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Occupational Vision

La Vision au Travail

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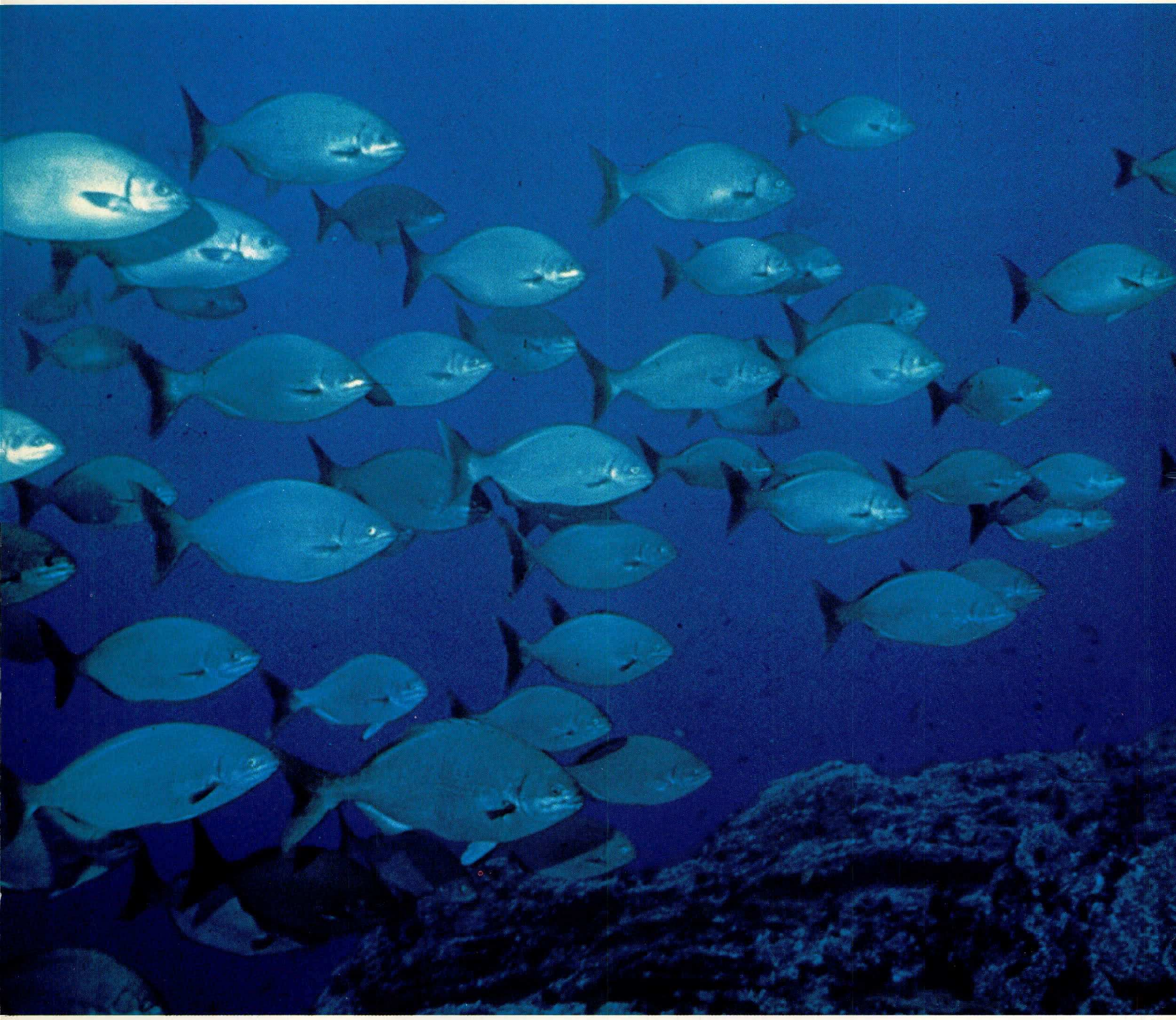

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1. Gorn, R., Opthalmology Times p. 1 March/81
* Potassium Sorbate

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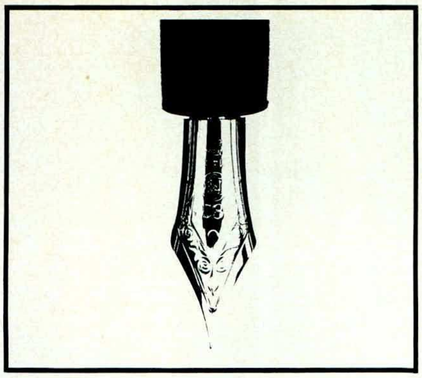

EDITORIAL

Militancy in Ophthalmology: An Hypothesis

An individual who is happy and contented in his calling is far less likely ever to develop a bias or an antagonistic attitude, let alone an antisocial attitude, than one who feels that he is abused and so vents his ire upon those he assumes are the cause of his troubles, real or imagined.

It is from this basic principle that the following hypothesis is enunciated as a possible explanation for the frequent ophthalmological attacks upon optometry.

Ophthalmology, often called the "Queen of Specialties", is one of the more sophisticated areas of medical practice, perhaps second only to neurology. The time, effort and interest required by the candidate student to obtain certification in this specialty makes it a genuine accomplishment and something in which one can take a good deal of pride. It offers a scope of practice which, when well-performed, can only lead to great personal satisfaction and respect by patients, colleagues and sister professions.

What then goes wrong to make an individual or individuals who are intelligent enough to graduate from medical school and obtain certification in ophthalmology, unreasonable, indeed paranoid, when presented with the accomplishments of optometry?

We have pondered this for years, vainly attempting to explain the phenomenon. It should not be from fear of unfair financial competition, because the ophthalmologist has the second highest earnings in medicine. It could be even higher if he spent his time with surgical and medical care, in lieu of doing refractions.

When he obtains his certification, his expectations are, logically, that he will spend his time practising ophthalmology.

What a letdown he must experience when he realizes that most of his time, up to 70% or more, is spent practising optometry, i.e. "examining eyes to determine their ocular and binocular status".[1]

Why should such a person whose training is in the care of disease spend so much of his time practising optometry? We suggest that there are insufficient medical eye care and surgical cases available to keep the oversupply of ophthalmologists busy in their specialty of surgery and medical therapeutics. This lowered patient flow derives from the following facts:

i) Progress in medicine and pharmacology. Years ago, numerous systemic conditions and infections caused secondary ocular conditions. Since the advent of antibiotics, the family physician can control the systemic condition and thus avoid many secondary effects such as iritis and choroiditis. Improved medications permit better control of diabetes and vascular conditions. Multiple visits to the ophthalmologist are reduced, if not completely eliminated, in many cases.

ii) The greater use of the family physician in primary eye care. Ophthalmology, in its attempt to destroy optometry, wants family physicians to shoulder an ever greater volume of eye care.[2] Assuming that the family physician can find time in an already heavy schedule, surely this can only result in a further reduction in the flow of patients to ophthalmology.

iii) Overproduction in the number of ophthalmologists trained. Ophthalmology claims that the specialty is undermanned and maintains an inordinate number of ophthalmological residencies, paying little attention to the cost to the taxpayer of these facilities or to how these excess people will find the medical and surgical patients to maintain a reasonable competency in their field. Canada has three times as many ophthalmologists per capita than they do in Great Britain.[3] Certainly the population is increasing. Aging and geriatric problems, particularly cataract and vascular conditions, will increase. An excess of ophthalmologists, however, does not mean fuller employment in their specialty, but rather that simply more ophthalmologists will be practising optometry.

Is official ophthalmology and medicine being fair and honest with young medical graduates in encouraging them to opt for ophthalmology? Will public bodies who pay for their training continue to support such a waste of intellect and manpower?

iv) Population ratio. According to medical statistics, it requires a population of at least 35,000 to keep an average ophthalmologist busy under present conditions, and far more if he practises *only* his specialty. In Canada, there are only 75 cities with a population of 50,000 or more.[4] What town of lesser population can provide surgical and hospital facilities for an ophthalmologist and keep him busy in his area of expertise? Specialized, high-technology equipment, e.g. ultrasound, lasers, brain scanners, V.E.R., E.E.G. and others, will be utilized only rarely in small towns, and so places these items beyond economic reality.

The excess number of ophthalmologists can be reduced to a rational ratio by attrition, and by a reduction in the number of training residencies. The money thus saved could then be applied to other fields of medicine where manpower is lacking. Eventually, ophthalmologists will be practising what they are certified to perform — surgical and medical therapy — not optometry. Moreover, from a more frequent practice of their specialty, they will become more competent surgeons, so fully occupied with the field that it will be obvious to health care planners that the public will be better served *in the non-medical aspects of vision care* by the optometrist. The training of optometrists in refraction, ophthalmic optics, binocular vision and low vision is superior to that of the ophthalmologist who presently engages in these activities to supplement his income from a lack of medical and surgical patients.

Recent statistics reveal that an ophthalmologist performs, on average, less than two operations per week.[5]

Apart from the waste of highly-trained skills and the high cost to the taxpayer, there are other sociological effects. Confusion of the public arising from interdisciplinary bickering is one. Higher fees to the patient and to health care plans is another. But for some individual ophthalmologists, there is a serious statistic. The suicide rate among the "non-surgical" ophthalmologists is the third highest among the medical specialties.[6] Could there be some relationship between this rate and the deception experienced by the student who, after certification, finds that his practice is 70% or more optometry, and less than 30% ophthalmology?

G.M.B.

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5. Where have all the patients gone? *Medical Economics* 59, No. 26; December, 1982.
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Convocation '83
University of Waterloo

Alumni gold medal winner — Dr. Toby Mandelman receives medal from Dr. Josef Kates, University of Waterloo chancellor at UW's forty-sixth convocation — May 27, 1983.

The 1983 Commencement exercises at the University of Waterloo were exceptional for Optometry. Dr. Glenn Fry, former Director of the School of Optometry, Ohio State University, addressed the assembly of students, faculty, parents and friends on the occasion of the Awards night for the class of '83.

Professor Long, Director, opened the evening with a few words of welcome, and then introduced Dr. Fry to the gathering. Following the Awards ceremony, C.A.O. President Dr. Roland des Groseilliers congratulated the new graduates and invited all of them to become involved in their respective local, provincial and national associations. Finally, Dr. Bruce Hawkins, President of the College of Optometrists of Ontario, presented licenses to those graduates remaining in Ontario.

For the first time in the University's history, the Faculty of Science Gold Medal for general excellence in undergraduate academic achievement was awarded to an optometry student. Toby Mandelman is the first optometry student ever to achieve this high distinction, and our congratulations go to her for this accomplishment.

The list of awards in optometry grows longer with each passing year. 1983 saw the presentation of four new awards: the A.W. Cole Award for Clinical Excellence; the Essilor Award for Clinical Excellence in Optics (which must be considered an outstanding contribution, for what would optometrists be without optics?); the Ciba Vision Award for Clinical Excellence in contact lens work and the Leopold Lacourciere Award for General Proficiency Awarded by the Ontario Association of Optometrists District #3. Details on all the awards and prizes follow, as well as the names of this year's graduating class members.

Awards and Prizes, 1983

The General Proficiency Medal Awarded by the College of Optometrists of Ontario
Toby Mandelman

A.W. Cole Award for Clinical Excellence
Stewart Katz

Ciba Vision Care Award for Clinical Excellence
Donna Mockler

Essilor Award for Academic and Clinical Excellence in Optics
Toby Mandelman

The Bausch & Lomb Optical Soflens Division, Outstanding Achievement Awards
First Prize — *Laurie Mageau*
Second Prize — *Debbie Currie*
— *Toby Mandelman*

The Bernell Clinical Optometry Award for Excellence in Orthoptics & Visual Training
Scott Mundle

The T.T. Beattie Award for Orthoptics and Visual Training
Debbie Currie

The E.F. Attridge Prize for Highest Achievement in Pathology
Toby Mandelman

The Canadian Contact Lens Society Prize
Bruce Pierce

The Percy Hermant General Proficiency Prizes
First Prize — *Toby Mandelman*
Second Prize — *Laurie Mageau*

The Lepold Lacourciere Award for General Proficiency Awarded by the Ontario Association of Optometrists, District #3
Adriana Filippone

The J.C. Thompson Memorial Prize for Optometry
Patty Hrynchak

William Feinbloom Low Vision Award
Toby Mandelman

The K-W Optical Company Limited Prizes
First Prize — *Stewart Katz*
Second Prize — *Stephen Frohlich*

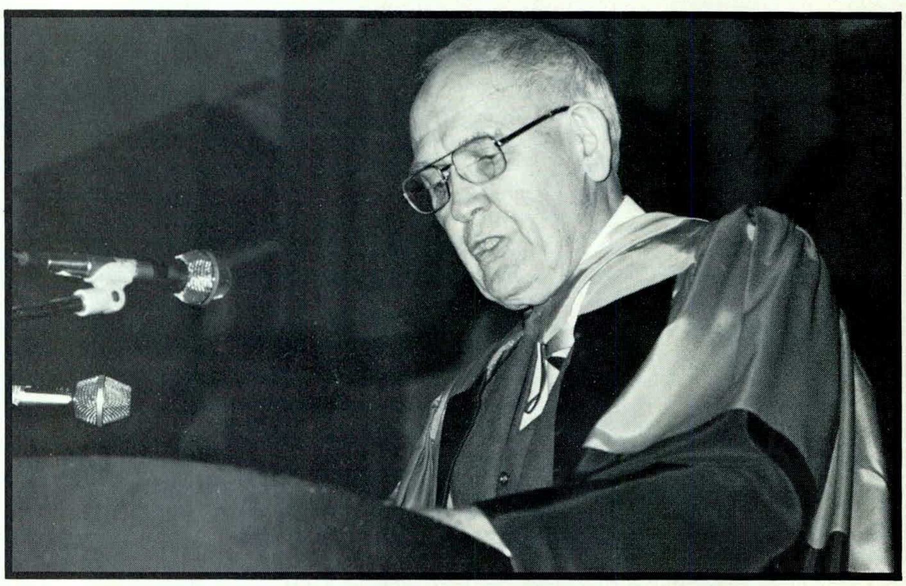
Prize for Academic Excellence in Ocular Pharmacology
Patty Hrynchak

Dean of Science Honours List
John Bettello
Angela Bratina
Julia Galatis
Patty Hrynchak
Elizabeth Irving
Laurie Mageau
Toby Mandelman
Bruce Pierce

Graduates — Doctor of Optometry 1983

Bass, Harvey	Winnipeg, Manitoba	Louie, Julie	Vancouver, British Columbia
Beange, Gordon	Sudbury, Ontario	Lutzi, Frank	Kitchener, Ontario
Bernacki, Ryan	Calgary, Alberta	Mageau, Laurie	Haileybury, Ontario
Best, Gary	Kippens, Newfoundland	Malik, Pamela	Bridgewater, Nova Scotia
Betello, John	Sault Ste. Marie, Ontario	Mandelman, Toby	Kitchener, Ontario
Bishop, Donald	Red Deer, Alberta	Manoff, Barry	Toronto, Ontario
Blaschuk, Gary	Winnipeg, Manitoba	Mockler, Donna	Oromocto, New Brunswick
Bojeczko, Donna	Burlington, Ontario	Mundle, Scott	Calgary, Alberta
Bratina, Angela	Sault Ste. Marie, Ontario	Murphy, Michael	St. John, New Brunswick
Brouwer, Annette	Edmonton, Alberta	Neumann, Robert	Regina, Saskatchewan
Chung, Archie	North York, Ontario	Neumann, Roderick	Regina, Saskatchewan
Coward, Bruce	Trenton, Ontario	Ng, Albert	Toronto, Ontario
Currie, Debra	St. Agatha, Ontario	Onstein, W. Robert	Terrace, British Columbia
DeBono, Emanuel	Mississauga, Ontario	Padfield, Paul	Waterloo, Ontario
Dumalo, Antoinette	Vancouver, British Columbia	Pazur, Alan	Ruthven, Ontario
Falconer, W. Terry	Kitchener, Ontario	Pierce, Bruce	Niagara Falls, Ontario
Filippone, Adriana	Sudbury, Ontario	Pogue, Mark	Cobourg, Ontario
Frohlich, Stephen	Thornhill, Ontario	Ryba, Edward	Sydney, Nova Scotia
Galatis, Julia	Bramalea, Ontario	St. Amand, Louiselle	Aroostook, New Brunswick
Georgi, Michelle	Scarborough, Ontario	Sanger, Brad	Kingsville, Ontario
Hiscock, Paul	St. John's, Newfoundland	Schnarr, Sandra	Waterloo, Ontario
Holroyd, Douglas	Calgary, Alberta	Simpson, Robin	Vancouver, British Columbia
Hrvatin, Doris	Chatham, Ontario	Trinaistich, Lucy	South Porcupine, Ontario
Hyrnchak, Patricia	Saskatoon, Saskatchewan	Vagners, Roberts	Toronto, Ontario
Iftody, Barbara	St. Albert, Alberta	Vetsch, Conrad	Calgary, Alberta
Irving, Elizabeth	Kelvington, Saskatchewan	Watters, Timothy	Sudbury, Ontario
Katz, Stewart	Sudbury, Ontario	Wensveen, Janice	Edmonton, Alberta
Kemp, Robert	New Liskeard, Ontario	White, Nixon	New Liskeard, Ontario
Lachoski-Powell, Dianne	Waterloo, Ontario	Wooten, April	Hamilton, Ontario

CONVOCATION ADDRESS



Dr. Glenn A. Fry, College of Optometry, The Ohio State University, Columbus, Ohio addresses University of Waterloo Forty-sixth convocation — May 27, 1983.

Glenn A. Fry

Chancellor Kates, President Wright, Deans and Members of the Graduating Class of 1983, and all of those near and dear to them.

I am most happy to be your commencement speaker. As a teacher, I have worked with many groups of students from entrance to graduation and I always get a thrill to see each group reach this moment of excitement and jubilation at which they tuck their diplomas under their arms and face the real world.

In order to figure out what I might do or say on this occasion, I have tried to think of my own graduation. I do not remember who the commencement speaker was or what he said. This has led me to the grim realization that anything I say is not apt to be long remembered. On the other hand, I am relieved to know that it is not necessary for me to say anything profound or wise. I do hope I can contribute to your sense of achievement and help bring your jubilation to a cresendo and send you on your way.

Coming back to my own graduation, the one thing I can remember well is that my parents were there. For them it was the culmination of years of sacrifice and hope. They believed that education was the most valuable gift they could bestow and my graduation meant to them a mark of success and a source of pride. They were simple people who revered such things as truth and beauty and honesty and goodness. I have come to realize that they were my finest teachers and the principles that they taught by example and word of mouth were the most important lessons I ever learned. I regard graduation first of all, therefore, as an occasion for expressing to our parents our love and appreciation.

When I graduated, a wife was something to dream about but many of you graduates have picked your partners and shared with them the joys and woes of reaching this point in time. To them also we must express our love and gratitude.

I want to begin what I have to say by telling you the story of a young lad who was applying for a job. The head of the company who was interviewing him asked him if he knew the motto of the company. The young applicant said: "Yes sir. It is 'push'. I saw it on the front door as I entered the building".

Chancellor Kates, if you were to ask me if I know the motto of this institution of learning, I could reply: "Yes Sir. It is *'Concordia cum Veritate'*. I saw it as I entered this hall". It is also a part of the Coat of Arms which is embossed on your invitation and your program. I have seen it before and as I stood in front of it I pondered over the many meanings it might have. The official translation in English given in the catalog is: *"In Harmony with Truth"*.

It is mere extension of the deep and abiding respect for truthfulness and honesty which we have learned from our parents.

There are many different kinds of truth. In court we have to swear on a bible to tell the truth, the whole truth, and nothing but the truth and then we can only answer yes or no to the questions put to us.

