standard fields. We discuss the implications for early diagnosis and management of glaucoma.

5)

GENERAL BLUE SENSITIVITY LOSS IN NORMAL, MEDIUM AND HIGH PRESSURE GLAUCOMA

L.A.M.S. de Jong*, J. Felius**, T.J.T.P. van den Berg*/***, E.L. Greve**
* The Netherlands Ophthalmic Research Institute
** Glaucoma Centre, University of Amsterdam
*** Department of Medical Physics and Informatics, University of Amsterdam

Foveal blue sensitivity is reported to be inversely influenced by highest IOP (1). We wondered whether there was also a pressure related influence on the results of blue-on-yellow perimetry. Blue-on-yellow perimetry was performed on a modified Humprey Field Analyzer (HFA). Blue (filter BG 25, Schott) stimuli (size V) on a bright yellow (filter OG 550, Schott) background, were used.

Controls (n=22), normal pressure glaucoma (NPG) patients (n=12), medium pressure glaucoma (MPG) patients (n=14) and high pressure glaucoma (HPG) patients (n=11) were tested. Points with best preserved sensitivity, after correction for lens absorbance, were selected and averaged, this was called general blue sensitivity. The loss was defined as the difference between the average of general blue sensitivity in all controls and the general blue sensitivity in every individual. General blue sensitivity loss (GBSL) did not differ significantly in the three patient groups. It was noticed, in all patient groups, that some patients (at least one in every group) had a much higher GBSL. At the present moment we cannot explain this finding.

(1) Yamazaki et al. in AJO 106: 397-399, 1988

6)

THE EFFECT OF LIGHT SCATTER ON CHROMATIC PERIMETRIC SENSITIVITY

Ian D. Moss, John M. Wild, David Whitaker.
Department of Vision Sciences, Aston University, Birmingham, UK.

The effect of light scatter on tasks such as visual acuity, contrast sensitivity and differential light sensitivity is well documented. These tasks are based solely on luminance measurements. Recently there has been an interest in the isolation of chromatic pathways by automated perimetry; however, the effect of scatter on these functions is unknown.

The present study investigated the effect of forward light scatter on the sensitivity gradient of the short-wavelength sensitive (SWS) pathway. The sample comprised 10 clinically normal subjects (mean age 23.2 years SD 2.5) conforming to rigid inclusion criteria. Short-wavelength sensitivity was determined using a modified Humphrey Field Analyser 640 (OCLI blue dichroic, Schott OG530 filters) with a custom program out to 30° eccentricity for four criteria: standard white-white, high luminance white-white, yellow-yellow and blue-yellow stimulus- background combinations. Scatter was induced by varying concentrations (0.04% and 0.08%) of 500nm polystyrene microsphere suspensions. Each custom program was performed with and without each scatter cells. Light scatter was quantified using the direct compensation technique of van den Berg. The difference in perimetric sensitivity between the scatter and scatter-free measurements was expressed as a function of the degree of scatter. In a second experiment, a sample of 10 subjects with marked inequality of the media between the two eyes was utilised. The difference in perimetric sensitivity between the two eyes was described as a function of the difference in scatter between the two eyes.

Forward light scatter altered the sensitivity gradient as a function of the amount and type of light scatter, with the degree of change being dependent on the given chromatic or luminance stimulus parameters.

7)

THE FOLLOW-UP OF GLAUCOMA WITH A REDUCED SET OF TEST POINTS

Diestelhorst M, Weber J, Gau A

Reduced sets of test points spare time, but have an increased sample error and measurement error. We tried to quantify the amount of error for the estimation of the global mean deviation (MD). Data base were the visual fields of 424 glaucomatous eyes measured with the glaucoma-specific program 30-S. Theoretically, the sample error decreases with increasing test point number. Practically, it was also dependent on the region where the subset of points was located. The best sample was given by a ring-shaped region between 15° and 20° eccentricity. The sample error was 0.402 dB (MD above -2 dB), 0.713 (MD between -2 and -10 dB) and 1.432 dB (MD below -10 dB).

With this sample, we determined the measurement error by a double test with a 5 minute brake in 42 patients. The averaged reproducibility of MD was ±0.41 dB for a the reduced set (14 test points) as an independent program and ±0.52 for the program 30-2 (74 evaluated test points). Reduced sets of test points in the right position appear to be a reliable alternative to standard programs. Theoretically, frequent short programs are even superior to less frequent long programs.

8)

POINT BY POINT LINEAR REGRESSION ANALYSIS OF AUTOMATED VISUAL FIELDS IN PRIMARY OPEN ANGLE GLAUCOMA

C O'Brien, B Schwartz. New England Medical Center, Boston, USA

We measured the rate of change of retinal sensitivity (by trend analysis) on a point by point basis in one eye of 39 POAG patients over a mean follow-up period of 3 years and 6 months (Octopus 2000R perimeter, programme 31). Twenty five points on the periphery of the central 30° field were excluded from the analysis, leaving 48 test locations to be assessed.

Twenty nine patients (74 %) had a significant ($p<0.05$) or borderline significant ($p<0.10$) rate of visual field deterioration at 1 or more test points. Alternatively, 19 of the 27 patients (70 %) with stable overall fields had evidence of a significant rate of field loss in at least 1 test location. The mean number of deteriorating points in these 19 patients was 3.2.

The use of global summary indices for longitudinal monitoring of the visual field in glaucoma may mask underlying changes occuring at individual test locations.

9)

IS DIFFUSE VISUAL FIELD LOSS IN LOW-TENSION GLAUCOMA A PROGNOSTIC INDICATOR FOR PROGRESSION?

Darmalingam Poinoosawmy, Jörg Stürmer, Colm O' Brien, and Roger A. Hitchings
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Diffuse field loss may be a sign of intraocular pressure-dependent damage in glaucoma, and therefore a predictor of further progression in Low-tension glaucoma (LTG) patients.
We studied the uninvolved hemifield (13 upper and 37 lower) in 50 LTG patients (mean age 65.1 years; Humphrey Field Analyzer, program 24-2). One masked observer retrospectively classified the uninvolved hemifield into four groups (normal (N), localized loss (L), diffuse loss (D), combined diffuse & localized loss (DL)). Two different masked observers assessed the same hemifield after a follow-up of 50.9±14.3 months (range 25-75 months) using pointwise linear regression analysis to define progression. There was no statistical difference in the incidence of progression between the 4 groups (N:4/10;L:8/17;D:6/13;DL:5/10 progressed).
The diffuse component of visual field loss in the uninvolved hemifield did not allow prediction of further progression.
The pressure-dependence of diffuse loss in LTG remains questionable.

10)

CUMULATIVE DEFECT CURVES AND GLAUCOMATOUS FIELD LOSS

Peter Åsman[1] and Jonny Olsson[2]
Departments of [1]Ophthalmology in Malmö and [2]Mathematical Statistics in Lund
University of Lund, Sweden.

The relevance of entirely *diffuse* field loss as a sign of glaucoma is controversial. Cumulative defect curves (CDC's) have been proposed to distinguish diffuse and localized field loss. CDC's rank deviations from the normal reference field and compare them with normative limits for each rank. The loss of spatial information in CDC's may, however, impair the intended detection of *localized* loss in early glaucoma. Using Humphrey 30-2 tests of 88 subjects from the Statpac normal database we estimated the lower 5% CDC normative limit for each rank. The eccentricity, r_{rank}, of the points contributing to the limit was recorded for each rank. Our CDC's were subsequently used to evaluate field results in 101 patients with glaucoma were analyzed with these CDC's.

For lower to intermediate ranks r_{rank} ranged from 7° to 27°. For the 20 highest ranks (most depressed points) r_{rank} was much higher (range 21°–28°). In the glaucoma group, on the other hand, the largest deviations were often encountered in significant central or paracentral scotomas. These deviations often failed to reach the corresponding CDC limits which were based on points in the mid-periphery where normal variability is large. — At present, CDC's are not optimized to distinguish diffuse and localized field loss.

11)

A GRAPHICAL BAR TO VISUALIZE THE QUANTITATIVE DEVELOPEMENT OF VISUAL FIELDS

Papoulis C, Weber J

The quantitative distribution of measurement values in automated perimetry can be shown by the cumulative curve (Bebié) or box plots. For the follow-up of a series of fields, cumulative curves are not very much suitable because they need much space. Box plots are very graphical, but usually they show only five percentiles: 0, 20, 50, 80 and 100. Changes of segments between them are unvisible.

The new graphical bar is a stack histogram which shows the portion of each defect class on the whole field. There are 8 defect classes. The graphical pattern is similar to the grayscale used for topographical field representations. The visualization of series of fields by series of graphical bars shows to be more precise and illustrative then alternative representations.

12)

"PERICECAL INDEX" IN EARLY GLAUCOMA AUTOMATED VISUAL FIELDS

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Department of Ophthalmology - General Hospital of Udine (Italy)

The aim of this study was to discover whether a group of test-points from a widely used threshold standard program (30-2 Humphrey Field Analyzer) could be employed to create a clinically useful "Pericecal Index" (PI).

The mean sensitivity of 11 test-points around the blind spot was calculated in 70 glaucomatous patients with very slight visual field damage, and in 55 age-matched normal subjects, taking into account only one eye. The difference was statistically significant ($p < 0.0001$). We also compared the PI with the mean sensitivity of 11 control points, located in the lower field at the same eccentricity, in glaucoma and in the normal group. Moreover,the mean sensitivity of these points in glaucomatous and in normal eyes was compared. The difference between PI and the control points was only statistically significant in glaucomatous patients. On the other hand, we found a significant difference between the normal and glaucoma control points, probably due to a scattered sensitivity depression in Bjerrum area.

13)

A VISUAL FIELD INDEX FOR NERVE FIBRE BUNDLE DEFECTS

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Department of Ophthalmology, University of Hamburg, GFR

The database PERIDATA provides a visual field index for nerve fibre bundle defects by calculating the conformity of sensitivity values in 21 nerve fibre zones of the central 30°-field (Weber & Schmitz 1992). We applied this index to the OCTOPUS normative data (n=836), and to 158 eyes with chronic glaucoma and 75 eyes with ocular hypertension.

The index was abnormal in 37 fields of healthy eyes (specificity 96%). 38 of 97 eyes with mild to moderate glaucomatous damage presented with a pathological index. From the 37 eyes with clinically obvious nerve fibre bundle defects, 27 had an abnormal index (sensitivity 73%). In 95% of ocular hypertensive eyes the index was normal. The index for nerve fibre bundle defects was less sensitive than expected, as demonstrated by ROC curves. It nevertheless may be helpful for the interpretation of nerve fibre defects of glaucomatous or other origin, especially in combination with an index for the nasal step.

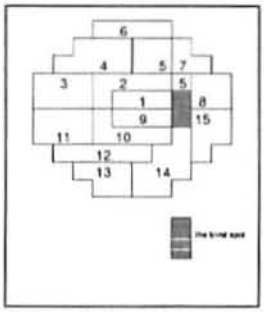
14)

SECTORIZATION OF VISUAL FIELD IN GLAUCOMA

Yasuyuki Suzuki[1], Makoto Araie[1], and Yasuo Ohashi[2]. [1]Department of Ophthalmology, and [2]Department of Epidemiology and Biostatistics, Faculty of Medicine, University of Tokyo, Tokyo

Sectoring of the visual field in glaucoma patients based on the assumed projection of the retinal nerve fiber layer has been advocated by several investigators, but they differ from each other. We sectorized the central visual field of glaucoma objectively by directly analyzing the visual field data of primary open angle glaucoma (POAG) without assumption such as the anatomy of the retinal nerve fiber layer.

One hundred three visual field data of the 30-2 program of the Humphrey Field Analyzer obtained from 103 POAG patients of early to moderately advanced stage were included in the present study, and they were analyzed by VARCLUS procedure, a new clustering algorithm developed by SAS Institute Inc. Based on the inter-test point correlation of the deviation of the measured threshold value from the age-corrected normal reference value, the Total Deviation (TD) given by STATPAC, test points of the 30-2 program were mathematically clustered and the 30° central visual field was divided into 15 sectors using a mathematical optimization strategy.



The distribution of sectors was compatible with the projection of nerve fiber layers and there was no sector extending over the horizontal meridian, but the sector pattern was not completely symmetrical around it. Thus obtained sector pattern may be useful in studying the visual field loss in POAG patients.

15)

THE QUANTIFICATION OF CONGRUENCE BETWEEN THE RIGHT AND LEFT VISUAL FIELD.

Jörg Weber, Universitäts-Augenklinik Köln

In the past, congruence betwen the right and left visual field could only be evaluated subjectively. This study presents a congruence index to assess the similarity of both visual fields objectively and quantitatively based on probability calculations. To proof validity, the index was examined in diseases with typical defect patterns. In 18 patients with suprachiasmal lesions, the index found a homonymous congruence in all 18 cases (100%). Of 26 persons with pituitary adenoma, in 22 cases the index found heteronymous congruence (85%). The validity of the method may be even higher, because all cases with untypical indices also had untypical congruence by subjective evaluation. Using this new method in 41 patients with primary open angle glaucoma, heteronymous congruence was detected in 73% and homonymous congruence was found in 17%. This new index may be useful for the development of computerized methods of differential diagnosis.

16)

POINTWISE ANALYSIS OF SERIAL VISUAL FIELDS IN NORMAL SUBJECTS

Alicja R Rudnicka[1], David P Crabb[2], David F Edgar[1]. 1. Applied Vision Research Centre. 2. School of Mathemetics, Actuarial Science & Statistics, City University, London, UK.

An alternative new visual field index (LP) is proposed and its sensitivity in detecting learning effects in normal subjects is compared with conventional analysis of the global indices as calculated by the Humphrey Field Analyzer 630. LP is the ratio of the number of locations that have increased in sensitivity to the total number of locations which have changed in sensitivity between field n and (n+1). This proportion is not influenced by extreme values of sensitivity unlike the global indices mean sensitivity (MS) and mean defect (MD).
Six fields (program 30-2) were obtained for 30 normal novice subjects (age 19 to 33 years, mean 24.5 years) from one eye selected at random. Statistical analysis of MD and MS illustrate the learning effect but a conclusive pattern is not observed. Plots for individual subjects illustrate the inherent variability associated with the problem of detecting a learning effect. LP demonstrated a clearer improvement in sensitivity, significant between tests 1 and 2 only ($p<0.01$). Analysis of the individual locations (test 1 to test 2) is presented as an alternative to the common subdivision of the field into areas. This technique, enhanced by a simple filtering process exposed the spatial configuration of the learning to be mainly in the superior field and with increasing eccentricity. However, it is shown to be partly a function of the extreme values (outliers) which occur in these regions of the field.
The aim of reducing the "noise" within serial fields underlying this index and the production of filtered spatial representations may be useful in detecting changes in glaucomatous fields.

17)

SHORT TERM FLUCTUATION VERSUS BRACKETING FLUCTUATION IN NORMALS, HYPERTENSION AND GLAUCOMATOUS EYES.

R. De Natale, G. Romeo, F. Famà. Ophthalmology Institute, University of Messina, Italy.

The bracketing fluctuation is a new perimetric index avalaible by using the PCL 90 computerized perimeter. This index is calculated during the normal threshold determination and indicates the intra measurement threshold variation registred in each test point.
In the present study the authors compare the bracketing fluctuation with the short term fluctuation as calculated in ten test points.

10 normal volunteers, 10 subjects with ocular hypertension and 10 glaucomatous patients with advanced visual field defects have been enrolled. No statistical difference, with respect to age, was present in any of the considered groups. The visual field was examined with the PCL 90 computerized perimeter using program 30 II

In normals and ocular hypertension subjects no significative difference between SF and BF was noted. In glaucoma patients with sever V.F. defects the BF showed higher value than SF, with a mean of p= 0.001

18)

PERIKON PCL 90: A STATISTICAL PROGRAM

Gandolfo E., Mattioli R., Capris P., Di Lorenzo G., Zingirian M. Novaro C., Danielli M. (University Eye Clinic of Genoa, Italy)

In order to collect a normal "data base" for the Perikon PCL 90 automatic perimeter, a large study has been carried out in 4 italian cities (Genova, Verona, Udine and Messina). Several parameters were taken into account: age, cultural level, sex, geographic origin etc.

The visual field of more than 350 normal people was analyzed using static and kinetic tests. All age classes were included in the study. A severe inclusion protocol concerning pupil size, IOP, media transparency, C/D ratio, etc. was adopted.

All collected data have been interpolated by optimized mathematical models utilizing multi-variables equations (age, meridian, eccentricity, luminance, etc.). This mathematical process provided us the normal static and kinetic thresholds for all tested points and different ages. Such a statistical program is able to provide:
1) global static perimetric indices (according to both Heijl and Flammer methods); 2) global kinetic indices; 3) mean reaction time, 4) perimetric maps (numeric, symbolic and differential); 5) probability maps; 6) follow-up maps.