In architecture, a thing like a wall or a door sill is true only if it is precisely horizontal or vertical when tested with a plumbline or level.

In a science like biology, chemistry, physics or geology, a truth is a fact which we have to establish by inductive or deductive reasoning.

In the field of philosophy, we ask about the nature of truth itself and the theory of knowledge is a huge topic to be covered.

In the quest for truth, we cannot always expect to find the answers. When I was an undergraduate at Davidson College nearly three score years ago, one of my assignments in a course in philosophy was to read a translation of Immanuel Kant's "Critique of Pure Reason". I ran across a curious passage which goes somewhat as follows: "When one person asks another 'What is truth?', this is a case in which the questioner asks an intractable question and tempts an incautious listener into giving an answer where none is possible and thus presents the ridiculous spectacle of one man milking a dry cow and the other holding a sieve". I learned from this that when cornered for the lack of an answer, one must be honest and suspend judgment. It is the secret for achieving peace of mind.

One of the beautiful ways in which the word truth is used is to describe the relation between man and man. Each man must be true to his fellow men. We speak of a certain person as being a true and loyal friend. He is true blue. Shakespeare put it this way. "To thine own self be true and it must follow as the night the day thou canst not then be false to any man". We speak of this as a moral truth. It comes close to the golden rule which is the ultimate rule of moral conduct.

Harmony between man and man can be an end in itself and I am told by a Latin scholar that it is possible to interpret your motto as "Harmony *and* Truth" which covers both the relation between man and man and also the commitment to the search for the truth.

Finally, we have our religious truths to consider. Your own country, like mine, is commited to the policy of separation of church and state and that is coupled with the freedom for each citizen to worship God in his own way. That puts the University in the position that it can make no pronouncements about what people ought to believe. But that does not stop the University from formulating the questions that need to be asked in exploring the meaning and purpose of the universe and its origin and destiny.

As we go out into the world we must all face the religious, social, political, and economic problems of our times and collectively we must try to solve them. It is amazing what we have already accomplished through our search for truth and knowledge.

In the field of science and health there has been steady progress. The things that impress me most, however, are the advances in computer and communications technology. Your own University has played a leading role in this development. I saw in the paper recently that a four-foot robot will deliver the 1983 commencement address at a community college in Arnold, Maryland. I should have warned you at the outset to pay attention, because I may be the last flesh and blood commencement speaker to whom you will have listened. I never dreamed it could happen but I have lived to hear human voices generated by machines. What is more remarkable, we are rapidly reaching the point where it will be possible to translate by machine from one language to another.

We have come to the point where we must say goodbye. I want you to leave with pride in your own achievements and with love and respect for this great institution from which you have graduated. I wish you well, and my only admonition is to abide by your motto, *Concordia cum Veritate,* and continue the search for truth and knowledge and the promotion of harmony between man and man.

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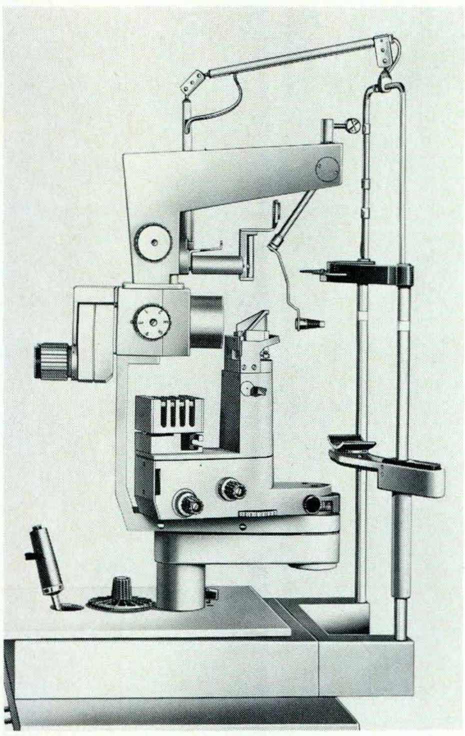

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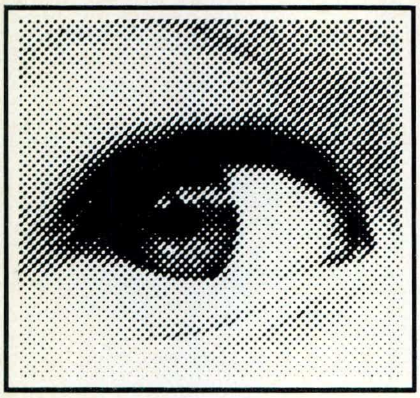

GUEST EDITORIALS

Benefits of Occupational Vision Care and Eye Protection Programs: An Alberta Viewpoint

The pioneer Occupational Vision Care and Eye Protection Program (OVC & EPP) was developed by the Alberta Optometric Association over 15 years ago for a major provincial government employer. This company was experiencing many of the problems normally associated with traditional safety eyeglass programs and, in fact, a disturbing number of serious eye injuries had occurred due to worker non-compliance.

Since the inception of the OVC & EP Program, eye and vision injuries have virtually been eliminated for this employer. As well, they have earned nearly 100 Wise Owl Awards, issued by the CNIB for cases where serious eye damage was prevented by the wearing of safety glasses. This success is viewed by all as a very humane and moral corporate achievement.

Over the years a small number of Alberta optometrists worked diligently to advance the objectives and framework of the OVC & EP Program, always to reflect Optometry's best ideals. The Occupational Vision Care Committee ultimately formed to co-ordinate these activities has grown to be one of the most enthusiastic and productive AOA committees. In 1979 the National Advisory Committee on Vision Care Plans was formed and since that time has promoted and standardized OVC concepts on a national level.

Eventually, interest in the OVC & EP Program expanded and other employers contracted with the A.O.A., further increasing evidence and recognition of the program's benefits. OVC committee members, faced with the demands of program expansion, were unable to adequately follow-up the increasing number of enquiries from industry.

In 1981 members of the Alberta Optometric Association designated third party development as an Association priority and hired a full-time Director — Vision Care Plans in 1982. This individual was directed to determine the OVC & EP Program's marketability, establish new OVC contracts and increase Optometry's exposure and involvement in all areas of occupational vision care.

The benefits of occupational vision care activities to AOA members are numerous. In 1982 Alberta optometrists serviced several thousand patients through the OVC & EP Program. Approximately 85% of Alberta members were utilized with no significant advantage to urban versus rural locales.

In many cases, OVC visits represent a patient's first exposure to full scope Optometry or vision care of any kind. Patients have no incentive to take their prescriptions elsewhere, resulting in an excellent opportunity to experience the advantages of comprehensive vision care. Of course, OVC patients very often consult their optometrist on future vision care requirements for themselves and their families.

A great deal of valuable public relations is gained from OVC exposure. For example, Optometry is now commonly viewed as the profession of expertise in the field of occupational vision care. Approximately 10-20 calls are received monthly at the AOA office with questions about eye safety, VDT's, office lighting and the like.

OVC visits often result in occupational health nurses changing their referral procedures to Optometry. Many companies that delay the decision to adopt the OVC & EP Program redefine their eye safety policies to reflect optometric input. In a number of cases, OVC promotion has resulted in practitioner/company programs that are administered locally. There is also growing interest in occupational vision care programs for VDT operators.

The potential for growth is unlimited. Alberta's OVC & EP Program has only scratched the surface. There are still over 19,000 eye injuries reported to the Alberta Worker's Compensation Board annually. This does not take into account the untold number of accidents to other parts of the body caused by inadequate vision.

In other provinces, positive signs are emerging. OVC & EP Programs have now been firmly established in British Columbia and Quebec. The Ontario Association of Optometrists will soon hire a full-time Director, Vision Care Plans. Provincial delegates to the National Advisory Committee on Vision Care Plans have the resources available to develop programs anywhere in Canada. Interprovincial programs with large national companies will be a primary goal of the NACVCP in the near future.

Individual optometrists play an important role in the OVC & EP Program expansion. Obviously, optometrists see many patients who are seeking primary occupational vision care. It is the optometrist's responsibility to educate industry and safety personnel and bring to their attention the availability of Occupational Vision Care and Eye Protection Programs.

Industry attitudes, government legislation and appropriate clinical research has not progressed sufficiently to fully demonstrate the need for effective and comprehensive optometric services. This realization will come. Optometry in Canada will most certainly benefit from responding to this very important and essential public service.

R. Glenn Campbell, B. Admin.
Director
Vision Care Plans
Alberta Optometric Assn.

A Call for a more Formal and Coherent Structure for Evaluating the Vision of Pilots

An Opinion:

It is distressing to note that even though vision plays a most important role in the safe operation of an aircraft, very few pilots are seen by qualified eye care practitioners. The pilot can choose whomever he or she wants.

Commercial pilots are subjected to intensive physical examinations every six months. Private pilots must be examined yearly. These medical check-ups are usually conducted by physicians who are designated by the Ministry of Transport as Aviation Medical Examiners (AME). As a rule, commercial pilots are seen by physicians who have specialized in aviation medicine. Unfortunately, many of the physicians who are allowed to examine the private pilot have no such particular expertise.

In the early days of aviation, the pilot had to possess perfect distant vision. There wasn't much cockpit instrumentation so the more farsighted he or she was, the better. With the advent of more sophisticated aircraft, the information about the workings of various parts of the aircraft had to be incorporated into a bewildering array of dials, all at varying distances from one's eyes. This produced some visual discomfort for many people and, indeed, many of the pilots in their late forties and fifties could not easily read the dials. The visual demands on the pilot have changed through the years, but the visual requirements for potential pilots, as set out by the authorities, have remained the same. The time has come for optometrists to take a new look at the whole question of vision as it concerns the pilot.

A tradition in visual testing is rating the patient's vision as related to a designated normal at a particular distance. Movement, lighting, letter quality and a person's position are all rigidly controlled in the examination room. It is practically impossible to relate this result with what the pilot will see when travelling at 485 km/h at night, in fog, with intense aircraft vibration.

Night myopia and space myopia are conditions that occur in flight. People will react differently with varying degrees of disability. At present, there is no routine testing of this phenomenon by the eye doctor to determine how, or if, this will change with age, and how dark adaptation may be affected.

Reaction time is almost never tested. A person's speed of reaction is affected by age and related conditions. For example, in the Cat II landing (see note end of text), the 52-year old pilot will react much more slowly, both physically and visually, than his 35-year old first officer. There are no standards to define what constitutes a dangerously slow reaction. Shouldn't this be tested periodically as the pilot ages?

The power of the lenses prescribed for presbyopia is usually designed to give a focal distance of approximately 16 inches. The depth of field can range from 14 inches to 20 inches or less. A chart clipped on to the steering yoke is usually 13 inches away while some dials can be over 30 inches away. There is no one correction which will incorporate all of these distances. Therefore, multi-prescriptions are quite common. Imagine the chaos that would occur if a pilot's first pair of reading glasses are prescribed by a practitioner unfamiliar with the cockpit environment.

The International Civil Aviation Organization (I.C.A.O.) has designated the maximum power distance between the eyes that is acceptable for a commercial licence (+ or - 3 diopters). Young people, in many cases, can easily overcome this designated amount and register 6/6 with the poorer eye. But the breakdown can, and does, occur under stress conditions or when the pilot is fatigued.

I have personally examined three first officers this past year who fell into this category. Either they never had to undergo a professional eye examination, or it was simply missed. They continued to register perfect Snellen acuity with each eye at each medical check up. I was consulted because they started to complain of slightly blurry vision after extended periods of flight. Should these individuals be grounded? Should they be corrected with glasses or contact lenses immediately, or should we wait until acuity drops below 6/6? How will their depth perception be affected if corrected at this point? In order to make the proper decision, the eye specialist must have a combined expertise in both eye care and aviation.

One of aviation's most pressing problems is whether or not contact lenses should be used by flight personnel. I had occasion recently to read a document written by a pilot who was either given the task of looking into the field of contact lenses or who took it upon himself to do so. (The article didn't make this clear). He recommends that the pilot interested in contact lenses be fitted by an ophthalmologist, not an optometrist, completely ignoring the fact that over 90% of the lenses fitted today were designed and perfected by optometrists. What kind of validity will his "findings" have?

This brief paper outlines only some of the reasons why a more logical policy must be formulated when it comes to the question of a pilot's eyesight.

1. Every pilot, whether commercial or private, should have his or her eyes examined yearly.
2. There should be specific, specialized testing procedures for flight personnel. These procedures do exist today and can be incorporated quite inexpensively in an optometric office.
3. Pilots' visual examinations, whether performed by an ophthalmologist or an optometrist, should only be done by practitioners familiar with the flight environment.
4. A multidisciplinary group should be set up by the M.O.T. to periodically review: —
   a) visual standards of flight personnel.
   b) advances in the vision and eye care field relevant to the aviator.
   c) a list of practitioners able to properly examine the pilot, according to pre-defined standards.

Note: Category II Landing (Cat II) Procedure.

General rules for a Category II landing come into effect when visibility is reduced to 100 ft. above the runway.

The first officer watches the instrument panel and calls out appropriate readings e.g. height, speed etc.

The Captain at all times looks out and watches for the runway.

At 100 ft. above the runway the first officer calls out "100 feet" and "decision". The Captain makes the decision whether to land if he sees the runway or to go around.

The Captain has approximately 3 seconds to make that decision. Obviously excellent vision and reflexes are essential.

A Category III landing is designated when 50 ft. visibility is present.

Lorne G. Hart O.D., F.A.A.O.,
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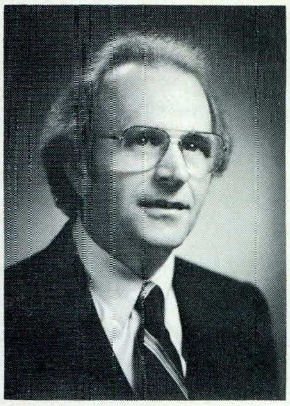
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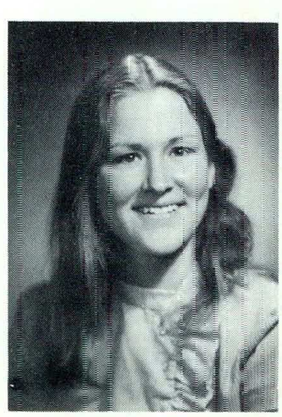
Joy


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Congress Gleanings

G.M. Belanger

This 18th Biennial Congress is the third time that Vancouver and the B.C.O.A. have hosted our national Congress. Previous visits date back to 1959 and 1971. (That 1959 meeting, at which Harold Coape-Arnold took office, witnessed C.A.O.'s first steps in the preparation of Optometry's briefs to the Hall Royal Commission on Health Services, whose report appeared in 1964).

Grag Walsh, former C.A.O. Executive Director, 1969 - 1972, as suave and beau brummel as ever, renewed acquaintances with optometrists from across the nation. Greg is now a successful criminal lawyer with one of the larger legal firms in Vancouver.

Harry Perrin, C.A.O. President 1949 - 1951, and still a resident of Vancouver, ambled by to say hello. It's unfortunate that he is so little known to so many of the recent, and less recent, graduates. Here was a golden opportunity to meet with, and learn about, a significant segment of Canadian optometric history. (Two more former Presidents, Fred Nuttal, 1946 - 48; and Cliff Palmer, 1955 - 57 are now retired and live quietly in Lethbridge, both fountains of information on optometric history.)

Newfoundland set an outside-the-province attendance record. 37% of its members attended. Had other provinces equalled this percentage, the hotel could not have accommodated them all.

In chronological order, here are the several past-Presidents who attended this Congress:
Bill Lyle, 1957; Ed Rea, 1967; Hugh Mackenzie, 1969; Ivan McNabb, 1975; Garson Lecker, 1977; Roy Brown, 1978; Jack Huber, 1979; Hervé Landry, 1980 and Reid MacDuff, 1981.

Most of North American Optometry is represented in this picture. With a majestic mountain panorama behind them, C.A.O. President Dr. Roland des Groseilliers and his wife, Margaret, host A.O.A. President Dr. Timothy Kime (r) and his wife, Barbara (second from right) at a pre-banquet cocktail reception.

There were also several past recipients of the President's Award present: Maurice Belanger, 1967; Fred Attridge, 1969; Ted Fisher, 1971; Clair Bobier, 1975; Bill Lyle, 1979 and Emerson Woodruff, this year's winner.

Although C.A.O. Congresses are essentially national in nature, they are assuming more and more an international flavour. Some foreign colleagues who were in attendance: Dr. Timothy Kime, President of the A.O.A.; Dr. John Wilson, President of the New Zealand Optometric Association; Dr. Sol Rattes, Perth, Australia; Dr. John Elliott, Brisbane, Australia; Dr. Vince Taylor, Pretoria, South Africa.

The Dean of the Pacific University School of Optometry, manning a booth in the hopes of recruiting Western students unable to find a place at Waterloo, was also present.

During Professor Long's report on activities at the School of Optometry, University of Waterloo, a quiet voice from the audience asked why one-

One of the highlights of this year's education sessions was a panel on Low Vision Services in Canada, which featured (l-r) Dr. Ian Bailey, University of California at Berkeley; Dr. Johanne Murphy, Institut Nazareth et Louis Braille, Longueuil, Quebec; Dr. John Jantzi, Surrey, B.C. and Dr. George Woo, School of Optometry, University of Waterloo.

half the enrollment at Waterloo is female. Professor Long's even quieter answer, "My charm", brought down the roof. A final commentary from another voice credited Claude Beaulne in Montreal with even greater charm, since 2/3 of the students in Montreal are female.

Gérard Lambert, the new Executive Director for C.A.O., and his good spouse Monique, made the rounds to get acquainted with as many practitioners as possible. Gérard and Monique are natives of St. Boniface, Manitoba, and are both bilingual. Gérard is a former Administrative Director of l'Association des Optométristes du Québec, and his experience will stand him well in his new position.

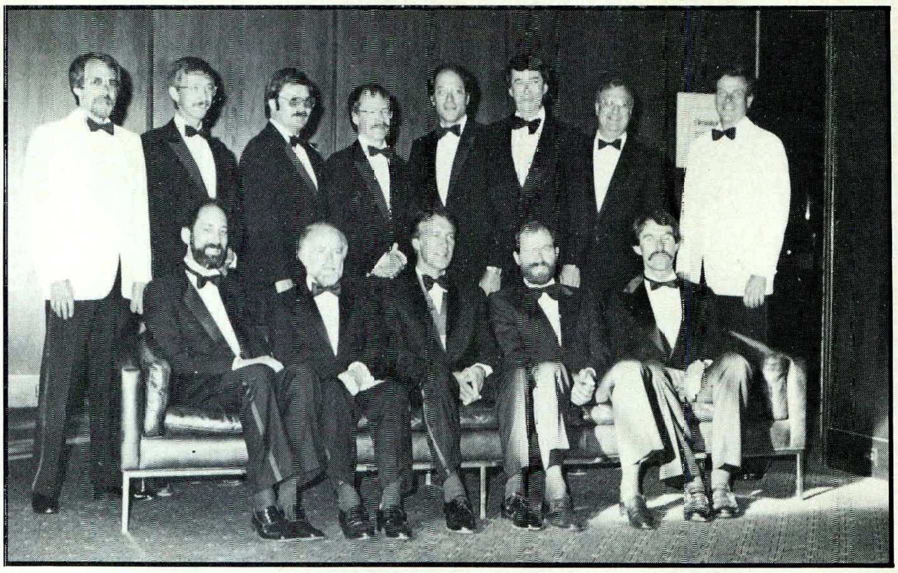
It is unfortunate that so few colleagues from Quebec were in attendance for all parties could stand to gain much from the activities in Quebec. Dr. Jean-Marie Rodrigue, the A.O.Q. President, was in attendance, as well as the Registrar and President of l'Ordre des Optométristes du Québec, and each contributed importantly to business sessions, the former to the Interaction '83 sessions, and the latter to the national board. It is a pity that no representatives from the School of Optometry, University of Montreal attended.