19)

MATHEMATICAL MODEL OF THE GLAUCOMATOUS VISUAL FIELD. EVALUATION OF THE "DELPHI" PROCEDURE

Manuel GONZALEZ DE LA ROSA, Carmen MESA MORENO,
Cristina MANTOLAN SARMIENTO, Fernando MARTIN BARRERA
Universidad de La Laguna. Tenerife. Canary Islands, SPAIN.

By knowing the threshold at four critical points, the sensitivity of any other area of the central field can be deduced by means of multiple regression equations. This mathematical model, which was developed previously by means of a study carried out on 618 eyes of 384 patients (r=0.84), was evaluated by exploring 10 points, on 27 eyes of 27 patients on four different occasions.

The fluctuation of the estimated values (mean=1.68 dB., s.d.=1.34) was less than half of that which was shown when exploring the points directly (mean=3.57 dB., s.d.=3.13).

We propose a new form of representation which indicates the probability, in terms of percentage, of a pathology in each area of the visual field, comparing the distribution of the threshold in the normal population, with the probable threshold interval estimated by the regression formula.

20)

EXTERNAL CONTROL OF TESTING AND DATA ANALYSIS ON THE HUMPHREY FIELD ANALYSER

John G Flanagan, J.W. Cassidy. University of Waterloo, Waterloo, Canada.

The Humphrey Field Analyzer (HFA), like most commercial instruments, was a closed system with dedicated computer control. Recently "Gateway" was developed as a set of commands to allow a remote system interface. Although this permits total control and custom programmability of the HFA it is a low level command set, requiring programming skills to implement intelligent testing strategies. We present a mouse driven, "Mac-like" control programme, WATGATE, to allow customised tests to be easily written using the Gateway commands. WATGATE incorporates hard-coded, intelligent testing strategies with user configurable parameter settings. Thus it is possible to achieve automated, custom testing, including random testing and thresholding of user selected stimuli. The parameter settings include, amongst others, selection of stimulus duration, intensity, size and colour for a flash stimulus; frequency and amplitude for an oscillating stimulus; thresholding strategy; fixation target; and background. The programme runs on IBM-compatibles and requires either a VGA or Hercules graphics card.

A second programme, HDISK, is a vehicle for information transfer from HFA data files to ASCII files on an IBM compatible system. The programme acts as a conversion utility by reading directly from HFA formatted diskettes and converting to a DOS format. The output files can maintain all header information or simply list coordinates and sensitivity values for interfacing with commercially available analysis or graphics software. Companion programmes to HDISK provide a range of functions including field comparison, simple statistical analysis, co-ordinate interpolation, data listing on a printer, and grey scale laser printing. Examples of application, printouts and data manipulation will be illustrated for both programmes.

21)

COMPARING LONG TERM VARIABILITY USING THE HUMPHREY FIELD ANALYSER AND THE RING PERIMETER IN GLAUCOMATOUS AND NORMAL SUBJECTS

P.H. HOUSE, R.L COOPER, Royal Perth Hospital, Perth, Western Australia
M. BULSARA, Biostatistics Consulting Service, Univ. of W.A.

Long term fluctuation in differential light threshold (DLT) perimetry may make clinical definition of disease progression in glaucoma patients difficult. Ring perimetry as developed by Frisen has a unique target which enlarges as sensitivity decreases. This results in a visual field which shows no increase in variability in the superior or peripheral parts in normal or glaucomatous subjects. Whether this feature results in a significant reduction in variation compared to DLT using the Humphrey Field Analyser (HFA) has not previously been tested.

Fourteen normals and 21 clinically stable glaucoma subjects with known mild to moderate glaucomatous field damage on the HFA were prospectively enrolled and performed six fields on the same eye over approximately a six month period. The order of the HFA and ring perimetry was randomised to avoid uneven fatigue effects and the first field was discarded to reduce learning effects.

Raw scores are not comparable directly as the psycho-physical function tested is different for the two machines. In order to compare variability a multi-linear regression for each point, of mean sensitivity at that location against the standard deviation found for the five measurements,was performed for each group and each machine. This was controlled for subject, distance from fixation and direction from fixation.

Results show a significant increase in variance with the HFA as sensitivity declines for both normals and glaucomatous subjects. The distance from fixation and the direction from fixation of the locus tested were significant controlling variables for the normal subjects but not the glaucoma patients. The Ring perimeter in glaucoma patients showed no correlation between sensitivity and variance, with direction from fixation a significant controlling variable but not distance. Normal subjects showed a significant increase in variance as sensitivity increased, although the effect was small. The effect was not influenced by the location of the locus tested. This study confirms that variability on the Ring perimeter does not increase as field damage worsens in glaucoma paients. Whether this translates into a clinical advantage in determining progression remains to be tested.

22)

PROBABILITY OF GLOBAL INDICIES IN LOW TENSION GLAUCOMA

Chul HONG, MD & Ki Yung SONG, MD
Glaucoma Service, Dr. Hong's Eye Clinic, Seoul, Korea.

Low tension glaucoma (LTG) is said to have visual field (V.F.) defects to be closer to fixation, to be deeper, and to have steeper slopes. To confirm the pattern of V.F. defect of LTG, the diffuse and localized V.F defects were compared with those of primary open-angle glaucoma (POAG) using mean deviation (MD) and corrected pattern standard deviation (CPSD) calculated with the STATPAC of Humphrey V.F analyzer, respectively.

Sixteen eyes of LTG with mild V.F. defects were enrolled and 34 eyes of POAG were used as control. Neither mean MD nor CPSD of LTG was significantly different from each of POAG. However, comparing the probabilities of MD and CPSD, severe defect of CSPD was more significantly noted in LTG than POAG.

Probability of MD and CPSD might be helpful to understand the V.F defect of LTG than MD and CPSD themselves.

CHAIRPERSON: C. JOHNSON
CO-MODERATORS: Y. YAMAZAKI
C. LANGERHORST

Fri., Oct., 23
1:30 PM – 3:00 PM

1)

THE MAGNITUDE AND LOCUS OF PERIMETRIC FATIGUE IN NORMALS AND OHTs.

Chris Hudson[1], John M. Wild[1], Anne E. T. Searle[2] and Eamon C. O'Neill[2]. [1]Aston University, Birmingham, UK & [2] Birmingham and Midland Eye Hospital, Birmingham, UK.

The aim of the study was to quantify the magnitude, and identify the locus, of the fatigue effect in trained, age-matched normals (n=20) and OHTs (n=20) during a standard perimetric procedure. Program G1X of the Octopus 1-2-3 perimeter was employed for both eyes of each volunteer since the thresholding of stimulus locations does not depend upon seed points. A break of 1 minute between phases, and of 3 minutes between eyes, was given. The global visual field indices MD and LV were calculated for each of the eight stages of Program G1X.

Global group mean MD and LV, although showing no statistically significant difference between the two groups, deteriorated in a biphasic manner for both eyes of both groups; with the inflection point occurring at the end of phase 1. Global group mean MD deteriorated by 1.32dB and 1.18dB for the first and second eyes respectively of the normals and by 0.98dB and 1.11dB for the OHTs ($p<0.001$). Global group mean LV deteriorated by 2.84dB and 5.74dB for the first and second eyes respectively of the normals and by 3.30dB and 4.00dB for the OHTs ($p<0.001$).

The influence of visual field locus was determined by calculating the indices for stimulus locations within and without 17° eccentricity respectively (ie central and peripheral) and for the horizontal (ie superior and inferior) and vertical (ie nasal and temporal) hemifields. Peripheral group mean MD and peripheral group mean LV deteriorated in a time related manner ($p<0.001$) for both groups. No statistically significant difference between the superior and inferior, or nasal and temporal, hemifields was found for either group. The genesis of perimetric fatigue will be considered in the light of these results.

2)

RELIABILITY INDICES IN AUTOMATED PERIMETRY

Corallo G., Gandolfo E., Magnasco A., Semino E., Morescalchi F. Novaro C., Danielli M. (University Eye Clinic of Genoa, Italy)

The percentage of errors and fixation losses in automated perimetry shows a great variability and a difficult predictability. The aim of our study was to detect the characteristics of patients and perimetric tests which may increase the prevalence of positive catch trials.

In a retrospective study, we analyzed the perimetric results stored by a Humphrey 640, selecting only the first examination for each patient, in order to avoid fatigue and learning effects.

We correlated (Spearman RS test) the different kinds of errors to the following parameters: 1) examination strategy (threshold and suprathreshold); 2) test duaration; 3) presence and severity of V.F. defects; 4) diagnosis; 5) sex; 6) age; 7) refractive error and visual acuity.