The editor took advantage of the spectacular west coast scenery to put to good use the binoculars given as a gift by his Ottawa colleagues on the occasion of his 25th anniversary as C.J.O. Editor.

Not to be outdone by Joe Clark, our own national President went him one better and left *two* valises of family clothes at the Bayshore Hotel after checking out. As a result, Mike DiCola was able to add another qualification to his growing resumé — that of baggage agent.

Brian Cox had to regularly interrupt and retrieve his good wife from the persistent historical enquiries of the editor.

Wise words from Bill Lyle, who claims that a drug which has no side effects indicates either that the drug is too recently on the market, or the speaker knows little about that particular drug.



C.A.O. Council hardly shows the wear of five solid days of business sessions just prior to the President's banquet. Seated l - r: Dr. Bruce Rosner, Secretary-Treasurer (Manitoba); Dr. Ralph Rosere, President-elect (Nova Scotia); Dr. Roland des Groseilliers, President (Ontario); Dr. Reid MacDuff, past-President (Newfoundland); Mr. Don Schaefer, Executive Director. Standing l - r: Dr. Robert Bell (New Brunswick); Dr. James Patriquin (Newfoundland); Dr. Rainer Zenner (Prince Edward Island); Dr. Rix Graham (British Columbia); Dr. Barry Winter (Ontario); Dr. James Krueger (Saskatchewan); Mr. Gerard Lambert, Executive Director (eff. October 1) and Dr. Scott Brisbin (Alberta).

Len Koltun ran around distributing hats and buttons promoting the City of Regina as the 1985 locale for our 19th Biennial Congress. Pity the poor horse who would have the rider as pictured on the button deposited in the saddle.

With so many optometrists of the female gender, the "Ladies" Programme has now gone the way of the dodo and yielded to the term "Spouses" Programme. Congress organizers will undoubtedly have many headaches ahead as they seek to create a programme which will suit equally the male and female tastes.

The organizers are to be congratulated for having the moral fortitude

Following an emotional thank you, Dr. Emerson Woodruff (l) accepted the 1983 C.A.O. President's Award, presented by past-President Dr. Reid MacDuff.

to ask a divine blessing prior to sitting down to the two main meals offered. In offering grace, both Ted Fisher and Norm Armstrong produced such gems that both are recorded here for posterity, and with the hope that the practice continues.

Ted Fisher: God increase our hyperopia so that we may take a long-range view of our professional problems and work together toward their solutions. God correct our astigmatism so that we may not have an erroneous or distorted view of optometry's place in Society. And Lord reduce our myopia so that we may look out from our daily round of activities and see the plight of many of our fellow humans around the world. God give us the vision to do our part to help those who know only hardship, hunger and disease. Help us to help them and bless this bounteous meal that we may be enabled to serve others. Amen.

Norm Armstrong: Almighty God in Whom we move and have our being, we ask your blessing on this company of colleagues and guests. We give thanks for the leadership we enjoy. We ask your blessing on those chosen to lead, and seek new avenues to serve. Bless the food in which we are about to partake, and may those who prepare and serve it be also blessed. This prayer we ask in your confidence. Amen.

It would be a serious oversight not to mention our exhibitors, whose presence enhances the success of our Congresses. The system of scheduling no conflicting activities, so as to provide an opportunity to visit the booths and talk with the exhibitors is to be encouraged. Such an arrangement is the least we can do to do justice to those whose financial support makes the Congress viable.

President des Groseilliers (l) presents a plaque to outgoing Executive Director Don Schaefer, who leaves October 1 to assume the position of the I.O.O.L.'s first International Director, based in London, England.

For some statistics:

Attendance:

Members	Spouses	Children
281	156	69

The importance and popularity of contact lenses is manifested in the number of firms in attendance. Optometrists, however, should not neglect ophthalmic lenses in their prescribing habits. Contact lenses are too limited in their treatment characteristics to be applicable to the totality of vision problems.

It was a treat to note the number of Canadian practitioners on the Education Programme, particularly Dr. Johanne Murphy, of the Institut Nazareth et Louis Braille in Longueuil, Quebec.

It was a pleasure to hear A.O.Q. President Rodrique discuss recent accomplishments in Quebec. His dynamism reflects an attitude that is needed to confront our many problems.

Discrete enquiries of a number of exhibitors indicate that at least those few were pleased with the number of visitors to their booths. The setting of specific times for visiting the exhibits seems to be the key to this expressed satisfaction. The fact that this was a national Congress may have had some effect on the interest shown by practitioners in the exhibits.

The President sported his chain and medal of office, designed in 1975 for Ivan McNabb by Bonnie Edworthy of Calgary. It gets lighter each year as the engraving shaves off a few more milligrams of the medallion.

Comments from several members lean towards returning the formal banquet to the more traditional format used in the past.

Council looked very sedate as they posed for a group picture just prior to the banquet — understandable when you consider it was Day 5 of the business schedule for them.

Not being a specialist in protocol, this writer cannot say that we pulled a boner by overlooking a toast to the Queen, but it was a delight to hear Norm Armstrong toast Canada, and to hear the assembly sing the National Anthem with Ted Fisher at the piano.

Of the many occasions attended by this writer at which the President's Award was presented, all but one of the winners have been overcome by emotion, and this has shown in their acceptance speeches. Emerson was not this exception. The award was well-merited and yet hardly on a par with his contribution to Optometry.

A.O.A. President, Tim Kime, in addressing the business session, stressed the similarity of problems facing Canadian and U.S. optometry:

— the proliferation of commercial chains.
— relaxation of bans on advertising; consumerism and the F.D.A.
— ophthalmic opposition.
— internal divisions.

His theme as President is "Control your own destiny. Optometry is neither dead nor dying. Avoid overreacting so as not to become part of the problem."

To achieve this, he proposes attention to a number of factors:

— the independent O.D., not the chains.
— re-integrating the city centres.
— student recruitment and placement; conveying to the graduates the need for a professional practice.
— getting patients into our offices by better service.
— the need for interprofessional communications.
— Government relations; federal and state drug laws; F.D.A. pronouncements.
— organizational optometry; viewing your association as a partner, not a competitor.
— the need to develop professional leadership.
— practice enhancement.
— militant medicine.
— optometric education.
— general and in-office public information.

John Wilson informed the assembly on aspects of New Zealand optometry:

— registration since 1928.
— non-use of drugs in refraction.
— elimination of company trading.
— new Act in process covers optometrists and dispensers.
— Auckland University grants a B.Sc. degree and graduates 12 per year.
— problems with M.D.'s re school children.

He concluded by extending an invitation to Canadians to attend their Congress in October, 1984.

Ramblings of an Observer

The success of any national Congress depends upon several factors which must include a well-balanced educational programme and a business programme which will not only interest practitioners but entice them to attend. But, in truth, are there enough to draw people from all areas of Canada to attend? Are the professional and technical aspects alone sufficient in themselves? Could it be that the city chosen, its geographical location, its natural beauties, its historical and political backgrounds, not to mention available social and cultural amenities, outweigh the lectures and speakers? Could not the yen for travel be a significant factor in boosting attendance?

The best of lecturers and choice of subjects, and well-run business meetings do not seem to be the whole answer. As the attractiveness of the city chosen decreases, the educational aspect must be enhanced.

The recent Congress can be hailed as a successful event, not only for the members registered, but also for attendance at lectures and at business sessions, as well as for time spent in the exhibit hall. Of the 14 Congresses, out of 18, that this observer has attended, the business sessions were about the best run and attended. The exhibitors were ecstatic at the attention they got from the registrants, and they felt the time was well-spent.

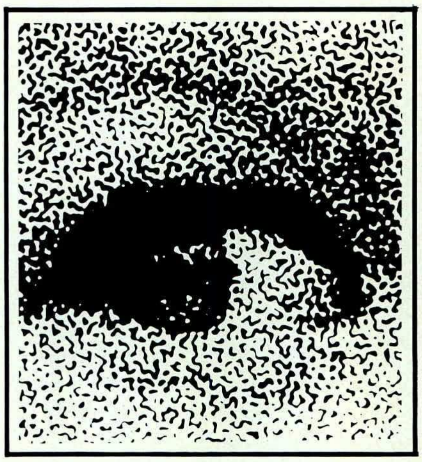
Organizing the educational program is becoming the most difficult part of the Congress. Every year, speakers of note must be booked months ahead, most of them being constantly on speaking tours. Their repeated appearances on different podiums means, all too often, a repeat of the same lectures for lack of time to continue their research between invitations.

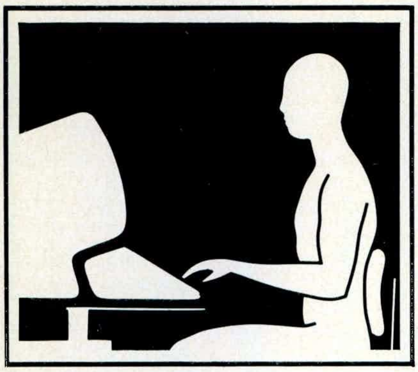
This is no reflection on the competence of the speakers, or on the efforts of the Congress organizers to offer an attractive program. Rather, it is a reflection on the too-great popularity of some topics and some speakers. And this cannot be avoided, because of the proliferation of Congresses, seminars and conventions. One optometrist admitted hearing the same speaker giving the same lecture at three different events!

How then to resolve this problem? Top-notch, well-known speakers are not all that numerous. Can less well-known, but equally competent speakers be expected to draw the crowds? Can we not look further afield, to Europe, the British Isles, Australia, for speakers of perhaps equal ability, but not as widely known internationally?

Can organizers risk offering some more fundamental topics, instead of the headline makers, less newsworthy, but so essential to good optometric practice? Is the answer to be found in concurrent lectures on different topics, with the attendant increase in organizational costs?

It is a challenge to be met. This observer does not envy the educational committees' task of deciding on a programme capable of attracting practitioners from all areas of practice. May these few observations be of some help.





Aspects of Visual Stress in Visual Display Terminal Work

L.J. Mah*

Abstract

There have been frequent complaints arising from the operation of visual display terminals (VDT's). Radiation, ergonomics, and lighting factors have been intensely investigated,[1,2,3] but visual stress has not received the same attention and study.

This paper discusses inherent deficiencies in the images of a VDT, how the visual system reacts, and how fatigue results from the stress.

Recommendations and solutions for the VDT operator are explored.

Abrégé

L'usage d'écrans cathodiques est fréquemment source de malaises et de plaintes. Les facteurs de radiation, d'illumination et la situation ergonomique ont reçu beaucoup d'attention. Ce n'est pas le cas du "stress visuel". Ce travail enquête sur les déficiences inhérentes des images des écrans cathodiques, sur les réactions du système visuel face à cette tâche et tente d'expliquer le pourquoi et le comment de la fatigue résultant de l'usage de ces appareils.

*O. D., Coquitlam, B.C.

Print Material vs. Visual Display Terminal Images

Images are generated on a VDT by a high-voltage electron beam scanning over the phosphor-coated inside surface of a cathode ray tube. These phosphorus particles are excited by the beam to a transient higher energy state. After excitation, the particles drop back to their original energy level, releasing absorbed energy in the form of electromagnetic radiation, some of which is visible light, seen as a VDT image.

These electronic images, or characters, are not considered ideal stimuli for vision. In comparison with printed matter, VDT characters have a number of shortcomings not seen in printed matter, namely flicker, glare, contrast and their dot matrix method of character generation.

Flicker

Flicker refers to the intermittent release of light energy by the phosphor. The rate of flicker is directly related to the rate of scan of the electron beam. This, in turn, is controlled by the rate of polarity reversal of the alternating current, which in North America is 60 cycles per second. Flicker, which requires neurological processing to render an image as continuous is, of course, not present in printed matter.

Glare

Glare refers to the reflection of external sources of light from the surface of the cathode ray tube. These reflections reduce contrast and legibility of characters, but may be controlled by various measures. Installation of anti-glare screens, removal of glare sources and proper lighting design of the VDT environment are examples of such measures. The surfaces of a display unit generally reflect light much better than paper, even glossy white paper.

Contrast

Contrast of images may be reduced by glare, lack of servicing, dust accumulation on screen surfaces or high levels of ambient room illumination. With printed matter, contrast is constant and usually high. Also, most phosphors eventually suffer a permanent loss of light output, which is accelerated by operation at high levels of brightness[2].

Method of Character Generation

Typically, VDT characters are generated by a dot-matrix method in which discrete dots make up the skeleton of the figures. These dots are enlarged and blurred to create complete characters. Resultant figures are complete, but have blurred edges. Printed characters do not usually suffer from this defect. Other factors such as chromaticity and character instability contribute to the list of shortcomings of VDT images.

The Visual Mechanism

The visual system works more efficiently when stimuli are clear, stable and of normal contrast. This type of stimulus is conducive to efficient accommodation, fixation and neural processing. VDT characters, because of their properties, flicker, glare, contrast and edge blur, are not ideal stimuli and have been shown to present difficulties to the visual system. The visual system manifests these difficulties with accommodative instability, fixation difficulties and changes in flicker fusion processing.[6,8]

Accommodative Search and Fatigue

With VDT images, the accommodative system tends to continually focus or search in a futile attempt to produce a clear image from the dot-matrix characters with blurred edges. Stark and Takahashi[5] found that a major stimulus to accommodation, whether accommodation was appropriate or not, is a blurred image. The resultant focussing search in VDT images is higher than in non-VDT images, and more inducive to accommodative fatigue. One important sign of this accommodative fatigue was shown by Murch[6] who demonstrated that VDT images did not elicit optimal accuracy of accommodation. Instead, the accommodative system moved towards the dark focus, or resting point of accommodation, rather than focus accurately on the plane of the VDT screen. The dark focus (as in empty field myopia), or the resting point of accommodation, refers to the refractive state of the eye when there is a lack of useful visual stimuli. This refractive state showed typical values in the -1.00 to -1.50 dioptre range[7]. The tendency of the accommodative system to move toward the dark focus was an indication of the relative inadequacy of VDT images as accommodative stimuli. This inaccuracy of accommodation is a lag of accommodation seen with printed matter.

Fixation and Spontaneous Eye Movements

The fixation of visual targets is accompanied by involuntary spontaneous eye movements. These movements are very small and keep the image projected on the retina in constant motion. Three types of movement have been identified: i) a slow "drift" causing the image to move slowly from the fovea; ii) a high-frequency "tremor" with vibration rates of 30 - 80, and up to 150 cycles per second; iii) a flicking "saccade" that returns the image to the fovea at the end of the "drift". These small eye movements sharpen contrast, transmit edge information and prevent retinal adaptation in attentive fixation[8].

With VDT images, it is probable that the function of these movements is compromised, that interaction of the small eye movements and the 60 cycle per second flicker of the VDT contributes to the perception of character instability, as well as to the difficulties in the neural processing of the image.

Critical Flicker Fusion Frequency and Neural Processing

The frequency at which a flickering stimulus changes in appearance from a discontinuous to a continuous one is the critical flicker fusion frequency (CFF). This is the lowest frequency at which a flickering stimulus is perceived as temporally continuous. A particular flickering stimulus may be continuous under some conditions, yet flicker under others. Many variables affect the value of CFF, some of which are: luminance of the stimulus, spectral composition, retinal position, size, temporal waveform, monocular vs. binocular presentation, stimulus pattern, state of retinal adaptation, pupil size, age of observer and general state of health.

Under the right conditions, the CFF ability of a given operator may approach or exceed 60 cycles per second at which time flicker could be perceived. A hypothetical example is one in which the VDT image is bright and large and is viewed by the light-adapted eyes of a young person in good health. Discussion of the neural processing of a flickering stimulus is complex. Suffice to say that the processing of a flickering image is more taxing than that of a non-flickering image.

Visual Fatigue and VDT Images

As compared to otherwise similar non-VDT work, VDT work has been shown, directly or indirectly, to cause lowered accommodative accuracy, accommodative spasm, accommodative infacility and decrease of CFF. These induced deficiencies are discussed below.

Lowered Accommodative Accuracy

Murch[6] has demonstrated by laser refraction that the visual system does not accommodate as accurately to VDT images as to print copy. Laser refraction is a quasi-objective method of determining refractive status and can be used while the visual system is actively engaged in VDT work. Because it was felt that the visual system under stress would gravitate toward the dark focus[6], working distances were recommended which would allow the plane of the VDT screen to approach the dark focus. This would allow the underaccommodating visual system to maintain a clearer focus. Alternatively, the same result could be obtained with spectacles.

Increased Tonus, or Spasm, and Accommodative Infacility

Ostberg[10], also using laser refraction, found significant changes in the accommodative system after VDT work. Dark focus values increased temporarily indicating transient increased ciliary tonus or spasm. Transient accommodative infacility also occurred resulting in distance myopia and near hyperopia. In a group of nine air traffic controllers, dark focus values changed from 0.94 to 1.62 dioptres and accommodative facility decreased significantly, after two hours' work at a radar screen. For each subject, accommodation became more myopic for distance and more hyperopic for near. Similarly, Holler[11], using conventional refraction, found a 0.25 dioptre increase in distance myopia after four hours' VDT work, with recovery in 15 - 20 minutes in nine of the 14 subjects. These temporary changes in the ciliary muscle or corresponding innervation were suggestive of higher levels of stress in VDT work.

Decrease of CFF

CFF is an individual parameter, as discussed earlier, and an indicator of the ability of the central nervous system to detect a flickering image. This ability was shown to decrease after VDT work, again indicating visual fatigue[12].

Statistical Studies

Two relatively recent surveys of VDT and non-VDT workers in the United States and Canada are The National Institute of Occupational Safety and Health (NIOSH) 1979 survey[13] and the Canadian Labour Congress (CLC) 1982 Labour Education and Studies Centre Survey[14] respectively.

The first of these used, for statistical evaluation, a sample comprised of 42 VDT operators and 16 non-operators from three unions and showed a clear trend toward more problems among VDT operators.

Table 1

Frequent or Constant Vision Complaint	VDT Operator %	Non-VDT Operator %
Tearing or itching	41	24
Burning	37	16
Blurred vision	43	13
Eyestrain or sore eyes	52	18

The CLC survey compared VDT to non-VDT workers in 15 workplaces representing 12 employers and eight unions. There were 2,330 responses, making this the largest survey of its kind done in North America to date.

In the CLC survey, VDT workers experienced eye and vision problems twice as often as otherwise equivalent non-VDT workers. Most severely affected were those workers in intensive-use occupations, e.g. telephone operators, reservation agents, data entry operators and word processing operators. Overall, 41% of all VDT workers reported more frequently a change in lens prescription over the past year than did non-VDT workers (41% vs 35%). Severity and frequency of the symptoms such as burning, aching and blurring increased directly with the total number of hours worked on a VDT, and with the length of time worked without a break.

Both surveys indicated clearly that reports of visual complaints were more frequent and more severe in VDT workers than in their non-VDT counterparts in the groups studied.

Recommendations

The following recommendations have been made to minimize visual stress from VDT work, to increase comfort and efficiency.

Special VDT Spectacles

Non-Presbyopic Operators

With printed matter, the accommodative system of non-presbyopes is usually capable of sustained near work without unusual difficulty. However, with VDT images, the accommodative system of non-presbyopes has been shown to suffer the search[5], gravitation toward the dark focus[6] and accommodative infacility[10] after periods of work. Murch[6] has concluded that when a VDT is located at a distance corresponding to the resting point of accommodation, either physically or optically, any image, optimal or sub-optimal, can be held in more comfortable focus. VDT spectacles in the non-presbyope as a low plus or a near add correction were recommended to allow the dark focus to more easily approach the plane of the VDT image.

Presbyopic Operators

The conventional near correction for 40 cm. is often too restrictive for presbyopic operators. For example, the range of clear vision for a +2.50 addition extends to 40 cm. only. In practice, few VDT situations have working distances less than 40 cm. In prescribing VDT spectacles, consideration should be given to the greater working distances and occurrence of the dark focus. Krueger[15] has suggested values of VDT adds of +1.00 to +1.50 to allow a usable range of clear vision. It must be emphasized that working distances to the different work surfaces be known to determine the best compromise in add power and range of clear vision.

Single Vision vs. Multifocal

Grundy and Rosenthal[2] have felt that bifocals and trifocals would be acceptable, but should be adapted for VDT use by raising segment heights to correspond with the usually high position of the terminal screen. Others[12,15] have rejected multifocals because of the (corresponding) forced head posture, resultant cramps and frustration with segment size limitations. It is clear that optometric judgement is required in situations where either treatment may be used successfully.

Refractive Errors

Correction of ametropias, even small amounts, should be given careful consideration. Under the stress of VDT work, small amounts of astigmatism and hyperopia are apt to contribute to fatigue. The prescribing of a low add could be considered in both presbyopes and non-presbyopes. In low myopias, the removal of the distance correction may be an adequate solution.

Viewing Distances

Recommendations in the literature have been made about placing the display screen, keyboard and copy documents all at equal viewing distances to reduce the need to change accommodation. It has been shown by Krueger[15] that equal distances in the non-presbyopic operator may mean "uneconomical static muscular work" for the ciliary muscle. Deterioration of the accommodative efficiency was observed monocularly after some ten minutes of static accommodation. On the other hand, Krueger has also shown that constant changes in accommodation caused fatigue only after extended periods. Change in accommodation between 6.00 and 0.50 dioptres every four seconds caused fatigue only after 2.5 hours.

It follows that unequal viewing distances are not unduly fatiguing for the non-presbyopic operator. For a presbyopic operator with a lowered accommodative efficiency, equal distances to work surfaces would likely be of benefit. Measures of optimal viewing distances for non-presbyopes have been given by Murch[6] and Snyder[16], the former recommending distances greater than 50 cm. to avoid loss of resolving power and contrast sensitivity. It can be concluded that equal viewing distances are of greater importance to presbyopic than to non-presbyopic operators because of differences in accommodative efficiency.

Visual Hygiene

Visual hygiene refers to habits adopted to relieve the visual system of stress, in the case of VDT's, nearpoint stress. There is a general consensus that hourly rest breaks of ten to 15 minutes and limitation of total daily time spent on a VDT is required. A general recommendation to avoid VDT stress is to relax positive accommodation by, for example, fixating distance targets periodically. Other recommendations involve periodic ocular rotations, jump ductions and vergence exercises, and extra-ocular and ciliary muscle calisthenics to avoid static muscular fatigue. The use of near additions or low plus lenses to compensate for an underaccommodating system has already been mentioned.

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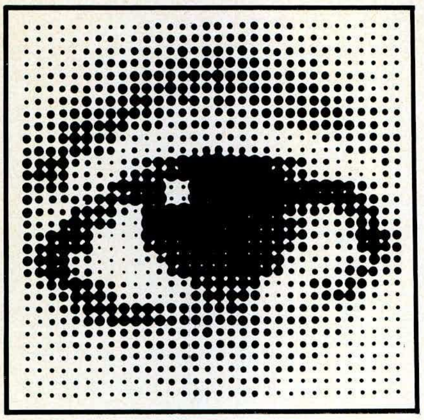

B.C.'s Occupational Vision Program

B.D. Cox*
T.J. Little†

The BCOA's occupational vision committee has adopted the model set forth by the national committee and, with a few minor adjustments, has created a program that is catching the eye of safety personnel around the province.

Although the economic climate has slowed progress, since its inception in April 1979, a step by step movement towards our goal has occurred. Third Party Chairman Dr. Brian Cox carried the load almost exclusively until the Association hired Mr. Tom Little part-time in July 1980 after Mr. Little left CAO's P.R. department to move to Vancouver. Dr. Cox spent a good deal of time in working with Mr. Little to contact industry and union officials, (as well as insurance brokers for the other third party priority, pre-paid family vision plans).

During this period, the Association's first formal contract was signed (June 1981) with Alcan Smelters and Chemicals of Kitimat, covering a work force of 2500 employees. In February 1982 the Association hired Mr. Little as full-time Program Director to advance the Third Party programs as well as public relations, government liaison, and general administrative tasks.

With the help of a nationally-produced 10 minute film, promotion of the OVC program increased. Before describing our promotional efforts, a brief outline of the BCOA program is in order:

*O.D., Chairman, BCOA Third Party Programs Committee
†B.J., BCOA Program Director

The emphasis is on the quality of occupational vision care:

* Complete case history including lighting, hazards and visual demands of the job (may require on-site survey).
* Complete oculo-visual assessment based on visual needs at work, irrespective of whether off-the-job requirements are different.
* Careful adaptation of the occupational prescription to the appropriate CSA lenses and frames (employer may designate suppliers or rely on optometrist's judgement).
* In the case of "plano" lenses, determine that CSA standards are met and ensure proper fit.
* Check prescription lenses and frames when returned from lab.
* Dispense eyewear and counsel patient on proper care, limitations, and potential pitfalls of the eyewear and its use, (even planos must become personal safety devices if they're going to be used).
* Undertake follow-up care as needed.
* Once a contract is signed with BCOA, billing for services rendered is sent by the optometrist to the Association office where it is checked and one monthly statement from all practitioners is sent to the employer. When BCOA receives payment it forwards the correct amount to each optometrist.

This entire process enables an employer to see the difference between professional care and the non-professional programs available — obviously as much emphasis must be placed on both examining *and* dispensing to convince employers to purchase the entire package. This is where the 10 minute film has played a key role. It graphically underlines the value of professional care and points out that compliance, and therefore safety, improves with the program.

The BCOA tries to keep members up to date on recent developments in occupational vision care since the program can't succeed unless all members can respond to workers' changing needs. A good example is the increased use of Visual Display Terminals (VDT's). We encouraged our members to attend the AOA symposium in Edmonton last April and then reported highlights in our newsletter, plus offered tapes of selected lectures. Ideally, a similar symposium on occupational vision will be held in B.C. in the near future.

We can not overemphasize the importance of keeping up to new developments: 1982 CSA Standard (Z94.3-M1982), new lines of safety eyewear, coatings, new lighting standards, effect of work environment on patient's visual welfare, contact lenses in industrial environments, etc.

As of this writing*, the BCOA had four contracts in place: Alcan, Westcoast Transmission Co. (the large pipeline and refining company

*Editor's Note: Since this article was prepared, the BCOA has added Westmin Resources Ltd., a division of Noranda Mines on Vancouver Island employing some 400 people, to its list of contracts, bringing the total to five.

affecting some 820 workers in about 30 communities), Ocelot Industries Ltd. of Calgary (operating a Methanol plant in Kitimat with several hundred employees) and the Petro-Canada refinery (in Taylor, B.C. employing several hundred people).

Altogether close to 4,000 people are eligible for service. Because of the local nature of all but the Westcoast contract, precise figures are impossible to provide, however with the Westcoast contract alone, the potential for the program is apparent. After a year of discussion and considerable input from the BCOA, Westcoast signed on May 11, 1982. Internal problems prevented the company from launching the program until October, but a separate agreement was also signed with Alberta for about 50 employees there.

As of July 15 the BCOA had processed $3638 in optometric billings to Westcoast in December, February, April and monthly billings up to July. The average bill was $42.80 per patient for 85 patients. Eighteen optometrists have billed a total of 31 times.

In the course of promoting a professional eye safety program, contact has been made with more than just employers and unions. An education process has begun with Worker's Compensation Board, B.C. Safety Council, Occupational Health Nurses, Safety Officers' education courses, CNIB, government departments, safety suppliers and others. In general, the public relations value of the program has been a great benefit for all optometrists.

Another aspect of OVC promotion is the need for flexibility. Although the program calls for a mandatory eye examination, this can become a labour relations problem for employers and unions. It is also true that employers must pay for third party initiated exams, whereas employees who choose to have their eyes examined independently are covered by the provincial Medical Services Plan. Thus the voluntary approach is often more appealing.

Another area requiring flexibility is the provision of plano eyewear. Many employers feel justified in spending a substantial amount on prescription lenses, but refuse to do so for non-prescription. We will accept contracts for the former, while maintaining that the latter is still important. This way a company can discover and appreciate optometric services, perhaps opting for plano service later on.

We are now looking at ways of attracting companies to enlist in the plano program, as none currently do. One suggestion has been to permit employees to come in with a preselected pair of planos for checking and fitting. This would be done at a reduced fee, but would require an evaluation period to determine the effectiveness of this approach.

On the other hand, a renewed emphasis will be put on explaining the importance of optometric judgement and counselling in the proper selection and fitting of plano safeties in spite of the cost. From both a physical and psychological point of view, this is clearly the path that will solve employers' problems with employee non-compliance and/or improper safety eyewear.

Our future plans are to revamp our OVC literature and continue to educate industry on the importance of professional care. A $30 levy was approved at our February Annual meeting, providing a further $6000 for OVC promotion, which will permit extra travel and publicity. We hope to expand committee membership to include optometrists from various parts of B.C. A special program for VDT's is to be incorporated as well. All in all, with economic recovery slowly returning, we look forward to a productive second half of 1983, and a solid future for the development of the Occupational Vision Program.

COLOR OF VDT's AND THE EYE Green VDT's Provide the Optimal Stimulus to Accommodation†

J.G. Sivak*
G.C. Woo*

Abstract

The longitudinal chromatic aberration of the human eye is substantial and therefore the colour of the phosphor chosen for VDTs will affect refractive state and accommodative demand. For most working distances, green stimuli (λ max 520 nm) are optimal.

Abrégé

L'aberration chromatique axiale de l'oeil humain est significative. Ainsi le choix de la couleur du phosphore utilisé dans un écran cathodique influence l'état de réfraction et la demande sur l'accommodation. Le vert (λmax 520 nm) est l'ultime choix pour la plupart des distances de travail.

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The recent dramatic increase in the use of visual display terminals (VDTs) in a variety of occupations has led to concern over possible detrimental effects on the visual system. Apart from the issue of radiation damage to the eye, an issue which has attracted a number of largely unsubstantiated claims and counter claims, attention has centered on the relationship between VDT use and the eye's focussing mechanism; i.e. accommodation (Cakir *et al*, 1979).

The indirect nature of the primate accommodative mechanism and the fact that it deteriorates with age in adults is well documented (Donders 1864; Weale 1962). The visual comfort of VDT operators is in large measure dependent on ensuring that the working distances of both the display screen and the keyboard are within their accommodative abilities. In addition to the gradual loss of accommodation with age (presbyopia), Östberg (1980) has shown that the accommodative mechanism exhibits signs of fatigue after extended VDT operation.

Relatively recent work has emphasized the importance of the relationship between chromatic aberration of the eye and accommodation. Discovery of the fact that the eye's refractive state varies with wavelength is attributed to Newton (LeGrand 1967). A number of studies, carried out with a variety of psychophysical and objective methods (Wald and Griffin 1947; Ivanoff 1953; Bedford and Wyszecki 1957; Bobier and Sivak, 1978), have shown that the human eye's longitudinal chromatic aberration amounts to 1.00 - 1.50 diopters between the C and F Fraunhofer lines (486 - 656 nm). In fact, experimental measures of this aberration are larger than that expected from calculations because of the exaggerated chromatic dispersion of the crystalline lens, especially at the blue end of the visible spectrum (Palmer and Sivak 1981; Sivak and Mandelman 1982).

It is commonly assumed that a specific wavelength within the chromatic aberration interval is in focus on the retina. The wavelength chosen has varied from 555 nm, the peak of the photopic spectral sensitivity curve, to 589 nm, the sodium line (Emsley 1952). However, beginning with Ivanoff (1953), it has been shown that the wavelength in focus varies with the state of accommodation (Millodot and Sivak 1973). When the eye is unaccommodated (fixating a distant target) a wavelength of about 650 nm is in focus. When the eye accommodates for targets located at closer and closer distances to it, the wavelength in focus gradually shifts toward the short wavelengths (Fig. 1 and 2). It is believed that chromatic aberration thus extends the eyes' range of accommodation. At a distance of 0.5 m the wavelength in focus is about 520 nm (Fig. 2). The effect of these findings on refractive procedures and on the refractive state of the eye in spectrally limited situations such as the underwater environment has been noted (Sivak 1975, 1979; Bobier and Sivak 1978; Woo and Sivak 1979).

Typical phosphors listed by Cakir *et al.* (1979) emit maximally in the blue-green region of the visible spectrum. Even the white phosphor mentioned (P4) has short wavelength emission characteristics (λ max 460/560). According to Cakir *et al.* the choice of phosphor colour may be based on personal preference rather than on any scientific reason, provided of course that contrast and display clarity are ensured. Nevertheless, it is possible that subjective reports by operators indicating a preference for green (Östberg, 1980) are a result of the relationship between accommodation and chromatic aberration just described. For a working distance of 0.5 m it would appear that phosphors P1, P31 and P39 (λ max 525 - 520 nm) would be ideal. Blue phosphors eg. P11, λ max 460 nm) would induce a small amount of near-point myopia (fig. 1) if the operator accommodates by an amount normally appropriate for 0.5 m. Presbyopes wearing near-point corrections may be overcorrected. Any long wavelength stimuli will, of course, result in an excess of accommodative demand and presbyopes will be undercorrected.

The use of closed circuit television magnifying systems by thousands of legally blind patients is of related interest. Television magnifying systems are believed to be superior to optical low vision aids because they reduce peripheral aberrations and distortions as well as postural tension and they permit binocular viewing of highly magnified images (Mehr *et al*, 1973). Until recently, all the systems available used black and white television monitors. However, coloured monitors are becoming popular perhaps due to the provision of a better accommodative stimulus.

The foregoing is meant to draw attention to the fact that the human eye suffers from a significant amount of chromatic aberration. The question of the portion of the visible spectrum in focus on the retina should be taken into account in the design and testing of video display terminals or any situation involving chromatic panel lighting.

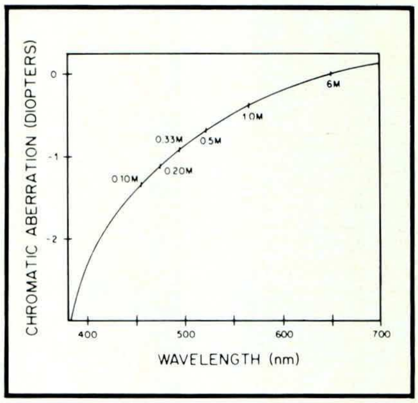
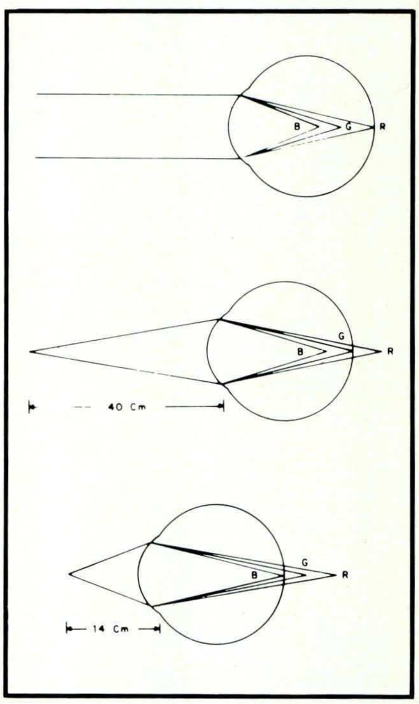


Fig. 1 Axial chromatic aberration of the human eye (adapted from LeGrand, 1967). The points on the curve indicate the wavelengths in focus for fixation distances varying from 6 meters to 0.10 meters. (after Millodot and Sivak, 1973).

Fig. 2 Schematic representation of the eye and the focal conditions of red (R), green (G) and blue (B) portions of the visible spectrum, for infinity and two finite distances.



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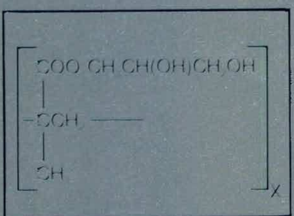

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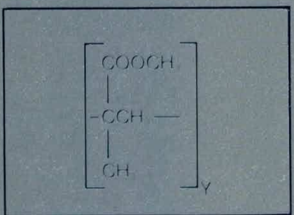

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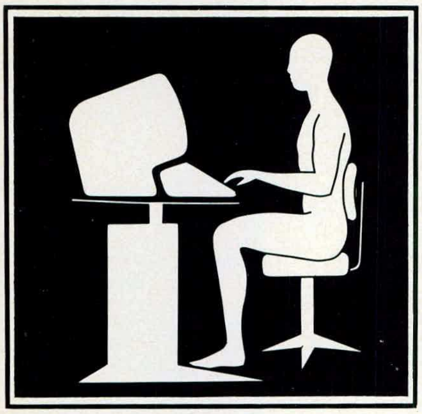

Working With Video Display Terminals*

Abrégé

L'usage des écrans cathodiques a soulevé la possibilité d'un lien entre ces appareils et certains problèmes de santé. Au début on soupçonnait que ces écrans étaient source de radiations nocives. Plus récemment on les juge sources de symptômes visuels et psychosomatiques.

Aucune enquête à date soutient que les écrans cathodiques sont intrinsèquement nocifs à la santé. Il semble que les problèmes de santé ne proviennent pas d'irradiation mais d'une mauvaise installation physique de l'appareil, une conception fautive de construction ainsi que des conditions latentes de santé qui se manifestent par suite des exigences visuelles de l'écran ou d'une mauvaise posture maintenue trop longtemps.

Une attention plus soignée à l'état de santé et l'application judicieuse de principes ergonomiques peuvent obvier ou diminuer les plaintes.

Les recherches à date indiquent que les radiations provenant des écrans sont de basse teneur et ne constituent pas un risque, selon les normes actuelles. Toutefois, les autorités sont inquietes des effets à long terme des radiations à basse teneur provenant de divers sources y inclus les écrans cathodiques. Il y a lieu de continuer les recherches dans ce domaine jusqu'a l'établissement d'un consensus dans le monde scientifique.

Puisque ces écrans bouleversent profondément le status quo du monde travailleur tant du côté des employés que des patrons il est important de maintenir une bonne communication entre ces groupes afin que les craintes de l'opérateur soient mises à jour et solutionnées.

Introduction

Video display terminals (VDTs), or visual display units (VDUs) as they are sometimes called, are comprised of a typewriter keyboard and a television-like display screen. Information is fed into a computer or memory system via the keyboard, and the image appearing on the display screen is generated by a cathode ray tube. The broadest application of this equipment is in graphic, data- and word-processing systems.

Display Screen

The method of image generation in a VDT is identical to the method used in a conventional TV set; the cathode ray tube (CRT) used in both instances is a glass vacuum tube with an electron gun at one end and a phosphor-coated screen at the other. When high electrical voltage is supplied to the gun, a stream of electrons is produced. This stream of electrons resembles a slender beam, and can be directed to any desired position on the face of the screen. The electron beam interacts with the phosphor-coated screen to emit a bright spot of light.

Scanning control sweeps the beam across the surface of the screen in a series of regularly spaced horizontal lines called raster-scan lines. The method most commonly used to form the letters or characters that appear on a VDT screen is dot-matrix generation. This means that each character is defined by a set of dots selected from a rectangular matrix (or source) of dots by the scanning control. The resolution of the matrix is defined by the number of horizontal and vertical dots used to determine the maximum extent of the character image; e.g., five dots by seven dots, or seven dots by nine dots. In general, a five by seven matrix is adequate for displaying capital letters and numerals, but seven by nine and above are the ones most commonly used in the processing of text for display.