The preliminary results (500 cases) suggest the following correlations: a) age with false positives; b) low visual acuity, test duration and severe V.F. loss with false negatives; c) neurophthalmological disturbances with false positives and fixation losses.

3)

FIXATIONAL INSTABILITY DURING PERIMETRY AND THE BLINDSPOT MONITOR

Shaban Demirel and Algis J Vingrys, Department of Optometry, University of Melbourne, Parkville VIC 3053, Australia.

We consider the nature of normal fixational instability that occurs during automated perimetry and the ability of the blindspot monitor to find such losses. We considered the effect that sampling rate (10-25%) and size of fixation loss (0°, 2°, 5°, 10°) have on the blindspot monitor.

Twelve young (20-28) normal observers performed 12 consecutive threshold tests (averaging five minutes). Eye movements were recorded using an infrared eye-movement monitoring system to an accuracy of ±0.5° while subjects performed thresholding. The number of fixation losses recorded by the perimeter was very low for all sampling rates. However, analysis of eye movement traces shows considerable fixational instability characterised by slow drifts with an occasional saccadic movement. Three degree fixational drifts occur about 4 times per test (every 78 secs), 2° drifts occur 14 times per session (every 22 secs) and 1° drifts happen every 8 seconds. Large eye movements (≥3°) were found in all observers. We tested the ability of the Heijl-Krakau method to detect repetitive and pseudo-random fixation losses performed by a well trained perimetric observer in the presence of 2°, 5° and 10° eye movements. No two degree fixation losses were ever detected whereas 5° and 10° fixation losses were detected on 94% and 100% of occasions for the 10% sampling rate. We conclude that fixational instability is usual during automated perimetry and that the blindspot monitor only detects eye movements ≥5° with any level of reliability. We conclude that increasing sampling rate has little benefit in detecting fixational instability.

4)

THE EFFECT OF FIXATION LOSS ON PERIMETRIC RELIABILITY.

Algis J Vingrys and Shaban Demirel, Department of Optometry, University of Melbourne, Parkville VIC 3053, Australia.

Automated perimeters calculate several reliability indices for each threshold test including: fixation loss, false positives, false negatives and short-term fluctuation. This study was designed to assess the affect that poor fixation has on threshold and these reliability indices. A well trained observer performed thresholds on the Humphrey Field Analyser using a modified 14°x18° grid pattern and a Size 3 target. The grid had a 2° interstimulus spacing centred on the blind spot and mirrored into the equivalent nasal field of the same eye. The subject performed a repetitive pseudo-random set of fixation losses during testing. The effect that different sized fixation losses (0°, 2°, 5°, & 10°) and the presence or absence of a scotoma (physiological blind spot) had on thresholds and on reliability indices was evaluated.

Mean threshold was reduced with unstable fixation. False positives occurred infrequently and were unrelated to fixational stability. False negatives only occurred in the presence of a scotoma and only if fixation was unstable. Short term fluctuation was significantly higher in the presence of a scotoma and higher still if fixation was unstable. These findings lead us to the following conclusions: 1) False negatives may not only indicate a fluctuating threshold but also the presence of a scotoma moving within the field. 2) Short-term fluctuation may arise from the movement of a small, steep sided scotoma within the field (Vingrys and Verbaken, ARVO Abstracts: 31 (4), 191, 1990), and 3) Eye movements decrease perimetric reliability and flatten the Hill of Vision.

5)

PERFORMANCE OF UNRELIABLE PATIENTS ON REPEAT PERIMETRY

Richard P. Mills, MD, Yi Li MD, and Brinda Trivedi
University of Washington, Seattle, USA

29 patients who were unreliable on initial Humphrey 30-2 testing were tested further using the Humphrey 24-2 and the High-Pass Resolution (HRP) standard threshold programs. Criteria for unreliability were as follows: fixation losses ≥ 15% (despite active technician involvement), false positives ≥ 15%, or false negatives ≥ 30%. While reliability rates did show some improvement in 66% of patients, 23/29 remained unreliable on one or both of the repeat tests, most often because of high fixation loss rates.

The HRP device utilizes several software features not employed by the Humphrey perimeter that are designed to improve performance on reliability catch trials. In this group of patients, the overall reliability on retest was the same on both Humphrey and HRP, the Humphrey recording somewhat fewer false negatives and the HRP fewer fixation losses. Thus, in patients who are inherently unreliable, software features to improve attentiveness do not usually convert the patient into a reliable perimetry subject.

6)

SERIAL COMPARISON OF RELIABILITY INDICES IN CONVENTIONAL AND HIGH-PASS RESOLUTION PERIMETRY IN NORMAL SUBJECTS

Rajender N. Mohandas, James H. Whelan, Balwantray C. Chauhan, and Terry A. McCormick Department of Ophthalmology, Dalhousie University, Halifax, Canada

The purpose of this study was to compare the reliability indices in conventional (Humphrey) and high-pass resolution (Ring) perimetry. The results are taken from a long-term prospective study of clinically normal subjects who were perimetrically naive at enrollment. A battery of standard and non-standard psychophysical tests are performed every six months on one randomly selected eye. To date 146 subjects, whose mean age was 50.24 years (range 33 to 84 years), have been enrolled. Of these subjects 103 have had 2 sets and 71 have had 3 sets of examinations. For all visits, the distributions of the reliability indices with each technique were highly (positively) skewed with the median values ranging from 0% to 5%. The indices remained surprisingly constant in subjects completing all three sets of examinations ($P > 0.05$). We compared the current arbitrary criteria used to identify unreliable fields to those derived by taking the first visit 95th percentile values as cut-offs. Using the arbitrary criteria, nearly all patients had unreliable fields due to fixation errors for each visit and technique. Using the empirical criteria, unreliable fields were attributed, as expected, more equally to all three parameters, though the percentage of unreliable fields remained constant. Our results show that the reliability of normal subjects tested with conventional and high-pass resolution perimetry are comparable.

7)

A COMPARATIVE STUDY BETWEEN HIGH-PASS RESOLUTION PERIMETRY AND DIFFERENTIAL LIGHT SENSITIVITY PERIMETRY IN GLAUCOMA PATIENTS

Yoshiki Kono, Mihoko Maeda, Tetsuya Yamamoto & Yoshiaki Kitazawa
Dept of Ophthalmol, Gifu Univ Sch of Med, Gifu-shi, Japan

High-pass resolution perimetry (HRP) can provide not only a measure of the number of functioning optic nerve fibers but also the data pertaining the shape of visual island. We investigated the correlation between HRP and a standard differential light sensitivity perimetry (Humphrey Field Analyzer 630, HFA) in 110 eyes of 69 open-angle glaucoma patients in whom reliable examinations with HRP and HFA were done. Functional channels (FC) and adjusted local deviation (ALD) of HRP were significantly correlated with MD ($r=0.75$, $p<0.01$) and CPSD ($r=0.73$, $p<0.01$) of HFA, respectively. The correlation tended to be higher in eyes with more advanced field changes as compared to those with less changes ($r=0.69$ vs 0.35 for FC and MD, $r=0.66$ vs 0.24 for ALD and CPSD). The observed variability of correlation coefficients with the progress of field defects might be attributed to the physiological factors tested in two different methods of perimetry.

8)

HIGH-PASS RESOLUTION PERIMETRY: COMPARISON BETWEEN 'MEAN dB SCORE' AND 'NEURAL CAPACITY' IN GLAUCOMA DIAGNOSIS AMD FOLLOW-UP.

Peter Wanger MD,PhD and Lene Martin-Boglind,RN
Department of Ophthalmology, Sabbatsberg Hospital,
S-113 82, Stockholm, SWEDEN

High-pass resolution perimetry (HRP) measures the resolution thresholds at 50 locations within the 30 degrees central visual field. The thresholds (minimum angles of resolution, MAR) are directly proportional to retinal ganglion cell separation. The HRP system provides two measures of overall visual field function: mean score, which is calculated from log target sizes, and neural capacity, which uses the inverted MAR values, reflecting retinal ganglion cell density and giving greater weight to the most central visual field.

In the current study these two measures were compared in normal subjects, patients with ocular hypertension and newly diagnosed, treated glaucoma patients, followed for two years.

The correlation between mean score and neural capacity ranged from -.85 to -.94 in the examined groups. In the 54 treated glaucoma patients 22 visual fields were classified as improved, 18 as unchanged and 14 as deteriorated after two years, when mean scores were used. Using neural capacity the corresponding numbers were 15, 24 and 15.

The choice of statistic measure influenced the evaluation of treatment in 17% (9/54) of these early stage glaucoma patients.

9)

HOW DOES HIGH-PASS RESOLUTION PERIMETRY (HRP) ESTIMATE RETINOCORTICAL NEURAL CHANNELS?