Because the light emitted by the phosphor coating of a cathode ray tube decays rapidly, the image on the screen must be continually refreshed in order to present a stable, flicker-free image. The characteristics of the phosphor and the resolution of the character shapes together determine the time required to display a single line of text.

Health Aspects

The widespread use of video display terminals, since their development a little more than a decade ago, has been accompanied by varying degrees of uncertainty as to their possible health hazard. Initially, particular attention was directed to their potential as a radiation hazard but more recently this concern has been enlarged to include possible visual and musculoskeletal problems. The following section outlines psychological, radiation, fatigue and visual factors involved in VDT operation. It is not intended as a comprehensive text on these health aspects, but it is hoped that it will be

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By the Occupational Environment Branch of the Ministry of Labour with the assistance of Ulrika Wallersteiner — Occupational Health Consultant
Dr. Craig L.T. Galbraith — Assistant Director, Division of Occupational Health, Ministry of Health
Dr. M. Wayne Greene — Director, Radiation Protection Service, Ministry of Health

of some practical help to those individuals with concerns in this area.

1. *Psychological*

One of the most effective precautions that can be taken to safeguard against future dissatisfaction, discomfort, and health problems among operators of video display terminals is to involve the operators from the beginning in how to use these sophisticated machines with assurance. In practice, the successful introduction of VDTs depends principally on the attitude of those involved. When this has not been achieved, the costs of poorly designed work change are eventually paid for by the community as a whole. Worker alienation can be prevented if the potential VDT users understand their role in the overall work process, if they have a sense of control over their tasks, if they understand the importance of their jobs, and if they do not feel isolated within the working environment.

Individuals differ in their response to change, the difference depending on whether change is perceived in a positive or a negative light. If the perception is negative, then the potential for health problems would probably increase if VDTs were introduced in a manner that failed to meet the needs of both the job and the users.

To cope with a negative perception, supervisors must be prepared to recognize that the individual may regard the introduction of VDTs as a nuisance, because it requires a change in job description; as disturbing, because it demands the rejection of old skills and the acquisition of new ones; as unsettling, because quality of work may henceforth be measured in terms of quantity; and as a threat to security, because of the possibility of redundancy. Singly or in combination, these responses can generate an anxiety that may cause the individual to exhibit symptoms of both psychological and physiological stress that can lead to illness.

2. *Radiation*

Considerable attention has been focussed on the possibility that harmful electromagnetic energy radiates from VDTs. Electromagnetic radiation is of two major types, ionizing and non-ionizing.

Ionizing radiation occurs normally in nature, emanating from radioactive materials in rocks, soils, building materials, space, and is commonly used in diagnostic and therapeutic medicine. The average Canadian receives approximately 200 mrem* of this type of radiation annually, approximately half of which is from natural background. Federal and international standards, recognizing the harmful effects of excessive ionizing radiation, recommend that members of the public not receive whole-body doses of more than 500 mrem in a year, exclusive of medical and dental radiation exposure.

The only ionizing radiation that a VDT is capable of producing are X-rays of low energy, (produced inside the cathode ray tube). These X-rays are of low penetrating energy when compared to medical and dental X-rays. X-rays which are generated inside the cathode ray tube are totally, or almost totally absorbed by the material of the screen or tube housing, (i.e. glass enclosure and other shielding materials). The maximum allowable limit of ionizing radiation from VDTs is set at 0.5 mR** per hour measured at 5 cm from any accessible external surface of the VDT. (Reference: Radiation Emitting Devices Regulations made under the Radiation Emitting Devices Act of Canada).

Measurements of thousands of VDTs for X-rays, indicate emission levels of at least 10 to 20 times lower than the allowable limit of 0.5 mR/hour. Generally, radiation surveys of VDTs have failed to detect any ionizing radiation coming from the machines.

To assess the validity of claims that VDTs might be emitting X-rays at low level, (below background levels), 60 different models were tested in Health and Welfare Canada — Radiation Protection Bureau's low level counting facility. This facility can detect low energy X-rays at emission levels of 500,000 times lower than the mandatory standard for VDTs (0.5 mR/hour). No X-ray emission was detected during the tests.

Non-ionizing radiation has a much lower potential for causing adverse health effects that does ionizing radiation. Non-ionizing radiation includes ultraviolet, visible, infrared, microwave, and radiofrequency, which includes, very low frequency (VLF), and extremely low frequency (ELF)). Non-ionizing radiation surveys of VDTs indicate that these types of radiation are either undetectable or hundreds to thousands of times lower than the applicable radiation standards. (Table 1 summarizes the maximum radiation exposure levels allowable for each frequency range of non-ionizing radiation.)

Table 1

Non-Ionizing Radiation Maximum Radiation Exposure Standards

Type of Radiation	Standard
Ultraviolet (UVA)[1]	1 milliwatt/cm^2
Infrared[1]	10 milliwatt/cm^2
Microwave[2]	1 milliwatt/cm^2
Radiofrequency[2] (above 10 MHz)	1 milliwatt/cm^2

Some VDTs produce measurable quantities of very low frequency (VLF) electromagnetic fields. Typical measurements in the operator's position show results of less than 1

**mrem (millirem)* — provides a measure of the amount of ionizing energy actually absorbed by a person, (i.e. dosage).

***mR (milliroentgen* — provides a measure of ionizing radiation emission. (1 mR is equivalent to approximately 1 mrem for X-rays).

[1]Threshold Limit Values for Chemical Substances & Physical Agents in the Work Environment, ACGIH, 1982.

[2]Safety Code 6, Recommended Safety Procedures for the Installation & Use of Radiofrequency & Microwave Devices in the Frequency Range 10 MHz - 300 GHz, Health & Welfare Canada, 1979.

mW/cm². These emissions, technically not radiation, are associated with the beam scanning circuitry and have a frequency range from 15 kiloHertz to 300 kiloHertz. Many common electrical appliances, e.g., electric can openers, electric kettles, etc., emit VLF and ELF with intensities equal to or greater than VDTs. There is no evidence of detrimental biological effects from the levels of VLF and ELF generated by VDTs.

Health and Welfare Canada in its booklet *Safety Guide for Video-Display Terminals* concludes:

> "It can be stated unequivocally that Video Display Terminals do not emit levels of any electromagnetic radiation of any wavelength that could possibly be hazardous to any person, male or female, young or old, pregnant or not, and therefore do not present an occupational radiation hazard".

Non-ionizing radiation surveys for ultraviolet, visible, infra-red, microwave and radio frequency emissions indicate that these are well below recognized radiation standards. Although it is recognized that exposure to high-intensity microwave radiation can cause cataracts and other damage associated with heating of soft tissues, no VDT in Canada has to date been shown to produce cataracts.

Although published studies indicate that radiation emissions from VDTs are low and do not constitute a health hazard based on current radiation standards, concerns still exist over the possible long-term effects of low-level radiation from many sources including VDTs. More research is required in this area to obtain a consensus among the scientific community.

3. *Fatigue*

Fatigue is a broad term for which there is no unequivocal definition. VDT operators may experience it as psychological, physiological or general body fatigue, just as would any other worker — the extent depending on their work tasks, and on such individual characteristics as general health and lifestyle.

VDT operators who enjoy good health may become fatigued, and experience both visual and postural discomfort in the absence of any visual or postural problems. Although pre-existing problems of this nature predispose a person to fatigue, the condition is thought to be due largely to a sustained effort to see clearly and maintain a static posture.

Prolonged attention to visual detail with reduced eye movement in a restricted visual VDT field, when coupled with the absence of auditory stimulation, can give rise to fatigue and symptoms of eyestrain. The latter is experienced in the form of irritated, heavy, dry, burning eyes, and is sometimes associated with headache and focusing difficulties. Indeed, eyestrain symptoms may indicate the presence of a more generalized fatigue. Similarly, postural-fatigue symptoms can arise from prolonged stationary postures. Because the body is designed for movement, a fixed posture is much more tiring than a dynamic one, as can readily be appreciated by comparing an individual's tolerance to standing and to walking.

In the case of VDT operators, it is important to realize that, for practical purposes, the visual and musculoskeletal systems behave as a single functioning unit. Shortcomings in vision, for example, are commonly compensated for by faulty work postures that may give rise to symptoms of muscle fatigue. The converse holds true for postural shortcomings. In both instances, however, the symptoms that arise may not indicate the source of the problem, because visual and musculoskeletal deficiencies may co-exist.

To avoid fatigue, discomfort and health problems, the VDT operation should be designed to accommodate reasonable rest pauses. These pauses should not be defined in terms of apparent work-station inactivity, as in the case of waiting time that occurs during normal VDT use; nor should they be selected in an unpredictable fashion based on work convenience. Preferably, the operator should be permitted to rest in an area removed from the VDT station, and prior to the onset of noticeable fatigue. The rest pauses should be scheduled regularly. Their scheduling and duration should be based on the visual demands of the task and the total work time at the VDT — e.g., 15 minutes after every two hours for those working under moderate visual demands.

Rest pauses are a means of overcoming or avoiding occupationally induced fatigue, and it is therefore the recovery value, not the nominal duration of a rest pause, that is important. Frequent pauses taken before the onset of a high level of fatigue are judged to be more effective than longer but less frequent pauses after fatigue has set in.

Job rotation or substitution of a less demanding activity can also provide a means of recovery from fatigue.

Some work settings have had their usual informal communications significantly altered by the introduction of VDTs, so where possible, the location for rest pauses should take this factor into account.

4. *Visual*

(a) Normal Vision

The normal eye is a fluid-containing sphere with a transparent cornea, admitting light to the lens, which focuses it onto the fovea and the retina, the image sensitive parts of the eye. For viewing distances of less than 20 feet, one third of the focussing ability, the active or "accommodating" aspect, is carried out by the internal muscles of the eye and by the malleability and elasticity of the lens. The remaining two thirds of focussing ability, the passive or "non-accommodating" aspect, is carried out by the cornea and the internal fluids of the eye.

The capacity of both the internal muscles, which vary the size and shape of the lens, and the external muscles, which control eye movement and depth perception, is so great that they do not normally become fatigued or exhausted. Current medical opinion holds that it is not possible to damage the eyes through use. One may, however, develop eye fatigue and discomfort symptoms from a prolonged effort to see clearly, because visual acuity is not a fixed property of the eye, but rather a function that depends on visual capacity, as well as on the quality of such optical stimuli as level of illumination, glare, contrast, character size, and colour.

(b) Impaired Vision

Between the ages of 20 and 60 it is common for the focusing capacity of a normally sighted individual to be reduced by about 25 percent, as the lens becomes less flexible. As one ages, this slow but progressive process results in a slower rate of accommodation to distances, diminished ability to detect small differences in light levels, and increased sensitivity to glare.

These changes tend to become the rule rather than the exception after the age of 40. Owing to the added visual demands inherent in VDT operation, these age-related impairments, together with other common visual problems that affect 20 to 30 percent of the work force, must be taken into account when the visual aspects of VDT operation are being considered.

(c) Visual Disabilities

The defective eye is usually characterized by an abnormality in one or more of the eye structures which comprise the image forming mechanism, such as an abnormal eyeball size (short-sightedness — myopia and long-sightedness — hyperopia), an unusual shape to the cornea (astigmatism), an altered lens structure (aging change — presbyopia) and cataracts, a change in the volume or viscosity of the eye liquids (glaucoma and aging), and impairment of the muscle balance controlling eye movements (squints, strabismis and phorias).

Most eye disabilities can be compensated for by the use of appropriate spectacles or corneal contact lenses. However, it is essential that the eyeglasses chosen provide a range of focus adequate for viewing such varied items as equipment and documents, each of which may require different visual capabilities. For example, glasses prescribed for reading may not match the viewing distance of either the VDT screen or keyboard. It may therefore be necessary for an operator to use bi- or multi-focal lenses, for without a sufficient range of focus, a person may unconsciously resort to dysfunctional postural positions in order to secure the optimal viewing distance.

(d) Vision Testing

According to the majority of published expert opinion, there is little likelihood that VDTs produce damaging or disabling eye conditions. What research documents have indicated, however, is that failure to accommodate the operator in VDT design, implementation, and use may result in health complaints.

Although these complaints may not be individually disabling, their combined effect on a continuing basis may prove debilitating. It is therefore important that vision testing not be treated as a substitute for normal health and eye care. In the absence of generally accepted guidelines on visual testing, it is recommended that eye examinations be conducted on the principle of early detection and correction of defective vision. Any ongoing visual complaint should serve to indicate the need for a prompt and complete optometric or ophthalmological examination, including refraction, acuity, accommodation, colour vision, corneal, lens, and retinal testing.

Operators should undergo regular vision testing prior to and during their working with a VDT if there is an existing eye complaint, a corrected visual defect that has not been examined for two years, or a marked concern about the safety of VDT viewing — especially if the work involves a high visual demand and the potential operator is over 40 years of age.

If large numbers of employees require vision testing, employers, union, and occupational health and safety personnel may want to consider establishing a formal visual-test program. Like other health-surveillance programs, it should take into account the need for confidentiality, and the setting up of a central system for recording results, in order to ensure detection of an abnormal incidence of visual defects. Program organizers should also consider the need to educate employees on the health aspects of VDTs, to regularly assess employees with defective vision, and to evaluate existing rehabilitation resources and employee benefit packages to determine how they might be adapted to provide retraining and alternate job placement of employees.

5. *Other Medical Conditions*

It has been estimated that between one and three percent of the epileptic population is subject to visual-reflex epilepsy — i.e., epileptic seizures induced by visual stimulation. Despite the rarity of this condition, it would seem a wise precaution to have

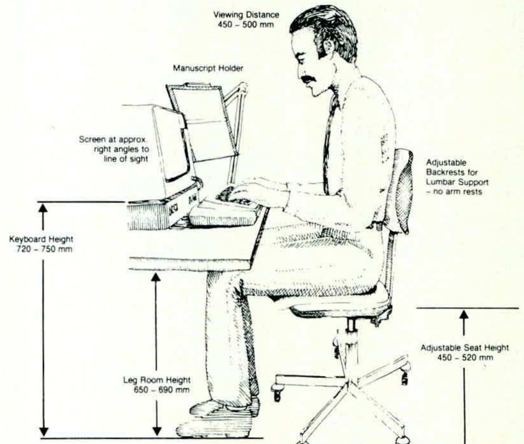

FIGURE 1 — WORK STATION DIMENSIONS

known photosensitive epileptics undergo an appropriate medical examination before using VDTs, especially if the employee has a history of being adversely affected by watching TV.

Ergonomics

Ergonomics is the planning and adapting of equipment or tasks to promote the comfort and efficiency of workers.

By applying sound human engineering principles to the design of the VDT work environment, the incidence of visual and musculoskeletal-induced discomfort and fatigue can be significantly reduced. The following sections identify visual, postural and environmental problems normally present in the VDT work environment, and offer proven ergonomic principles for their control.

1. *Vision-Related*

As discussed in the preceding sections of this text, working at a VDT places special visual demands on the operator. Because of this, the following factors merit special attention:

(a) The Quality of the VDT Display Image

Display-image resolution is determined by *character size* and *intercharacter spacing*. If the characters are too small or too close to one another, legibility is diminished. If the characters are too large, then the phosphor dots appear to dissociate. At times, VDTs may suffer from distracting *flicker* (the characters seem to "jitter" or "shimmer"). This is due to the decay of the phosphor image before it is refreshed by the electron scan. Maintaining a minimum refresh rate of 60 Hertz (cycles per second) should prevent flicker. *"Swim"* is the term used when the whole screen image wavers or moves. This is caused by power supply instabilities, or power supply voltage consistently below the nominal voltage rating of the VDT. The signal strength may be insufficient to ensure a static image. In such a case, it may be necessary to consider the installation of what is termed a "dedicated power line" or constant-voltage device. The *resolution* (clarity) and *luminance* (brightness) of the VDT characters may be degraded by grime on the screen or deteriorating cathode ray tubes. Periodic cleaning of the screen, and replacement of an expiring CRT will enhance the resolution and luminance of screen characters.

(b) Presence of Glare

Glare results when bright sources of light — e.g., light fixtures, windows, or their reflected images — fall within the operator's field of vision. Once the processes of visual adaptation are disturbed, visual discomfort may result. The operator may adopt a poor body posture to minimize the glare, possibly leading to neck and back pains.

VDTs should not be placed against a bright background such as windows or white walls, because the eyes adjust to the total light entering them, and the images on the screen become more difficult to see. Walls should be textured (matte finished) in neutral tones to reduce reflections. Windows should be furnished with pattern-free curtains or roll blinds (venetian blinds can cause a pattern of light stripes). The VDT should be located so that the operator's line of viewing is parallel to the windows, hence avoiding VDT screen reflections. Similarly, light fixtures should be located along the sides of the VDT. Light fixtures located in front of the VDT operator cause direct glare, and those located directly overhead or behind the operator cause reflected glare. To control glare, light fixtures should be shielded with prismatic diffusing lenses or, preferably, cube-parabolic louvres.

Another means of reducing glare is to install filters on the front of the VDT screen. Different types of filters are currently available. However, reducing reflections by this means occurs at the expense of resolution and image brightness. A roughened screen panel (fine grain etch) or a coating of VDT screens provide the best methods of controlling reflections without too much compromise of brightness and clarity. The screen should not have been too coarsely etched, or the character image will diffuse and seem unclear. From the point of view of reducing reflections alone, micromesh filters have been judged to be equally effective, but they greatly reduce brightness, contribute to blurring, and produce a flat display that may be difficult to read. Polarization (tinting) of filters with an anti-glare coating is the second-best method. Because filters have some disadvantages, the best method for preventing reflections is to position the VDT correctly in relation to light sources. An adjustable screen angle will also help.

(c) Other Sources of Glare

Shiny key tops and source documents can be distracting to VDT operators. The shape of the key top can act as a mirror. For this reason, keys should have a matte surface, and be a neutral colour — for example, gray.

Source documents may be over-illuminated or wrongly positioned, thus creating difficulties in reading. If possible, the source document should be provided on other than white, glossy paper, so that strain caused by frequent adjustment — from the dark screen to the bright paper and back — is avoided or reduced.

(d) Lighting for the VDT Environment

Discerning text on a VDT screen is greatly enhanced by reduced ambient or environmental illumination: light characters on a dark screen require less light for reading than do dark characters on a light background. The average brightness in the total visual field should be matched with the brightness of the immediate visual objects, in order to reduce constant readjustment of the eyes to the varying lighting conditions.

When the user's task involves both VDT and paper, a compromise light level is required; one bright enough for the paperwork without reducing screen contrast.

Ambient light levels:

— 500 - 700 lux* is an acceptable compromise for tasks requiring

continuous use of source documents;
- 300 - 500 lux* is an acceptable compromise for tasks requiring occasional use of source documents.

2. *Posture-Related*

Four basic conditions must be satisfied in order to make the work area operational.

VDT users should be able to:
- reach and operate all controls;
- see and read the displays;
- adopt a comfortable posture by adjusting chairs and the VDT; and
- have easy access in and out of the work place.

Back problems are mainly caused by incorrect work place design leading to poor posture and muscle tension. Figure 1 identifies preferable work-station dimensions. Numerous factors contribute to poor posture.

(a) Seating

A suitable chair is an important part of a VDT work station. Failure to have proper seating and good posture can cause fatigue in calf, thigh, back and neck muscles. For the VDT user, a suitable chair will have the following characteristics:
- total adjustability, which can be regulated from a seated position;
- good stability (preferably on five legs and castors);
- no arm rests to interfere with arm movements;
- adjustable backrest to support the lower spine and lumbar region;
- a backrest that is adjustable in two directions — forward and up;
- rounded front seat edge to prevent cutting into the thigh;
- flexible, upholstered material that helps to distribute the pressure of sitting more evenly, thus eliminating pressure spots and blood pooling; and
- woven chair coverings to prevent sliding, body heat buildup, prespiration and chafing.

Other requirements that must be met if the chair is to satisfy the foregoing conditions are as follows:
- chair should be adjustable in height between 450 and 520 mm;
- correct sitting height is obtained with feet flat on the floor, and the thighs in a horizontal position on the chair seat;
- depth of the chair should be about 380 mm;
- seat depth, while sitting, should be less than the distance from the back of the buttock to the inside of the calf, to allow sufficient space to prevent the edge of the seat from pressing into the back of the calf;
- backrest should be adjustable in height between 125 and 200 mm from the seat;
- backrest must be sufficiently high to give direct support to the small of the back;
- angle between seat and backrest should be between 95 and 100 degrees; and
- seat should be horizontal or sloping back by up to 5 degrees.

(b) Foot Rests

For smaller operators, when the desk height is fixed, correct leg posture (thighs horizontally on the seat and feet flat on the floor) can be achieved with a foot rest, having these characteristics:
- adjustable both in height (from 0 to 50 mm) and inclination (10 to 15 degrees); and
- large enough to cover the entire usable leg area to avoid movement restrictions.

(c) Desks and Work Surfaces

Desk space should be adequate and not cluttered. Too small a desk makes the work place unpleasant and cramped, and inhibits proper working posture. Desks should provide:
- enough space for document holders, incoming and outgoing document trays, calculators, pencils, etc.;
- an area for handbags and briefcases, to prevent tripping;
- adequate leg room; and
- desk tops should not be too thick, otherwise correct arm position cannot be maintained.

Measurements required for desks to satisfy the above conditions are as follows:
- desks should have a suitable height to accommodate a keyboard height of 720 to 750 mm above the floor; VDT screen height and keyboard height should be independently adjustable; ideal arrangement is a VDT with a keyboard detached from the display screen, and a fully adjustable machine stand;
- minimum leg-room height should vary between 650 and 690 mm; and
- leg-clearance space between thigh and desk should range between 170 and 200 mm for easy access in and out of the work place.

(d) Keyboard and Screen

If the keyboard is attached to the screen casing, it is impossible for all operators to sit comfortably while keying and reading the screen. Hence a detachable keyboard is strongly recommended, also:
- optimum height of keyboard should permit forearms and hands to be held approximately horizontally;
- wrists should not need to be cocked-up in order to reach the keyboard, as this may produce wrist problems; hence keyboard should be of minimum thickness to ensure correct elevation;
- keyboard should not be placed too far from the desk edge, as this subjects wrists and forearms to cutting action;
- screen height should be such that the viewing angle is approximately 20 degrees below the horizontal, thereby allowing for a slightly downward gaze in accordance with the natural curvature of the spine; and
- viewing distance between the screen and the eyes should not be greater than 700 mm (450 to 500 mm recommended).

(e) Document Holders

Placing documents flat on the desk results in awkward twisting and bending, which leads to neck and shoulder tension. Using adjustable document holders, and placing them

*lux — unit of illumination level — 500 lux is equivalent to approximately 50 footcandles.

next to the VDT screen at a similar angle, distance and height, provides the following advantages:
— minimizes bending and twisting of the head and neck;
— minimizes eye adjustments, as the viewing distance between the source and screen is decreased; and
— minimizes reflected glare from the source document.

(f) Posture

Holding any set of muscles in a fixed position for a long time is tiring, but some positions are less fatiguing than others. Special attention must be paid to the arms, head, spine, pelvis, abdomen and thighs of the seated operator.

Optimum VDT work-station design will enable the operator to assume the following favourable posture:
— arms should be held horizontally at a 90 degree angle from the elbow; raising them higher for an extended period requires more energy, and results in earlier onset of fatigue;
— wrists should be in line with the forearm, as cocking the wrists up may result in wrist problems;
— head should be slightly inclined forward to follow the natural curve of the spine; if the head is bent down too far, the support will shift from the spine to the shoulder and neck muscles, thereby inducing fatigue and headaches;
— spine should be kept fairly straight, with the backrest supporting the lower back and pelvis, enhancing the lumbar curvature of the spine, and preventing rotation of the pelvis and consequent fatigue and strain in the back muscles;
— abdomen will be naturally tucked in with a straight upright spine, thereby aiding in the support of the spine and back muscles;
— thighs should be resting horizontally at a 90 degree angle from the pelvis; and
— feet should be placed flat on the floor and not wrapped around one another, as this compresses the soft tissue of the thighs and calves, diminishing blood flow; a foot rest is necessary for smaller operators.

Employing good posture is essential if the VDT operator is to avoid unnecessary discomfort, fatigue, aches and pain.

Even when the operator is provided with a properly designed workplace, problems may occur. Maintaining a fixed static posture (even an apparently good one) is fatiguing. A certain amount of movement is necessary and is encouraged. Doing simple body and eye exercises during rest breaks can be helpful in avoiding strains in the back muscles, fatigue of the eye muscles, and the long-term consequences of blood pooling. It is in the area of posture that the VDT operator has the most control over his/her work environment, health and well-being. Appendix "A" describes some simple exercises the VDT operator can do at the workplace.

3. *Environment-Related*

General working conditions are also important. The visual environment has already been discussed in some detail. However, several additional points deserve mention:
— the opportunity to rest the eyes by viewing relatively distant objects is important; visual relief areas that are visible from the VDT work place are desirable; backgrounds with distracting patterns, a lot of free movement, and in sharp contrast to the work station, however, should be avoided; and
— optimally, all large surface areas should be in soft pastels or warm gray, and devoid of point sources of light.

Other environment issues of importance are temperature and humidity.
— all VDTs and related equipment emit heat, often as much as 400 watts from a single VDT; this may place considerable demands on the existing ventilation system;
— concentration often leads to a reduction in eye-blink rate; the lack of humidity tends to dry out the secretions on the surface of the eye and may cause irritation; and these symptoms may be intensified in contact-lens wearers.

Static electricity can also cause problems for VDT operation:
— discharge between operators and VDTs can cause data loss, program changes and operating difficulties; static charges can attract dust and dirt to the screen face; and static electricity can cause skin irritation for operators.

Providing draft-free ventilation, avoiding overcrowding of VDTs in the work place, and maintaining a constant relative-humidity level (preferably 50 to 70 percent) should minimize or eliminate these problems. Periodic cleaning of the VDT screen with anti-static solutions will control dust accumulation, and anti-static floor mats can reduce static-electricity problems in low-humidity work places.

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Editor's Note

Copies of a booklet which includes the foregoing text, as well as illustrations of a) the structure of the eye; b) a work station layout; c) examples of good and poor posture; and Appendices: a) simple exercises for the VDT operator; b) an employee referral form re: vision testing; c) an examiner's form re: vision testing and d) investing in a VDT — Equipment selection; can be obtained by writing:

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The Effect of Aging of the Visual System on the Pilot

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The effects of aging of the visual system are encountered daily by the practising optometrist. How these visual changes can affect the mature pilot (over age 40) is not so well-documented.

Optometrists will have the opportunity to examine more people who fly as the field of aviation becomes more accessible to the average person. We are also now encountering more professional pilots in their late 50's and 60's as the men and women who started flying at the end of the Second World War reach retirement age. Retirement age for the commercial pilot is 60, but people can continue flying privately into their 70's, as long as they remain healthy and can pass the physical requirements for flight.

Up to the present time, aviation research has not isolated all the visual factors used in flight. Therefore, it is quite difficult to determine how aging affects these factors, and thus affects flying ability. For the purpose of this paper, we will assume that there is a steady deterioration of our visual abilities with age. It is, therefore, important to determine when this deterioration will affect the ability to perform a certain task or, in our case, at what point safety in flight will be compromised.

It is important for the practitioner to understand the stress placed on the visual system in flight. The pilot, at all times, has to be able to locate other aircraft in his/her vicinity and estimate their altitude and direction. (S)He must also try to visualize where other aircraft are as (s)he listens to their conversation with ground control. Instruments are checked, the horizon is scanned and then attention turns back again to the cockpit environment. All of this is accomplished in varying lighting conditions at various distances ranging from optical infinity (the horizon) to the approximately twelve (12) — inch distance to the overhead switches in the Boeing 767 aircraft. Specific instrument distances will vary from aircraft to aircraft and from pilot to pilot. It is important for you, as an optometrist, to ask your pilot patient to measure the distance from his or her eyes to i) the instrument panel; ii) the overhead dials and iii) where his or her flight charts are normally kept. Some charts are clipped to the steering column, a distance of 18 inches and, in other aircraft, the charts must be placed on a shelf beside the pilot approximately 33 inches away. Backman and Smith, in their publication, **Vision in the Aircraft Cockpit**[1], have compiled the distances used by most pilots in the different types of aircraft.

A large amount of visual, auditory and somatic information must be quickly assimilated and interpreted, and the pilot must react accordingly. These demands on a pilot become greater during landing and take-off, increase further around high-density airports and become even more intense and stressful under bad weather conditions. In all of these circumstances, peak efficiency of his or her visual and reflex systems must be maintained.[9]

Since reaction time also slows with age,[4] the diminishing ability of the brain to react quickly enough to process and analyse the information received through the visual senses can produce a dangerous situation. It is also increasingly difficult to disregard distracting stimuli which might be present in the cockpit,[4] for example, the second officer making slight engine corrections, or the distraction of a malfunctioning dial.

One of the first visual changes a pilot will complain about as he or she approaches 40 is a loss of focussing ability. As the crystallin lens becomes harder and more yellow with age, glare becomes more of a problem, and the transmission of light to the retina will gradually diminish. Therefore, operating under low illumination levels, e.g., in clouds or at dusk, might present some problems[9].

The reason for the loss of focussing ability has to be carefully explained to the pilot and an appropriate prescription given when the reading of charts becomes difficult. The optometrist must make sure he or she knows the particular distance used.

The reduction of glare with coated lenses is an even more complex problem. Some of the parameters to be considered include the tint, which must not change the real colour of the environment, nor can it impede vision when the pilot looks at the dials in the cockpit.

I have found that the most

successful prescription arrangement is "Half-eye" frame for cockpit use and bifocals, with the upper distance area tinted grey #4 and the lower segment clear, as the sunglass prescription. I have used the photogray lens, but with very little success, because not enough ultraviolet light penetrates the cockpit. Polaroid lenses are excellent but I have found that the labs will not, or cannot make the lower segment clear.

One might also expect to find a drop in dark adaptation with age,[2,9] but research on this question has given us conflicting results. We can only say at this time that there is a high correlation between good health, lack of ocular disease, and good dark adaptation. On the other hand, the ability to recover from the effects of bright light does deteriorate with age.[2] The senior pilot will experience this deterioration when flying near lightning storms, or when encountering the bright lights of a city during a night approach. Dark adaptation, and the ability to recover from the effects of bright lights, are not exactly the same. Recovery from bright light is the very early portion of the dark adaptation curve. To lessen these effects, the dial illumination system should be turned up high. Conversely, when approaching poorly-lit airfields, (and these still exist), the dial illumination system should be turned up just enough to give good near vision, but not high enough to impede distance vision.

Much experimentation is done in controlled laboratory conditions, and the findings applied to the real world. This can be subject to grave distortions, as in the case of visual acuity. The visual acuity obtained in the office is used to determine what the acuity of the pilot will be in flight. While this is a proper technique for most of the people we examine, it can be very misleading when testing flying personnel. The visual acuity needed to perceive a moving object in space is quite different from the acuity needed for a stationary letter on a chart.[5]

For example, prescribing a +1.00 o.u. for driving will be used with no complaint, but will have to be reduced to +0.50 o.u. to be worn comfortably when flying, even though we found the +1.00 o.u. in our subjective and it gave us a perfect 20/20 acuity. It has been found that the measure of static visual acuity has very little relevance to the dynamic visual acuity needed in flying.[5] The rule of thumb in prescribing at distance for aviators is minimum plus to see the 20/20 line less 0.25 o.u. This formula has worked very well for me through the years. I suspect that the reason pilots feel more comfortable with the results using this technique is because of the effects of both space and night myopia phenomena.

The proper functioning of the oculo-motor system is essential for the rapid scanning of the area within and outside the cockpit, the identification of moving objects, such as birds and other aircraft, and is most important in aiding the pilot in determining the position of the aircraft on landing. There is a definite diminution of this ability with age,[10] but it can be maintained at peak efficiency with the appropriate training.

Central and peripheral fields are also reduced with age,[7] the reduction coming most rapidly after age 50. Emotional and physical stress can also tend to constrict the fields. To limit the effects of this constriction, the aviator must be taught to keep moving his/her eyes, constantly scanning the total flying environment. Visual exercises such as rotations and fixations, peripheral awareness training and especially tachistoscopic training can be used. The constriction of the senior pilot's visual field can become quite extensive when one combines stress conditions, poor lighting, physical fatigue and age[3]. Interestingly, tests have shown that field reduction in the pilot population lags behind that of the general population.[7,10] This, I suppose, is due to the constant exercise of this aspect of vision in the course of pursuing this vocation.

Excellent depth perception is also important in flying.[8] It is used to determine range, rate of closure and motion in depth. Complaints of deterioration begin around age 40, but, again, seem to be less extensive in healthy individuals.[8]

The optometrist must teach his or her older pilot patients to compensate for the deterioration of their visual skills. Visual deterioration due to the aging process seems to occur more slowly in the pilot population, possibly due to the constant exercising of these skills and abilities in flight, and the constant practice in flight simulators. Therefore, the key to maintenance of peak efficiency of the visual system is constant exercise and good health.

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Successful Visual Training for a Presbyopic Patient Following Unsuccessful Prism Therapy

K.M. Robertson*

Abstract

Orthoptic therapy was instituted on a presbyopic patient having convergence insufficiency. The combination of presbyopia and convergence insufficiency has often suggested a poorer prognosis. Prism therapy had been attempted previously and the measurement over ten years indicated some form of prism adaptation as well as reduced measured fusional reserves. During visual training and after cessation of visual training the increased positive fusional vergences were monitored and recorded.

Abrégé

Un presbyte souffrant d'une insuffisance de la convergence a été soumis à un programme d'orthoptique. La presbytie et l'insuffisance portent à pronostic douteux. La prescription de prismes durant une dizaine d'années démontre une certaine compensation ou adaption à leur effet ainsi qu'une diminution de l'amplitude de la fusion.

Au cours du programme et à la suite les réserves de la fusion positive ont manifesté un regain d'amplitude.

*O.D., M.Sc.
Adjunct Assistant Professor
Coordinator, Binocular Vision Clinic,
University of Waterloo

History

A 52-year old male was referred to the Binocular Vision Clinic at the School of Optometry, University of Waterloo. His complaints consisted of blurred vision at his reading position and occasional diplopia.

The diplopia in the distance occurred while driving when tired.

His bifocal prescription was as follows:

right lens:
+1.00 ⊃ 2Δ B.I. +1.75 addition
left lens:
+0.75 ⊃ 2Δ B.I. +1.75 addition

Interpolar separation was 68/65 which equaled his interpupillary distance.

This prescription adequately corrected his hyperopia and presbyopia.

Tests measured over the above glasses gave the following results:

Cover tests

1) unilateral cover test at 6M: monofixational exophoria.[1,2,3]
2) alternating cover test at 6M: 7Δ exo + 4Δ(in Rx)=11Δ (total exodeviation.
3) unilateral cover test at 40 cm: monofixational exophoria and intermittent exotropia.
4) alternating cover test at 40 cm: 18Δ exo +4Δ (in Rx)=22Δ total.

Loose Prism Vergence Tests

1) negative fusional vergence at 6M: x/10/8
2) positive fusional vergence at 6M: x/10/4
3) negative fusional vergence at 4M: x/20/18
4) positive fusional vergence at 4M: x/6/2

Fixation Disparity Tests

1) at 6M:4Δ B.I. required to alleviate the fixation disparity
2) at .4M: 1Δ B.I. required to alleviate the fixation disparity.

Tests for Sensory Fusion

indicated that the deviation occasionally became manifest at 40 cms.

Steroacuity

at 40 centimeters was reduced to 50 seconds of arc.

Near Point of Convergence

was measured as 11 centimeters from the bridge of his nose.

The diagnosis, therefore, consisted of:

1) hyperopia
2) presbyopia
3) basal exodeviation
4) convergence insufficiency

The recommended optometric therapy consisted of visual training to increase reflex positive fusional reserves and voluntary vergence. Records of the patient's previous visual care over the past 10 years were acquired, evaluated and recorded in Table 1.

After eight weeks of training consisting of five in-office visits and home training, glasses were supplied without the relieving prisms. The patient's binocular vision status was monitored over the following year.

His progress also is recorded in Table 1 for comparison and is described under **Data.**

Procedures

The methods used in the office to improve positive fusional vergence consisted of gradually increasing the stimulus to convergence on Brewster stereoscopes, Wheatstone stereopsis, anaglyphic targets, vectographic targets, and prism bars while ascertaining that there is no induced suppression and that bifoveal fixation is present.

Similar methods were used at home excluding the Wheatstone and Brewster stereoscopes.

To improve voluntary vergence, the stimulus to convergence was altered to induce retinal disparities of such large magnitudes that reflex fusional vergence was not stimulated, i.e. — a 10 Δ base-out prism was placed in front of either eye while the patient is viewing a target.

Data

In Table 1 are recorded the negative and positive fusional limits measured at 6M (upper half) and at .4M (lower half). (All recordings are total positive fusional vergence, no added prisms necessary).

Visits #1-6 indicate the ten years before entering the binocular vision clinic in visit #7.

Visit #5 indicates the visit when the 4 Δ base-in relieving prisms were first prescribed.

Visit #8 indicates the 8 weeks of visual training, and therefore

Visit #9 indicates the fusional vergence reserves after training.

Visit #10 indicates the fusional limits after wearing the prescription with no prism and no visual training.

Visit #11 indicates the fusional limits after 4 months home training and 6 months of no visual training.

N;Y means no;yes respectively indicating the presence or absence of blur or diplopia (DIPL) in the case history.

NPC means near point of convergence.

The column Rx indicates whether the refractive error was corrected (yes) or not (not) and if the 4 Δ base-in (4 Δ BI) was prescribed or removed (0BI).

The three measures of NPC with asterisks (*) were taken through the 4 Δ BI relieving prisms.