L Frisén, University of Göteborg, Sweden

A major goal of HRP is to obtain a subject-oriented index of the state of the visual system, capable of replacing the machine-oriented indices used in conventional perimetry. Realization of this goal demands demonstration of a very close quantitative agreement between HRP test results and a relevant anatomical parameter. This report reviews pertinent data in the framework of a proportionality model of resolution. The model implies that resolution in peripheral vision is directly proportional to retinal ganglion cell separation, with different proportionality factors for different contrast levels. The model was found to agree very well with the psychophysical and anatomical data. It can be extended to govern many new types of analyses, e g, what class of ganglion cells are probed by HRP (parvocellular), and what loss of retinocortical neural channels occurs with age (approximately one channel per eye and hour). Results also indicate a simple proportionality between HRP contrast levels and the fraction of active neural channels, with the largest fraction operating at the highest contrast.

10)

ESTIMATION OF RECEPTIVE FIELD AREA AND DENSITY OF HUMAN RETINA USING COMPUTER SIMULATION

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**Dept. of Ophthalmology, Shiga Univ. of Medical Science*
***Kyoto Univ.*

Relationship between the detection threshold and the area of light stimulus (which is called the area-threshold relationship) was explained by the model TAMIT (total activity model for increment threshold). TAMIT is essentially composed of two processing stages. The first stage corresponds to information processing by retinal ganglion cell (RGC). The second stage is for summation of all outputs from RGC. In this model RGCs are threshold elements with a receptive field in the retina, and when the total output (total activity level) exceeds the psychological threshold, light is detected.

In this paper, we changed all the 8 changeable parameters of TAMIT and simulated area-threshold curve. By fitting simulated curve to the psychophysical area-threshold curve obtained from our experimens, we estimated the shape and the density of human receptive field.

11)

EXAMINATION OF RECEPTIVE FIELD USING AUTOMATIC PERIMETER

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A simple method to investigate the visual receptive field using an automatic perimeter (Topcon SBP2020) was developed. Nine retinal points (0, 5, 10, 15 and 20 degrees from the fovea on nasal upper and nasal lower meridian) were tested using 8 test objects, the diameter of which was 0.8 to 103 minutes. Threshold was determined using the bracketing method into 1 dB. The area-threshold curves were drawn.

In 19 eyes of normal subjects the receptive field diameters calculated from the area-threshold curves were similar to that obtained by our psychophysical experiments using a fundus perimeter.

Some cases of glaucoma, ocular hypertension and optic neuropathy were tested. In early glaucoma cases whose visual field tested with object III was normal, the area-threshold curves in the Bjerrum area were irregular where small target were used, and the receptive field diameters were larger.

12)

CHARACTERISTICS OF FREQUENCY-OF-SEEING CURVES IN GLAUCOMA

Balwantray C. Chauhan[1], James D. Tompkins[2], Raymond P. LeBlanc[1], and Terry A. McCormick[1] [1]Department of Ophthalmology, Dalhousie University and [2]Department of Electrical Engineering, Technical University of Nova Scotia, Halifax, Canada

We undertook this study to determine factors that affect the characteristics of frequency-of-seeing curves in glaucoma patients and suspects. Our sample consisted of 45 subjects (26 glaucoma patients, 13 glaucoma suspects and 6 normals) whose mean ages were 68.0, 55.2 and 54.5 years respectively. A program was written to interface with the Humphrey Field Analyser to enable us to measure frequency-of-seeing curves. We presented stimuli ranging 17 dB (centred on the estimated threshold) in 1 dB steps with 5 repetitions at each stimulus intensity. We tested between 4 and 6 locations in each subject with the stimulus intensity and location randomised. Fixation was monitored using the Heijl-Krakau method. We obtained 143 curves from the glaucoma patients, 78 from the suspects and 36 from the normals. Using a probit program we calculated the threshold, interquartile range (an estimate of the slope) and the mean confidence interval (an estimate of goodness-of-fit) of each curve. In all three groups of subjects the slope of the frequency-of-seeing curve was highly correlated to threshold ($P < 0.001$). The mean confidence interval was correlated to threshold in only the glaucoma patients, though some patients produced remarkably 'clean' curves with significantly elevated thresholds while others produced 'noisy' curves with near normal thresholds. Our results suggest that theoretical modeling of glaucomatous responses may be inadequate.

13)

FREQUENCY-OF-SEEING; DEPENDENCE ON TOTAL DEVIATION

Anders Heijl[2], Jonny Olsson[1], Boel Bengtsson[2], and Holger Rootzén[1] [1]Department of Mathematical Statistics and [2]Department of Ophthalmology in Malmö, University of Lund, Sweden

Knowledge about the perimetric frequency-of-seeing curve is of value when designing algorithms for visual field testing, and for subsequent analyses of visual field data.

We measured the frequency-of-seeing curve during computerized field testing with the Humphrey field analyser. To each conventional 24-2 test we added 80 stimulus exposures in a preselected test point and at 4 levels of intensity, mostly at subthreshold levels. We calculated threshold estimates and slope-characteristics, σ, at each selected point, assuming Gaussian frequency-of-seeing curves and using false positive and false negative rates estimated from the catch trials.

In a first group of 32 subjects (9 normal subjects, 19 patients with glaucoma and 4 with cataract) we found that σ depended strongly on the deviation of the threshold from the age-corrected normal value. A regression equation on this deviation was clearly significant ($P < 0.0001$). A second group of 8 subjects (4 normals and 4 with glaucoma) were tested three times at each of two test locations. The σ-values in the second group were well predicted by the regression equation in the first group. Interestingly, the residual variation due to subject was non-significant while the location-dependent variation within subjects was significant ($P < 0.02$; analysis of variance in a nested model).

We conclude that the slope of frequency-of-seeing curves shows large variations. However, the major part of this variation is related to deviations from the age-corrected normal thresholds and the width of a subject's frequency-of-seeing curve may nevertheless be fairly accurately predicted.

14)

AN ANALYSIS OF SPATIAL SUMMATION USING HUMPHREY FIELD ANALYZER

Naoko Iyori, Genichirou Takahashi, Nobuyuki Koyama, Kenji Kitahara
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The characteristics of spatial summation in the visual field were examined using the Humphrey field analyzer(HFA). The threshold static perimetry was performed with the program 30-2 and 60-2 of the HFA using the test light size Ⅰ, Ⅱ, Ⅲ, Ⅳ and Ⅴ on 5 normal observers. The results were transferred into the computer and the results of 30-2 and 60-2 were compiled and analyzed. The coefficients of summation for each point of examination were calculated assuming that the summation curve is a straight line. The average of the coefficient of summation at 0' is 0.36, at up to 10' is 0.54, at up to 20' is 0.59, at up to 30' is 0.71, at up to 40' is 0.79, at up to 50' is 0.87 and up to 60' is 0.79. As a result, it was confirmed that the coefficient of summation increased with eccentricity. This method is useful for studying the characteristics of spatial summation in various diseases.

15)

Motion Perception in Patients with Ocular Hypertension and Primary Open-angle Glaucoma

Shinichi Moriya, Kimio Matsuda, Ikuo Azuma

(Osaka Medical College)

A new program has been developed which uses personal computers to analyze local motion perception in persons with ocular hypertension and primary open-angle glaucoma. The program displays 19×13 dots arranged in a matrix pattern on the CRT screen: one at a time, a sequence of dots moves randomly and reciprocally on the vertical and horizontal lines. The subject tells whether the dot is moving vertically or horizontally; the time of motion perception is thus obtained. It was found that motion perception was subnormal in patients with ocular hypertension and primary open-angle glaucoma.

16)

Temporal Modulation Perimetry In Glaucoma And Ocular Hypertension

E. J. Casson and Chris A. Johnson

Optics and Visual Assessment Lab, University of California, Davis

Temporal Modulation Perimetry (TMP) measures modulation sensitivity to 2, 8 and 16 Hz sinusoidal flicker at 44 locations in the central 30° visual field. To establish the efficacy of this method in predicting and following glaucomatous visual field loss, we have obtained longitudinal TMP measurements on 28 ocular hypertensive patients (OH) and 14 early glaucoma patients (EG). Eighty-four percent of EG patients showed reliable (consistent over 2 years) reduced sensitivity at all frequencies, while OH patients showed either a reliable reduction in sensitivity (15.1%) or an increase in sensitivity above normal values (22.6%). A small percentage (4% OH, 8% EG) show a mixture of high and low-sensitivity defects. In both groups, these abnormalities, which are generally localized, occur at all frequencies. However, the overlap between the location of defects in the same year is highest between the 8 and 16 Hz representations of the visual field. Analysis across the three years indicates that the largest defects and the greatest amount of overlap in location occur in the 8 and 16 Hz representations in both groups. Comparisons of TMP results with the results of concurrent standard automated testing demonstrate considerable overlap in defect location and suggest that TMP deficits preceed the onset and progression of visual field loss.