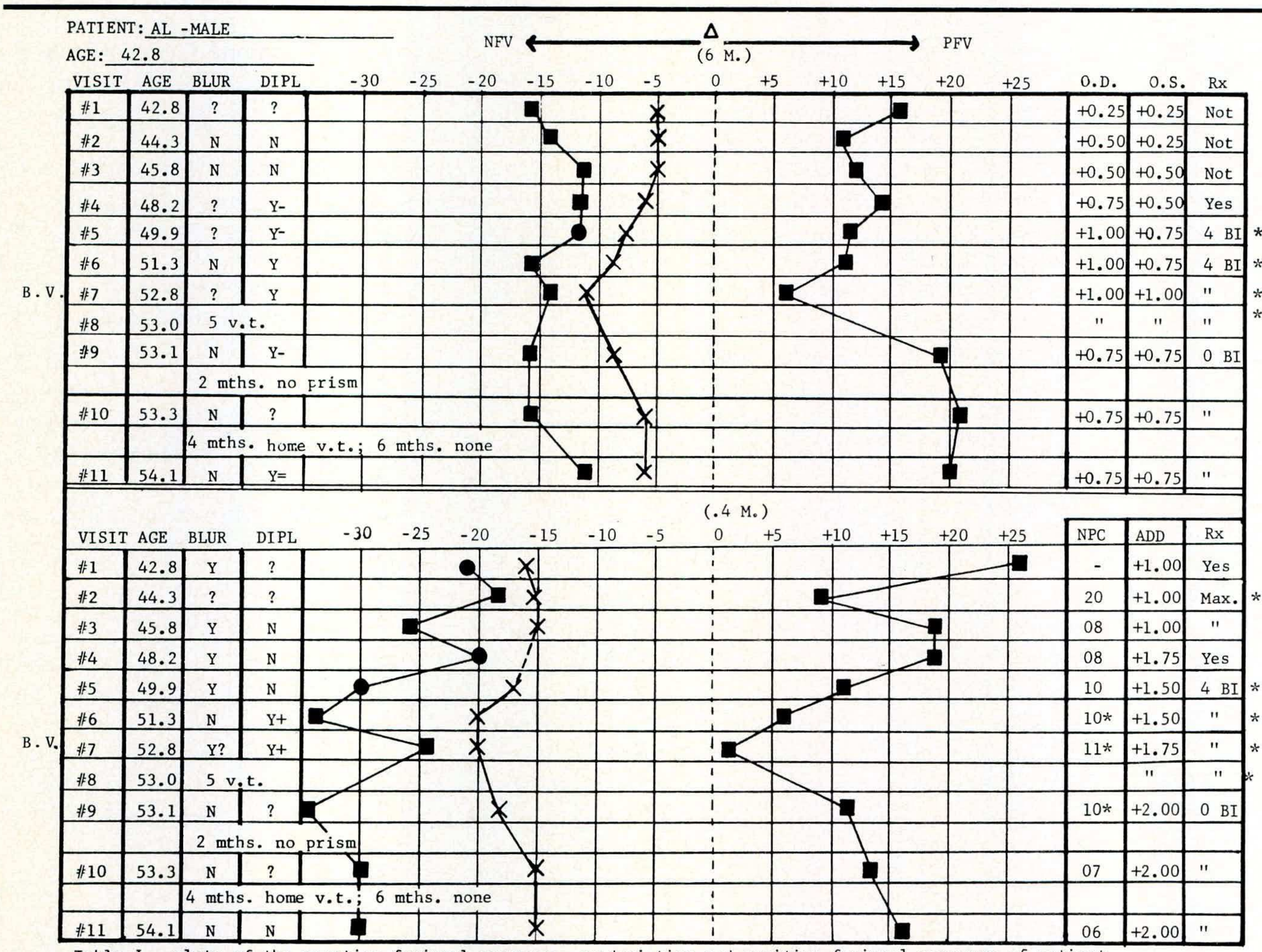
□ — indicates break

0 — indicates blur

X — indicates magnitude of the deviation.

Discussion

It has been shown that presbyopes are amenable to visual therapy,[4] however, is visual training the preferred treatment? Relieving prisms for some intermittent exotropes are not usually recommended.[5] The presbyopic patient described in the text did exhibit prism adaptation. The basal exodeviation measured by the von Graefe method steadily increased in magnitude from visit #4 to visit #7 while 4 Δ base-in relieving



6 M.:

VISIT	AGE	BLUR	DIPL	O.D.	O.S.	Rx	
#1	42.8	?	?	+0.25	+0.25	Not	
#2	44.3	N	N	+0.50	+0.25	Not	
#3	45.8	N	N	+0.50	+0.50	Not	
#4	48.2	?	Y-	+0.75	+0.50	Yes	
#5	49.9	?	Y-	+1.00	+0.75	4 BI	*
#6	51.3	N	Y	+1.00	+0.75	4 BI	*
B.V. #7	52.8	?	Y	+1.00	+1.00	"	*
#8	53.0	5 v.t.		"	"	"	*
#9	53.1	N	Y-	+0.75	+0.75	0 BI	
		2 mths. no prism					
#10	53.3	N	?	+0.75	+0.75	"	
		4 mths. home v.t.; 6 mths. none					
#11	54.1	N	Y=	+0.75	+0.75	"	

.4 M.:

VISIT	AGE	BLUR	DIPL	NPC	ADD	Rx	
#1	42.8	Y	?	-	+1.00	Yes	
#2	44.3	?	?	20	+1.00	Max.	*
#3	45.8	Y	N	08	+1.00	"	
#4	48.2	Y	N	08	+1.75	Yes	
#5	49.9	Y	N	10	+1.50	4 BI	*
#6	51.3	N	Y+	10*	+1.50	"	*
B.V. #7	52.8	Y?	Y+	11*	+1.75	"	*
#8	53.0	5 v.t.			"	"	*
#9	53.1	N	?	10*	+2.00	0 BI	
		2 mths. no prism					
#10	53.3	N	?	07	+2.00	"	
		4 mths. home v.t.; 6 mths. none					
#11	54.1	N	N	06	+2.00	"	

Table I - plots of the negative fusional reserves, exodeviation and positive fusional reserves of patient AL-Male from age 42.8 to 54.1. Symbols are described under DATA in the text.

prisms were being worn. The measured reserves of positive fusional vergence both at 6M and .4M steadily decreased until on visit #7 it was 2Δ at .4M — at which time the diagnosis was intermittent exotropia. The symptoms of diplopia at 6M and .4M did not appear until the base-in relieving prisms were prescribed. It is interesting to note that the near point of convergence measured in visit #5 with no base-in prism equals the near point of convergence measured in visit #6 with 4Δ B.I. after 1.4 years of wear.

After visual training was commenced, the basal deviation from visit #7 to visit #9 decreased substantially. With the removal of the 4Δ B.I. relieving prisms further reduction of the basal deviation was noted and the cessation of diplopia occurred.

After ten months, (4 months of home visual training and 6 months of no visual training) the basal deviation remained at the same magnitude equaling that measured 9 years earlier before prism therapy was instituted. The positive fusional amplitude did not regress.

Conclusions

1) The presbyopic patient described in this test did adapt to base-in relieving prisms with accompanying symptoms and signs of intermittent exotropia of the convergence insufficiency type.

2) With visual training and no prism therapy the trend was reversed and better binocular coordination with improved sensory integration was achieved.

3) The possibility that the presence of the monofixational exophoria was the determining factor of the prism adaptation was not discussed.

4) There is a definite need to evaluate all aspects of binocular mechanisms before visual training or prism therapy is commenced. These aspects need to be monitored and evaluated throughout the treatment.

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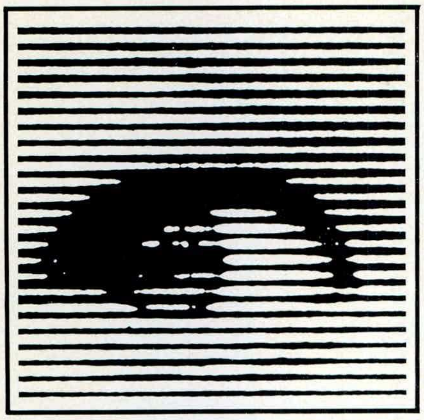

Ocular Accommodation in Juvenile Diabetics: A Preliminary Report

M.E. Woodruff*
J.V. Lovasik** M.M. Spafford***

Abstract

This paper discusses aspects of Ocular Accommodation measured by the push-up to blur out and minus lens to blur out methods in a sample population of juvenile diabetics. The data suggest an accelerated age-related trend to loss of accommodation. Since as many as 2/3 of this sample failed to reach Duane's minimum norms of accommodation careful measurement of ocular accommodation in young persons between 6 and 18 years of age may provide a means of early detection of diabetes mellitus, particularly when considered in conjunction with a tear glucose test and case history. Since this is a preliminary report the authors ask speculative questions on causative mechanisms.

Abrégé

Ce travail présente les résultats de deux mesures de l'accommodation déterminées dans une population de jeunes diabétiques. Les données suggèrent une tendance à une baisse prématurée de cette fonction. Deux tiers des sujets ne rencontrent pas les normes de Duane. Les auteurs proposent donc qu'une évaluation minutieuse de l'accommodation dans les âges de six à dix-huit ans pourrait servir à dépister la diabète surtout si on ajoute le test de glucose lacrymal et porte attention à l'histoire du cas. En marge de cette enquête préliminaire, les auteurs spéculent sur la cause de ce phénomène.

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INTRODUCTION

Diabetes is a disorder of carbohydrate metabolism resulting from insufficient action or production of insulin. The disease leads to various systemic disorders such as hyperglycemia, polyuria, muscular weakness and weight loss. This disease is often detected only when a routine urine analysis is done because of secondary complications arising from the underlying metabolic disorder. A definitive diagnosis of diabetes requires blood glucose tolerance determination. Diabetes has two forms; "adult onset" which is usually due to an hormonal imbalance affecting the regulation of insulin production and "insulin deficiency" form which is thought to be produced by viral infection of the pancreatic cells. The insulin deficiency form of the disease has a strong hereditary component and is termed juvenile or "Brittle" diabetes. The onset of this form of the disease usually occurs before 30 years of age, often much younger. Ten percent of diabetics fall into the juvenile diabetic classification[1-4] and thus a substantial number of cases are apt to appear in optometric practices making early detection and continuing vision care a necessity.

In addition to these metabolic changes there are also ocular changes that occur in diabetes. For example, there may be variations in refractive error and intraocular pressure, as well as structural changes in the extra ocular muscles, iris, cornea, conjunctiva and retina. The most serious ocular complications of diabetes are those resulting from vascular changes in the retina. Diabetic retinopathy[5-7] can be divided into three phases; the first, termed "background retinopathy" exhibits the development of microaneurysms, lipid deposits, hard exudates, macular edema and cystoid macular edema. A "preproliferative" phase follows, and is characterized by cotton wool spots, intraretinal microvascular anomalies centrally and peripherally, venous beading, papillary closure and anteriole abnormalities. The "proliferation" phase consists of neovascularization of the disc (NVD), neovascularization elsewhere in the retina (NVE), and proliferation of fiberous tissue over areas of the retina. This latter change results in a high risk of tractional retinal detachment. This proliferative phase presents serious consequences to both central vision and the visual fields which can lead to blindness.

In July, 1980, one of us (MEW) began a clinical program of photographic documentation of the ocular fundus of juvenile diabetic patients at the Kitchener-Waterloo Hospital in response to the medical advisor of the Diabetic Day Care Center.

Before using a cycloplegic agent to dilate the pupil of the eye preparatory to refraction and photography, the status of vision and ocular health of each patient was assessed. The initial objective of the project was to establish baseline data of the status of vision and the ocular fundus at a point in time, and to compare this baseline data with visual findings and subsequent fundus photographs taken under similar conditions.

As part of the oculo-visual assessment prior to fundus photography, the ocular accommodative ability of each eye was measured by the push up to blur out method commonly used in clinical optometrical practice. Interocular differences in accommodative ability as well as reduced accommodative amplitudes were noted in a number of the juvenile diabetics. These unexpected and unusual variations occurred with sufficient frequency to need exploration and correlation with various parameters of the physiological status and medical conditions of the patients.

Vision literature has a number of general references to loss of accommodation[8,9] in diabetes but few of these references are related to the loss of ocular accommodation in juvenile diabetes. In two recent ophthalmological[9,10] texts there is little or no documentation as to the extent of the reduction in accommodation or to the temporal aspects of accommodative loss in either juvenile or adult onset diabetes. The relationship of accommodative loss to the duration of the disease has not been quantified, nor is the response of the accommodative function to diabetic treatment documented. The effect of accommodative reduction on the association between ocular accommodation and the related convergence has not been explored. While the authors have been able to find references to loss of accommodative function in young persons[11-13], no papers in western vision literature reported detailed cross sectional or longitudinal studies of ocular accommodation in populations of juveniles who had diabetes mellitus. In Russian vision literature[14,15], we did identify two papers, one on ocular accommodation and a second on aspects of the extraocular muscles used in mediating convergence. These papers reported only a single cross-sectional study and left uninvestigated many of the areas and relationships related above.

Methods

Accommodative Amplitudes were taken by the push up to blur out method using Prince's Rule for all 49 subjects during the initial vision assessment at the K-W Hospital Diabetic Day Care Clinic. Two of us, MEW and JL made all of these measurements.

Subsequently 32 patients were seen in the University of Waterloo Optometry Clinic for a complete assessment of visual structures and functions including an electroretinogram and visually evoked cortical response work-up. At this visit amplitudes of accommodation were measured by the minus lens to blur out method. The majority of these measures of accommodation were made by one of the investigators MMS.

The amplitude measurement was taken using a standard near point reading card with a surface reflectance of 85%. The stimulus used was the 0.5M paragraph. Illumination was 15 ft.L, the luminance standard used for accommodative amplitude measurement at the School of Optometry.

RESULTS

Amplitudes of accommodation ranged from 15.0D to 7.0D with a mean of 10.0D (SD+/-2.96D).

The push up to blur out amplitude for each eye is displayed as a scatter plot on a replot of curves of Duane's normals[3], Figure 1. Duane's median amplitude and the range of high and low amplitudes are displayed in this figure as a solid line and shaded areas above and below the line. Fifty two of the 98 (53.1%) eyes comprising the sample did not attain Duane's minimum amplitude when measured by the push up to blur out method. Since magnification of the fixation target occurs as it is moved in a ramplike way closer to the eye, we assumed that this contributed a maximum of one diopter of measurement error to the push up to blur out findings. If this latter assumption is made, 32.7% of eyes fail to meet the minimum values of Duane's normal range of accommodation amplitude.

The minus lens to blur out amplitude data for each eye of 32 patients are shown in Figure 2. This figure shows that 67.2% of eyes failed to reach Duane's minimum amplitude. If it is assumed that a 0.50D measurement error was induced by the subjective judgement of the patient in responding to the steplike accommodation stimulus through minus lenses, the number of persons failing to meet Duane's minimum range of normality is 59.4%.

Figures 1 and 2 also contain insets which show the regression lines for both Duane's median amplitudes and the respective regression lines for push up to blur out and the minus lens to blur out amplitudes of accommodation. These figures show an accelerated decline of accommodative amplitude with age. The calculated regression coefficients represent the slope of these regression lines and indicate the change in amplitude per year of age. The rate of decline of amplitude per year, for the push up to blur out amplitudes was -0.37 D/year and the rate for minus lens to blur out amplitude was -0.35 D/year.

This sample of juvenile diabetics lacks representative number of subjects in some age groups. While, our data suggest the existence of an accelerated rate of loss of accommodative amplitude among juvenile diabetics, it will require additions to the sample in these groups to confirm or deny the validity of the indicated trend. Accommodative amplitudes derived by the push up to blur out method were equal between the two eyes of 30 of 49 (61.2%) patients; 10 of 49 (20.4%) had a difference of 0.5D, while 9 of 49 (18.4%) had differences of 1.0 to 2.00D between the accommodative amplitude of the two eyes.

The minus lens to blur out amplitudes of accommodation were equal or showed a 0.25D difference in 11 of 32 patients (34.4%), and 0.50D to 0.75D difference in 13 of 32 (40.6%) patients. The remaining 8 of 32 patients (25%) had accommodative amplitudes varying between 1 to 2 diopters, except for one of these eight who showed an 8.5D difference between the two eyes.

DISCUSSION

While vision literature is replete with descriptions of the structural

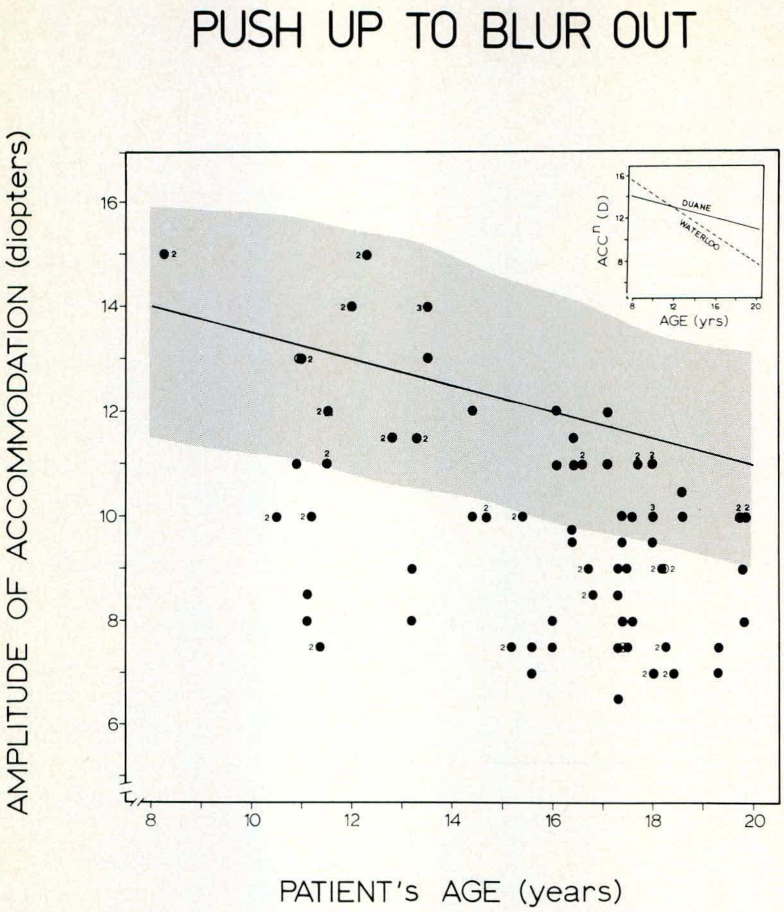

Figure 1
Graph showing the amplitude of accommodation as a function of the age of juvenile diabetics obtained by the push up to blur out method. Data points for accommodative amplitudes for 98 eyes are given by the small black points. The number beside some of the data points indicates the number of coincident values for accommodative amplitude. The solid line drawn through the shaded area represents Duane's median amplitude of accommodation while the upper and lower limits of the shaded area define the highest and lowest accommodation amplitudes reported by Duane. Note that a significant number of data points fall below Duane's minimum amplitude. The small figure inset compares the linear regression line (Slope = -0.25D/year) for Duane's median amplitude of accommodation values to the linear regression line (Slope = -0.37D/year) for the accommodative amplitudes obtained in the juvenile diabetic population in the Waterloo study. The data obtained to date suggests an accelerated loss of accommodation with age in juvenile diabetics.

damage which results from juvenile diabetes little attention has been paid to visual function of patients with this disease. Our studies show evident retinal structural damage to be minimal in most of the 49 patients discussed in this paper. Visual acuity which we will report on in detail at a later time is most frequently unaffected by the diabetic state and is either in the normal range or can be restored to normal levels when refractive errors exist. Thus if it were not known the children in this study were diabetics under treatment their eyes would generally be considered to be in a normal state of health until their accommodative amplitudes were measured. To further emphasize this point, both direct and consensual pupillary light refleses were normal, and only a few children exhibited any of the possible lenticular changes which relate to the presence of diabetes. Also, there were few abnormal phorias or ductions, and no convergence anomalies were found.

The possibility therefore exists that by accurately measuring amplitudes of accommodation routinely by both the push up to blur out and minus lens to blur out methods in persons under twenty years of age, diabetic onset might be detected at the earliest time. At the very least, juvenile diabetes must be ranked high among the differential diagnostic items to be considered when low amplitudes of accommodation are found to be below the ranges of eye norms in young persons. If optometric practitioners combine amplitude of accommodation measurements with in-office tests for elevated tear glucose[16] and a careful parental case history, they may well increase the rate of early detection of juvenile diabetics in clinical practice.

The results of our study show that the accommodative function must be carefully measured in the case of diagnosed juvenile diabetes since premature presbyopia occurs in such a large percentage of individuals with this disease. Many of the children of this sample require spectacle corrections for near work if they are to carry on their lives and education with usual efficiency and comfort.

Both sets of amplitude data for these juvenile diabetic patients appear to roughly divide the sample into three categories; 1) Patients who have amplitudes of accommodation which are in the normal range, 2) Patients with a moderate loss of accommodation and 3) Patients with a substantial loss of accommodation (32 eyes). We intend to use a blind technique to have our physician colleague assess whether or not the individuals in these three groups have significant difference in the medical aspects of their diabetic disease. We also intend to examine whether the duration since onset of the disease is a factor in the production of accommodative loss.