17)

THE NORMAL VISUAL FIELD IN LIGHT-SENSE, FLICKER AND RESOLUTION PERIMETRY

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130 eyes of 130 normal subjects with age 9 to 86 years (mean 43.7, ±19.0, median 45.0 years) were tested with the Humphrey-Field-Analyzer 640 (program 30-2), the automated flicker perimeter according to Lachenmayr [1,2] and the resolution perimeter according to Frisén [3]. The program of the flicker perimeter used in the present study examines 93 locations in the central visual field up to 40° of eccentricity. The program of the ring perimeter examines 50 points up to 30°. Subjects were excluded if they had: corrected visual acuity < 0.8, refractive error > ±5 dpt sph or 2 dpt cyl, the complete set of inclusion criteria is described elsewhere in detail [4]. For each individual the visual field tests were performed in random order using a short introductary learning program for each test procedure. The statistical analysis of the data shows a highly significant pairwise correlation between global visual field indices: Mean Sensitivity MS for the Humphrey-Field-Analyzer, Mean Flicker Frequency MF for the flicker perimeter and Mean Ring Score MR for the ring perimeter. The correlation coefficients are as follows: MF/MS: $r = 0.5320$, $p < 0.0001$; MR/MF: $r = -0.2753$; $p = 0.0015$; MR/MS: $r = -0.5935$, $p < 0.0001$. The results of the present study provide the possibility to convert normal data between the three different perimetric procedures.

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18)

LUMINANCE THRESHOLD FLICKER PERIMETRY IN PRIMARY OPEN ANGLE GLAUCOMA, OCULAR HYPERTENSION AND NORMAL CONTROLS: THE EFFECT OF FLICKER FREQUENCY

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Recent anatomical and physiological experiments in primates, and clinical evidence in humans has suggested that in glaucoma the axons originating from larger retinal ganglion cells suffer preferential loss early in the disease process. These larger diameter fibres have differing pschophysical properties from smaller ones; in particular they respond to stimuli of low spatial, but high temporal contrast, (together with motion detection and steriopsis).We have designed and built an automated flicker perimeter to further investigate temporal contrast sensitivity in glaucoma.

Luminance threshold flicker perimetry was carried out in four groups each of ten subjects; patients with primary open angle glaucoma, "low" and "high" risk ocular hypertensives, and normal controls. The rates of flicker employed were 5, 10, 15, 20, and 25 Hz. The results are presented and discussed in terms of the ability of the various rates to discriminate between the groups.

19)

LARGE FIELD SINUSOIDAL FLICKER TESTING SEPARATES GLAUCOMA PATIENTS FROM NORMALS

Alain Béchetoille and Bertrand Boussion
Ophtalmologie/CHU, 49033 ANGERS CEDEX 01 FRANCE

In an attempt to get a rapid screening clinical test between glaucoma patients and normals, we have studied their temporal modulation transfer function (TMTF)(De Lange curve) with a yellow light-emitting diode with a 5 mm diameter, providing an illumination of 14 candela/m2 which was seen at a 32° angle on a black background by using a special ocular. Participants observed flickering, with undilated pupils, at a distance of 25 mm. The diode was modulated in terms of both sinusoïdal contrast (0,1 % to 100 %) and frequency (6 to 62 Hz). All glaucoma patients (chronic open angle glaucomas, normal pressure glaucomas, early glaucomas) were tested with their intraocular pressure normalized, by medical and/or laser and/or surgical treatment, below 21 mmHg.

Although there is an important variability of TMTF in all groups including normals, all the glaucoma patients groups showed a marked depression of TMTF culminating between 16 and 30 Hz with a sensitivity of 85 % and a specificity ranging from 80 % to 93 %, depending from the type of glaucoma.

20)

PERIMETRIC STUDIES ON LONG-TERM HYPOTENSIVE GLAUCOMAS AFTER FILTERING SURGERY BY INTRAOPERATIVE MITOMYCIN APPLICATION

Por T. Hung, Tzyy-Chang Ho, Jui-Wen Hsieh, Pei-Fen Liu and Yu-Chih Hou
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Intraoperative application of mitomycin as adjunctive measure to enhance filtering effect has been popularized in recent years. One of the most important characteristic picture of mitomycin application is long-term maintenance of lower intraocular pressure of below 12 mm Hg post-operatively in most unventful cases.

The present study was carried on 20 glaucoma eyes to evaluate the visual field change by Octopus 2000 in these glaucoma patients who maintain a long term low intraocular pressure of less than 12 mm Hg through out the post-operative course for more than six month period. The reservsible visual field defect and its implication will be discussed.

21)

A LONG-TERM VISUAL FIELD EVALUATION OF GLAUCOMA PATIENTS TOPICALLY TREATED WITH TIMOLOL OR CARTEOLOL

Aharon Wegner, Ian A. Ugi and Hans Hofmann / Augenklinik rechts der Isar, Technical University of Munich, Ismaningerstr. 22, 8000 München 80, Germany.

48 patients with glaucoma treated with topical non-selective ß-blocker medication for 4 to over 10 years were examined in a retrospective study to evaluate the effectiveness of the therapeutic approach on the visual field loss and the possible influence of systemic hypertension on visual field deterioration.

According to the topical medication received for lowering the IOP to a value of under 22 mm Hg the patients were assigned to one of two groups:

-55 eyes of 32 patients (18 eyes of 10 systemic hypertensive) received Timolol monotherapy
-32 eyes of 16 patients (14 eyes of 7 systemic hypertensive) received Carteolol monotherapy

Patients visual fields including the short term fluctuations were evaluated at the beginning and the end of the observation period (Octopus 201 Programm 31/23 or G1) and a yearly visual field loss in each quadrant and at the center was calculated. There was no significant difference in visual field deterioration between the two groups. A comparison of systemic hypertensive and non hypertensive patients showed a significantly lower visual field loss in hypertensive patients of both groups.

Timolol and Carteolol seem to be equally effective in treatment of glaucoma. Glaucomatous patients with systemic hypertension topically treated with ß-blockers might have a lower risk of visual field deterioration.

CHAIRPERSON: F. DANNHEIM
CO-MODERATORS: M. ARAIE
G. TOMITA

Fri., Oct., 23
5:00 PM — 6:15 PM

1)

Correlation of Asymmetric Differences of Visual Fields with Asymmetric Differences in Optic Disc Cupping and Pallor and Retinal Nerve Fiber Layer Thickness in Primary Open Angle Glaucoma

Takenori Takamoto, Ph.D., Bernard Schwartz, M.D., Ph.D.
and Vinay Nangia, M.D.

Thirty-six primary open angle glaucomas were selected who showed asymmetric visual field loss. Absolute measurements were than made of the optic disc area using Littmann's magnification correction formulae. Optic disc cupping and retinal nerve fiber layer thickness were measured using stereophotogrammetric techniques and optic disc pallor using computerized image analysis. Visual fields were obtained using Octopus perimetry. Differences between eyes were determined as right minus left eye. Correlations were obtained between the disc and the nerve fiber layer measurements and the visual field measurements. Results showed that for the total disc, the most significant correlation was obtained between optic disc cup depth ($r = 0.4796$, $p < 0.05$) for differences between eyes and visual field loss. Results will be presented also for the quadrants of the disc. Our data suggest that asymmetric differences between eyes are more useful in correlating structural change with functional loss in primary open angle glaucoma.

2)

Positive correlation between rotation the disc and location of glaucomatous scotomata.

Etsuo Chihara MD, Kyoto University, Kyoto

Rotation of the optic disc (rotation of weak points in the optic nerve head around the anterior-posterior axis of the eye) may be a factor for atypical visual field loss. To substantiate this hypothesis, we studied a location of glaucomatous scotomata (S) with Octopus and rotation of the optic disc in 28 eyes.
When the optic disc was oval and the inferior pole was close to the fixation (in-rotation), the distance between the central fixation (CF) and superior glaucomatous scotoma (S) was shorter than that between the CF and inferior S in 16 of 18 eyes.
While, eyes with out-rotation (superior pole of the disc is close to the CF) had shorter distance between the CF and superior S in only 2 of 10 eyes ($P<0.01$, Fisher's exact test).

Our result suggest that rotation of the disc correlate with a distance between the glaucomatous scotomata and central fixation.

3)

LATERAL DIFFERENCES IN SHAPE AND COLOUR OF THE OPTIC DISC - ARE THERE ANY CORRELATIONS?

Zenker, H.-J., Mierdel, P., Marré, E.
Eye Clinic, Medical Academy, Dresden

Morphometric and colour measurements of the disc were performed to disclose lateral differences of the eyes in normals, ocular hypertensives and primary open-angle glaucomas using stepwise multiple correlation analysis.

For the whole sample lateral differences of the cup and rim were significantly depending on those of the disc (p 0.0000). Moreover, the eye with the greater disc had commonly a paler appearance of its temporal rim (p = 0.0199).

Only in primary open-angle glaucoma there were an additional significant relationship between lateral differences of cup and colour index of the temporal rim (p = 0.0133), whereas upper and lower rim correlations reached borderline significance.

4)

A MEASUREMENT-VALUE FOR THE THICKNESS OF THE NERVE FIBER LAYER AND THE CONFIGURATION OF THE EXCAVATION IN GLAUCOMA PATIENTS - A CLINICAL STUDY USING THE LASER TOMOGRAPHIC SCANNER (LTS)

E. Gramer, H. Maier, E. Messmer, University Eye Clinic Würzburg, Germany

153 eyes (82 patients) with ocular hypertension (OH), primary open angle glaucoma (POAG), low tension glaucoma (LTG) and healthy persons were examined with the LTS and Octopus perimeter 201 to evaluate the following two questions:
I. Can we find a parameter for the thickness of the nerve fiber layer in eyes with Elschnig scleral ring? In 63 eyes of 63 patients with scleral ring we measured the difference in height between the scleral ring and the retina in 250 µm distance at three defined points at the temporal margin of the optic disc: 1.) In 80% of the patients a smaller difference in height could be related to a greater visual field loss in the corresponding quadrant of the visual field. 2.) In healthy persons there was a decrease of the height difference with increasing age and a decrease with larger diameters of the optic nerve head. As this difference in height correlates with the visual field loss and clinical findings it might describe the thickness of the nerve fiber layer.
II. Is there any difference in depth and configuration of the excavation in eyes with POAG and LTG? In comparison to POAG in the same stage of the disease, eyes with LTG showed: 1.) a greater depth of the excavation in all stages except stage I. 2.) a significant steeper slope and a more flat and larger bottom of the excavation in stage I and II. Stages III to V showed no difference in the configuration of the excavation.

5)

COMPARISON OF CLINICAL METHODS TO DETECT STRUCTURAL DAMAGE FROM EARLY GLAUCOMA.
Daniel J. O'Connor, Joseph Caprioli, Thierry Zeyen. Yale School of Medicine, Department of Ophthalmology and Visual Science, New Haven, CT

The methods used to assess optic nerve damage in glaucoma require careful critical comparison. We determined the sensitivity, specificity and diagnostic precision of qualitative optic disc and NFL evaluation in 51 normals and in 132 glaucoma patients with early to moderate visual field loss. Qualitative evaluations were performed by three experienced, masked observers who independently graded stereoscopic color disc and monochromatic NFL photographs. Two of these observers needed to agree to be counted.

	Sensitivity	Specificity	Diagnostic Precision	Kappa
Disc Eval	73%	98%	80%	0.59
NFL Eval	70%	89%	74%	0.47

The precision of disc evaluation was superior to NFL evaluation. Kappa values indicate good inter-observer agreement. Future work will evaluate the relative ability of these methods to detect longitudinal change.

6)

CHOROIDAL PLEROMETRY: CLINICAL APPLICATION
G.N. Lambrou, T.J.T.P. van den Berg, F. Temporelli, E.L.Greve
Glaucoma Center & Medical Physics Dept., University of Amsterdam

We have previously reported an image-processing method for quantitative assessment of the choroidal hemodynamics from fluorescein angiograms. Earlier results from 16 experimental monkey angiograms had shown a linear relation between perfusion pressure and the estimated perfusion rate, indicating the lack of choroidal autoregulation. Sample results from 50 glaucoma and diabetic eyes are reported here. Appearance time maps showed the disk to fill simultaneously with the choroid, suggesting a common arterial source. In perfusion rate maps, the segmentation into territories supplied by different arteries was often evident, as well as the functional lobular segmentation. Microaneurisms showed as low-perfusion, highly fluorescent spots, and a "dye-leakage rate" was estimated in diabetic retinopathy eyes. The potential application field of the method includes glaucoma, diabetic retinopathy, ischemic macular disorders and the evaluation of the effects of general or topical drugs on the choroidal and optic nerve head circulation.

7)

VISUAL-FIELD DEFECTS AND PERIPAPILLARY CHOROIDAL BLOOD FLOW IN NORMAL-TENSION GLAUCOMA

Ch. Prünte, D. Stümpfig, and J. Flammer; University Eye Clinic, Basel, Switzerland

In 24 normal volunteers and 15 patients with normal-tension glaucoma, visual-field examinations using the Octopus perimeter with Program G1, and Indocyanine green (ICG) video-fluorescence angiography were performed. In all patients no history of ocular diseases or visual disorders other than normal-tension glaucoma was known. A choroidal-blood-flow parameter, mean arterial filling time (AFT), was determined by statistical image analysis in three measuring fields in the temporal peripapillary area. Furthermore, mean defects (MD) were calculated in areas of the central visual field corresponding to those ICG-measuring fields.
Three noteworthy results were obtained: 1. Systolic arterial blood pressure was significantly lower in patients with normal-tension glaucoma; 2. Arterial filling times were significantly increased in normal-tension glaucoma; and 3. The AFT was correlated to the MD in each respective visual field area. These results provide a further indication that disturbances in peripapillary choroidal perfusion and, thus, in the microcirculation of the optic nerve head are involved in the pathogenesis of normal-tension glaucoma.

8)

COMPARISON OF VISUAL FIELD DEFECTS AND OPTIC DISC CUPPING IN LOW-TENSION GLAUCOMA AND PRIMARY OPEN ANGLE GLAUCOMA

M.Fujii, N.Katsumori and K.Mizokami*
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Dept. of Ophthalmology, Kobe University*, Kobe, Japan

In this study, matching the stage of involvement, the relation of disc cupping to visual field defects(VFD) was compared between LTG and POAG.

49 eyes of 30 patients with LTG were compared with 45 eyes of 31 POAG patients. Appearence of disc cupping was divided into generalized enlargement type and notching type, and the vertical cup to disc ratios were also determined. Visual fields were tested by OCTOPUS 201 using program 31. The patterns of VFD were divided into 3 groups (P type; sensitivity loss in paracentral area, B type; loss in Bjerrum area, N type; loss in nasal peripheral area). Total loss in decibels were employed as the degree of VFD. The relation of C/D ratio, the pattern of VFD and total loss was compared between LTG and POAG.

As a results of matching the stage of involvement, the differences of the clinical characteristics between LTG and POAG could not be found.

9)

ANGIOSCOTOMAS IN AUTOMATED PERIMETRY: DIAMETER AND LOCATION OF NEIGHBORING VESSELS

A. B. Safran, A. Halfon, E. Safran, G. van Melle, and C. Mermoud
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Ten normal eyes were tested with the Octopus 2000R, using a 0.41° light stimulus. Sensitivity was quantified in points located around the blind spot, according to a regular, 0.5° constant, grid pattern. From 336 to 443 locations were tested in each eye. The result print-outs were superimposed on corresponding fundus photographs. At each tested point, the following ten parameters were evaluated : the respective diameters of the closest, the second closest, and the third closest vessels (expressed in 0.1° units); the respective distances from the apparent location of the tested point to the closest, the second closest, and the third closest vessels (in 0.25° units) ; and, finally, the distance between the two closest vessels (in 0.25° units). Altogether, 3869 locations were tested, and 42559 values were quantified.

The following two conditions were found to be related to reduction in sensitivity. (1) Proximity (<0.25°) to a large vessel (≥0.5° in diameter); (2) proximity (<0.25°) to one of two adjacent (<0.5° distant), moderately large vessels (0.3° or 0.4° in diameter). In 51.3% of the locations showing less than 26 dB, decrease in sensitivity could be explained by condition 1 (specificity 92.2 %), in 16.2 % by condition 2 (specificity 98.3 %), and in 67.6 % by condition 1 or 2 (specificity 90.51 %). Although studying angioscotomas by SLO might show higher correlations, evaluation with automated perimetry better illustrates the observations made in everyday practice. Clinical implications are important. (SNFSR, grant # 32.27842.89.)

10)

USING THE HIGH-PASS RESOLUTION PERIMETER IN DETERMINING THE USEFULNESS OF THE CPF LENSES IN RETINAL DYSTROPHIES

Kaori Oyama, Takanari Tokuhisa, Kenji Kitahara, Ryutaro Tamaki
Jikei University School of Medicine, Tokyo, Japan

In order to determine the usefulness of the CPF lenses for patients with retinal dystrophies, we measured the visual field of 10 normal observers and patients with 14 retinal dystrophies using the high-pass resolution perimeter. These measurements were taken both with and without the CPF lenses. It was found that there was a slight decrease of sensitivity in the normal observers when using the CPF lenses. On the other hand some of the patients with retinal dystrophies measured a significant increase in sensitivity, while others showed a significant decrease in sensitivity. Therefore, it is felt that the high-pass resolution perimeter can be an important means of determining the usefulness of the CPF lenses for retinal dystrophies.

11)

A DISSOCIATION OF THRESHOLDS BETWEEN GOLDMANN KINETIC PERIMETRY AND HIGH-PASS RESOLUTION PERIMETRY IN RETINITIS PIGMENTOSA.

Takanari Tokuhisa, Ryutaro Tamaki, Kaori Oyama, Kenji Kitahara
Jikei University School of Medicine, Tokyo, Japan

We studied the differences between the automated static perimetry of high-pass resolution perimeter and the kinetic perimetry of Goldmann perimeter in 11 patients with retinitis pigmentosa. There were 13 quadrants in which the largest target was not recognized in a total of 7 eyes of 5 patients even though their visual field showed symmetrical isopter in upper and lower or right and left quadrants in the Goldmann perimetry. We will discuss the causes of the dissociation of thresholds between Goldmann kinetic perimetry and high-pass resolution perimetry in retinitis pigmentosa.

12)

VISUAL FIELD AND VITAMINE A DEFICIENCY

Polizzi A., Bovero M., Brezzo M.V., Gesi R., Barbetta M., Gandolfo E., Fioretto M. (University Eye Clinic of Genoa, Italy)

The Authors describe the perimetric findings (Perikon PCL 90; program DSK) in 15 patients suffering from severe vitamine A deficiency following bilio-pancreatic by-pass surgery for pathological obesity (7 subjects) or synthetic retinoid fenretinide treatment in brest cancer patients (8 subjects).

In all patients abnormal dark-adaptation time, ERG and ocular surface were found.

Visual field examination showed diffuse decrease of sensitivity with an increase in MD and isopteric contraction as well as localized relative defects in the paracentral area with significant alteration of LV.

All perimetric deficits normalized after vitamine A administration.

13)

THE ROLE OF COMPUTERIZED PERIMETRY IN PRE-OPERATIVE EXAMINATION OF PATIENTS WITH SENILE CATARACT AND MACULAR DEGENERATION

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Computerized perimetry was used during pre-operative examination of 18 patients with SMD and senile cataract. 20 degrees of central visual field were tested using threshold strategy of the Humphrey Field Analyzer. ECCE with implantation of sphero-prismatic IOL was performed in all patients. The main aim of perimetric examination was to find paracentral areas in good functional condition (according to light sensitivity measurements). After implantation of sphero-prismatic IOL the projection of visual image on the retina was moved from the central area with severe functional loss to more sensitive zone of the central retina. The operation was most effective when the newly formed fixation point was situated not farther from the fovea than at 8 degrees.

14)

RETINAL TOXICITY OF SILICONE OIL STUDIED BY MEANS OF COMPUTERIZED PERIMETRY

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ISTITUTO DI OFTALMOLOGIA UNIVERSITA' CATANIA - ITALY

The Authors studied the variations of retinal function by means of computerized peri metry on patients operated on by vitrectomy with silicone oil tamponade. The aim of the study is to verify eventual retinotoxic effects of silicone. They performed the perimetric examination on a group of 18 patients treated for vitreoretinal pathologies and selected from a large number of cases. The selection criteria were: good postopera tive conditions and sufficient visual acuity. Silicone remained in the 18 eyes for a period of 120 days +/- 15. Five exams (Macular Threshold Test of Humphrey Field Analy zer= 16 points + foveal threshold) were performed: two, during the period of permanen ce of silicone oil in the vitreous cavity, and three after its removal. The Authors considered the SLD for every point tested by the program (total points 17) and calcula ted the mean value of these points for each test, making statistical comparison. T test and Anova test applied to their results did not show significative variations of SLD. These data suggest lack of retinotoxic effect of silicone when it is removed within 5 months.

Key words: Silicone oil, Computerized Perimetry, Retinotoxic effect.

15)

DO LASER SCARS GROW IN SPITE OF SUCCESSFUL LASER-COAGULATION OF SUBRETINAL NEOVASCULARIZATIONS (SRNV) ?

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There are reports (Morgan et al, Ophthalmology 96 (1989) 96-103) about growth of laser scars after coagulation of srnvs. However, a prospective, longitudinal study including an analysis of changes in the visual field has not yet been performed.

Patients and methods: In 7 patients, 8 srnvs (age-related, idiopathic, POHS) were successfully treated by lasercoagulation. Angiography and perimetry were done several times over a mean period of 5,5 months. Following photographic enlargement, the angiograms were in random order presented to two examiners who measured the area of the laser scars. Perimetry was done using special Octopus software testing 48 points of the central 12 ° of the fundus. Mean sensitivity and the number of points with a differential light sensitivity of ≥ 5 and 10 dB below the normal values were used for further analysis.

Results: Laser scars increase 21 % of their initial size (no significance, regression-analysis). The mean sensitivity rises by 1.4 dB. The number of points ≥ 5 and ≥ 10 dB below the normal Octopus values reduces on the average by 6.9 and 3.4, respectively. Laser scar scotomata do not grow.

Discussion: Our (preliminary) results differ from those in the literature. We compare our patients, our way of analyzing the data, and our laser technique to those of other authors.

16)

A TOUCH-SCREEN MULTI-STIMULUS VIDEO-CAMPIMETER

Mutlukan E., Keating D., Damato B.E.
Tennent Institute of Ophthalmology, Glasgow

A novel computerised test is developed for the examination of central 30 degree visual field with simultaneous exposures of multiple stimuli. The test operates on an IBM compatible personal computer fitted with an additional Touch-Screen high resolution monitor and a printer. Stimuli contrasts, coordinates and grouping formats, sizes and duration can be changed under operators control. The test requires conventional steady fixation at a centrally located mark on the Touch-Screen monitor in 30 cm viewing distance. A set of stimuli (either 1,2,3 or 4) at different coordinates are presented simultaneously by the operator at each step and patient is required to touch on the screen at the approximate locations where the stimuli appeared. Computer checks the correlation between the patient responses and stimulus coordinates and records the untouched stimulus locations and stimulus values. These steps are repeated until the whole grid is completed. Results can be saved and printed at the end. The test makes the threshold contrast sensitivity determination possible for both conventional bright-on-dark and also dark-on-bright perimetric stimulus across the central visual field. This equipment should be useful for both screening and quantifying visual field defects at low cost as well as bringing additional clinical information in glaucomatous and neurological visual system involvement with by using dark-on-bright stimulus.

17)

PRELIMINARY REPORT ON OBJECTIVE PERIMETRY BY VISUAL EVOKED POTENTIALS

Fioretto M., Fava G.P., Burtolo C., Gandolfo E., Zingirian M.

(University Eye Clinic of Genoa, Italy)

The Authors report a preliminary study on the objective assessment of target perception up to 25° eccentricity by visual evoked potentials (VEP).

A flash full field stimulator was appropriately modified to allow the stimulation of a predeterminate grid of points.

12 healthy volunteers were subjected to stimulation of 20 points by means of decreasing light intensity stimuli, and VEP were registered until the traces were no longer recordable.

Our data showed the possibility to objectively quantify perimetric thresholds.

18)

CLINICAL EVALUATION OF A NEW COMBINED FLICKER AND STATIC PERIMETER

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Recent evidence suggests that the earliest histological optic nerve and retinal ganglion cell damage in glaucoma results in a reduction in retinal thresholding of temporally modulated targets. To investigate this issue, we have designed and constructed an automated flicker and static bowl perimeter using high luminance, red, 1° light emmiting diodes. We have written flexible computer software to allow for customisation of different test strategies, and also included standard perimetry programmes.

In this report, we describe the physical characteristics of the apparatus and present clinical findings of flicker and static perimetry in ocular hypertensive and glaucoma patients. We compare our results for static thresholding of retinal sensitivity with the Humphrey Field Analyser using equivalent sized targets.

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