The above discussion begs the question as to why certain individuals loose varying amounts of accommodation while others do not. Is the adequacy of treatment a factor? If the trend to accelerated loss of accommodation with age displayed by our sample population exists even when the majority of patients are considered to have their disease well regulated, what is the condition that retards or prevents an accelerated loss of accommodation in some individuals while others of the same age group retain normal accommodative function?

We anticipate that through continuing research that these and other questions resulting from our work in the clinical optometrical care of this juvenile diabetic population will be answered.

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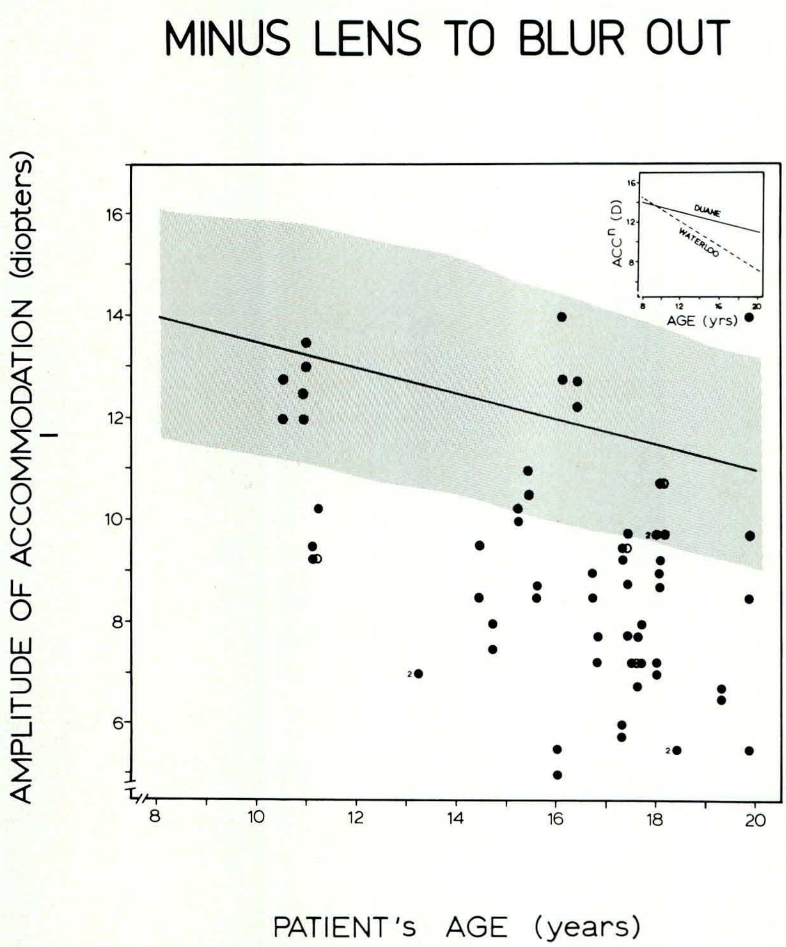

Figure 2
Graph illustrating the amplitude of accommodation as a function of the age of juvenile diabetics obtained by the minus lens to blur out method. Data points for accommodative amplitudes for 64 eyes are given by small black points. The number beside some data points indicates the number of coincident values for accommodative amplitude. The solid line and shaded area represent Duane's data as described in Figure 1. Note that a very significant number of data points fall below Duane's minimum amplitude of accommodation. The small figure inset compares the linear regression line (Slope = -0.25D/year) for Duane's median amplitude of accommodation values to the linear regression line (Slope = -0.35D/year) for the accommodative amplitudes obtained in the juvenile diabetic population in the Waterloo study. The data obtained to date by the minus lens to blur out method also suggests an accelerated loss of accommodation with age in juvenile diabetics.

VISION CARE NEWS

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1983

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New Brunswick Association of Optometrists
Annual General Meeting
Information: Ms. Noella J. Lebrun
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Fredericton, N.B.
E3B 1E5

October 8, 9
5th International Symposium on
Contact Lenses
Montreal, Quebec
Information: Quebec Optometric Association
465 St-Jean, Bur. 1003
Montreal, Quebec H2Y 2R6
(514) 849-8051

October 27 - 28
Interdisciplinary Conference — Studying Problems Associated with Video Display Systems, Ottawa, Ontario
Information: Catherine Coyle
77 Metcalfe, Suite 617 A
Ottawa, Ontario
K2P 5L6

October 28 - 30
Alberta Optometric Association
Annual General Meeting
Information: Miss Bonnie Werner
A.O.A.
#2 - 9333 - 50th Street
Edmonton, Alberta
T6B 2L5

November 6 - 10
28th International Contact Lens Congress
Caesar's Palace, Las Vegas, Nevada
Information: National Eye Research
Foundation
18 South Michigan Avenue
Suite 902
Chicago, Illinois
60603, U.S.A.

November 11 - 15
17th World Congress on Optometry
Vienna, Austria
Information: Michael J. DiCola
c/o C.A.O.

1984

April 11 - 14
Frontiers of Optometry
1st International Congress of the British College of Ophthalmic Opticians (Optometrists)
London, England
Information: Michael J. DiCola
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May 18 - 23
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Madrid, Spain
Information: Rosina Gomez-Baeza
General Manager
IFEMA
Avda. de Portugal, S/N
Apartado de Correos 11.011
Madrid-11, Spain

May 26 - 29
Optica '84
International Trade Fair for Opthhalmic Optics
Cologne, Germany
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Cologne
Messeplatz, P.O. Box 21 07 60, D-5000
Cologne 21
Germany

August 19 - 24
5th International Contact Lens Congress
Surfers Paradise, Queensland, Australia
Information: Kenneth W. Bell
Hon. Secretary
Contact Lens Society of Australia
818 Australia Square
George Street
Sydney, New South Wales, 2000
Australia

October 19 - 21
7th Latin American Congress of Optometry and Optics
Lima, Peru
Information: Dr. E.J. Fisher
c/o School of Optometry
University of Waterloo
Waterloo, Ontario
N2L 3G1

Tru Vision Progressive Power Lenses

The lenses are manufactured by American Optical of CR-39 hard resin material. Its optical design consists of a stabilized distance and near portion, with a 16 mm. corridor of gradually increasing power. The prescription range is from +4.25D to -5.00D with up to -3.00D cyl. adds +1.00 to +3.00. The blank size is 75 mm. The optical centre is displaced laterally and the near centre is placed 2.5 mm. in.

It has a smooth overall design which ensures easy patient adaptation and superior performance.

For details, contact American Optical

Fit 80 Ophthalmic Lenses

Manufactured from glass with a specific gravity of 3.37 and a refractive index of 1.80, this lens has a reduced edge thickness and a dramatically reduced weight. It can also be treated with a multi-layer anti-reflection coating.

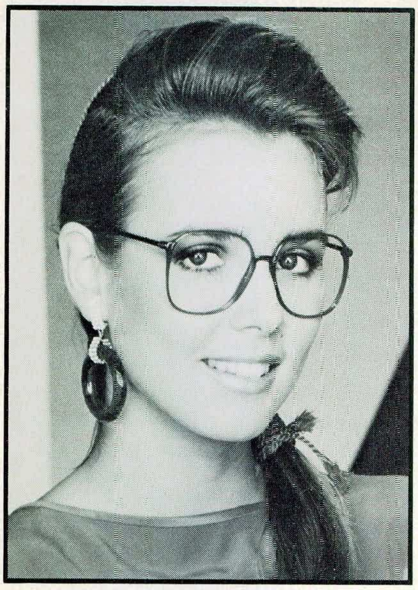
For information, contact
Lawrence Ophthalmic Laboratories
3430 Lawrence Avenue East
M1H 1A7

Silor UVS Lenses

These lenses offer protection from potential damage caused by ultraviolet radiation. They are available in 70 mm. straight top 25, super modular aspheric, 74 mm. semi-furnished single vision and 70 mm. 7X25 trifocals. It is possible to tint this lens, thus adding cosmetic appeal. For further information, contact the local branches of Imperial Optical.

Frame Material SPX

This is a new material used by Silhouette in the in-line frame design. The material belongs in the co-polyamid class. It has a low specific gravity along with mechanical stability and strength allowing lightweight, thin frames to be manufactured. With the rims being so thin, they are manufactured with a bevel and the lens itself is grooved. It also has a high surface hardness; it can be shrunk and does not deform until a temperature of 100° C is reached. The material is resistant to most alkalines,



solvents and oils. Other attributes are its high expansion value and its ability to return to the original form after deformation. Available from Canadian Optical Supply, 1435 St-Alexandre, Montreal.

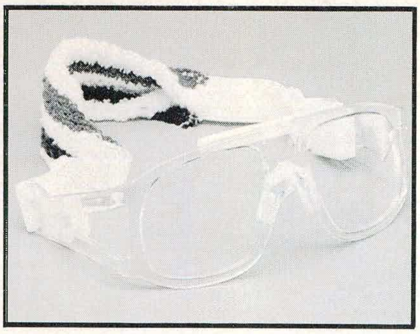
CONTACT made available to C.A.O. members

The European Federation of the Contact Lens Industry Limited advises that it is pleased to make available, on request, copies of their trade journal CONTACT. Interested practitioners are asked to write:

H.J. Gallimore, Secretary/Treasurer
The European Federation of the Contact Lens Industry Limited
12 Haycroft, Bishop's Stortford
Hertfordshire, CM23 7TJ
England

Super Eyegard nominated for Design Council Award

The Canada Optical Company's sport safety frame, Super Eyegard, was recently nominated for a National Design Council Award in the Design for Leisure category. Designed by the company's design staff in



Deseronto, Ontario, the frame comes in four basic styles: the Super Eyegard; the Adult Safe-T Eyegard; the Medium Safe-T Eyegard and the Junior Safe-T Eyegard. Further information can be obtained from:

Mr. Murdoch 'Mac' MacKinnon
Imperial Optical Canada
Hermant Building
21 Dundas Square
Toronto, Ontario
M5B 1B7

The Canadian Optometric Education Trust Fund Invites Applications for Funding
under the awards schedule for the
1984 Grant Program

Purpose of the COETF

Recognizing the need to support the continuing growth and development of the profession of Optometry, the COETF is prepared to financially assist the educational, research and manpower programs deemed by the Trustees to be more important to achieving these goals.

Suitably trained optometric manpower, and the profession's continued access to that manpower is vital to our academic evolution. *The COETF supports* faculty development in our schools of optometry, graduate students in specialized educational programs and investigative research by undergraduate students.

Ongoing research undertaken by the optometrist in private practice is just one type of professional development program which optometry must continue to initiate. *The COETF supports* projects established in a clinical environment to assist the visually handicapped and to assist other optometrists through preparation and publication of the details of these clinical research studies.

A third Canadian school of optometry is of vital concern to the profession. The ongoing activities of our two existing schools are just as important. *The COETF supports* needed alterations and renovations at both schools presently operating and stands ready to substantially assist in the operating cost support of a new school of optometry in Canada.

Continuing education in the 80s must be regular and structured as technology sweeps the profession forward into new methods and discoveries in the delivery of complete vision care. *The COETF supports* the development of an academic Chair of Physiological Optics and Continuing Education to meet these ongoing needs.

The Canadian Optometric Education Trust Fund invites your support in this "Vision of the Future". If you are (or know of) an optometric practitioner, student, educational institution, service organization or member of the general public who is presently involved in, or planning a program that meets any of the goals outlined above, then assistance might be available to achieve the project's objectives. Write to us, using the application on page 145 of the September, 1983 issue of the CJO, by February 17, 1984. The Trustees assure that all projects meeting the purposes of the Fund will be given serious consideration.

The COETF supports!

BOOK REVIEWS

Symptoms in Eye Examination by Geoffrey Ball, R.O., M.Sc., FBCO published by Butterworths & Co. (Publishers) Ltd, 1982

This easy reading, yet informative text book is divided into two sections.

The first section deals with patient/practitioner communication throughout the case history. It includes techniques to extract and interpret information obtained throughout the interview. It stresses the importance of listening carefully to what your patient is saying, as well as keeping your replies on a simple, understandable level.

In addition to verbal clues, this section also discusses various recording techniques to maximise time, space, and information gathered. Computerized systems are compaired and contrasted to standard recording card methods.

From the case history, the book then moves onto dealing with the problem patient who can't wear the prescribed spectacles comfortably. Problems induced by the patient, practitioner, and/or ophthalmic device are all discussed. A neat and simple check list is drawn up in an attempt to keep the cost of regrinding to a minimum.

The second section of the book deals with the analysis of data taken from the case history. It summarizes common symptoms and their probable causes. Accordingly, solutions to some of these problems are also suggested. A whole chapter is dedicated to the classic complaint of headache. Also discussed are conditions such as scotopic abnormalities, anisometropia, even dietary insufficiency as possible causes for the symptoms we all hear.

The book concludes with a very informative appendix which is made up of a series of trouble shooting charts. These charts list common complaints and possible causes for the symptoms. Although it is a rather simplified approach, it could give the doctor a starting point in terms of a tentitive diagnosis. It does not go as far as to suggest treatments, rightly, this should be left up to the doctor's professional discretion.

Although this book is written in a rather non-scientific fashion, I feel that the general practitioner could stand to expand his/her knowledge in the areas of extracting a very good case history from the patient, and utilizing this valuable information to its fullest extent.

W. Andrew Patterson, O.D.

Glaucoma: Conceptions of a Disease-Pathogenesis, Diagnosis, Therapy, edited by Klaus Heilmann and Kenneth T. Richardson. W.B. Saunders Company, Philadelphia, London, Toronto, 1978, price: $69.00, 434 pp.

Although published five years ago, this book remains a highly informative and authoritative text on the subject which is of great importance to all eye care professionals. From the forward by Hans Goldmann to the epilog by Stephen Drance, the contributors from North America, Europe and the United Kingdom represent many of the leading authorities in basic and clinical aspects of glaucoma research, diagnosis, and treatment.

The book is divided into eight major parts, Glaucoma: Conceptions; Functional Anatomy, Physiology and Pathology; Glaucoma Damage; Methods of Examination; Pharmacology; Management of the Glaucomas; Surgical Techniques and The Glaucomas: Classification and Synthesis. Within each section a varying number of chapters have been written by recognized researchers and clinicians in specific aspects of the field.

Having enjoyed the heated exchanges between several of the authors at scientific meetings for a number of years, there is much less diversity of opinion than I would have anticipated. As frequently happens in a book of this nature, there is considerable variation in the quality, depth and comprehensiveness of the respective chapters. In addition, there is inevitably a certain amount of duplication both in the text and in the references which are conveniently presented **in toto** following the epilog.

A number of the chapters merit individual mention either because of their importance to the understanding of current concepts of pathogenesis of glaucoma or to the clinical detection of glaucoma suspects.

Peter Graham mars his otherwise interesting and informative chapter on the "Epidemiology of Chronic Glaucoma" (reaffirming prevelances of chronic glaucoma in the 0.25-0.75% range) with a derogatory comment on optometrists who apparently have not the considerable training and experience required to make "an informed guess". Johannes W. Rohen's "Chamber Angle", David Cole's "Ciliary Processes", S.S. Hayreh's monographical "Structure and Blood Supply of the Optic Nerve" and Anders Bill's "Physiological Aspects of the Circulation in the Optic Nerve" provide an excellent anatomical and physiological background for understanding current concepts of the pathogenesis of glaucoma as covered in later chapters by Hayreh, Spaeth and Aulhorn. Evidence appears to indicate that the trabecular meshwork is the site of the abnormal resistance to outflow and hence elevated intraocular pressure but the precise mechanisms and reasons have not been fully explained. Despite sophisticated axoplasmic flow studies the ischemic theory for optic nerve head damage remains in favour over the purely mechanical hypothesis.

Hetherington's cursory chapter on ophthalmoscopy provides little more information than is available in recent basic texts, whereas Greve in a chapter on perimetry, succeeds in emphasizing the paramount importance of visual fields in the diagnosis and management of glaucoma; I found this chapter to be far more succinct, comprehensive and readable than his book. In it, he emphasizes screening techniques such as the Friedman Analyzer and the Armaly-Drance combined kinetic and static method for use with Goldmann type perimeters. He also describes the Octopus (Computer perimeter) in detail and concludes that "increasing pressure of time, the disease of our century, and decreasing quality of auxillary personnel...are good advocates for the adoption of automated perimetry".

The comprehensive chapter on Tonometry by Draeger and Jessen contrasts with and perhaps puts into perspectives "Tonography" which Dueker covers in less than four pages. I was pleasantly surprised to find an excellent chapter on photography by Riedel with details of goniophotography using the Zeiss Photoslitlamp and the Goldmann three mirror lens. Following the sections of medical and surgical management (which only occupy about 1/6th of the book) the book concludes with several chapters on the classification of primary, congenital and secondary glaucomas. Recent developments in the surgical and medical treatment of glaucoma such as Argon laser trabeculoplasty, Neodymium-YAG and other iridotomies, timolol maleate and other β 1 and β 2 adrenergic blockers, understandably, have sparse or no coverage.

In summary, the quality and usefulness of the figures are exceptionally good. Most chapters are well written and readable with typographical errors principally found in those sections which are the most verbose. Notwithstanding this comment I would recommend this book as a useful review and reference source for any practitioner involved in the tentative or definitive diagnosis of glaucoma.

Anthony P. Cullen, M. Sc., O.D., Ph.D., F.B.C.O.
University of Waterloo
Waterloo, Ontario

London in April?

Why not?

For further information:
Michael J. DiCola
c/o The Canadian Association of Optometrists
Ste. 207 - 77 Metcalfe St.
Ottawa, Ontario
K1P 5L6

The British College of Ophthalmic Opticians (Optometrists) presents

The Frontiers of Optometry
First International Congress

April 11 - 14, 1984

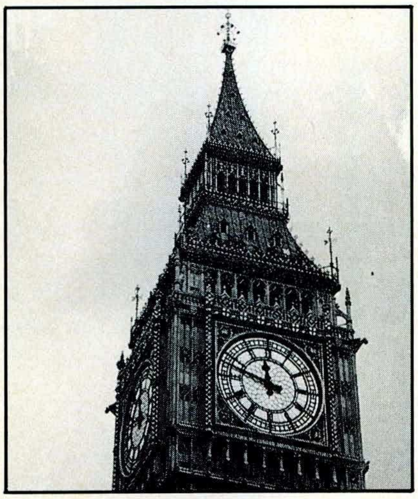
The Congress will comprise two and a half days of lectures by recognized experts in all fields of ophthalmic optics, symposia and discussion. It will be supported by a full social program, including a grand banquet at the Guildhall in the City of London.

The educational program is planned as a forward-looking, in-depth examination of how optometry will progress scientifically and technologically. In addition, it will explore the development of the profession elsewhere in the world.

Topics include: Optometry and Medicine — The Interface; Refraction; Electrophysiology and Electrodiagnosis; Ophthalmic Lenses; Contact Lenses; Binocular Vision; and Teaching Optometry.

Scheduled speakers include: Professor A. Bird, Moorfields Eye Hospital, London; Dr. C.J. Burns-Cox, Frenchay Hospital, Bristol; Dr. O. Braddick, Dr. J. Atkinson, Department of Experimental Psychology, Cambridge University; Dr. S. Sokol, New England Medical Centre, Boston; Dr. G. Guilino, OptischeWerke G. Rodenstock; Dr. B.A. Holden, School of Optometry, University of New South Wales, Australia; Dr. R.D. Reinecke, Ophthalmologist-in-chief, Wills Eye Hospital, Philadelphia and Mr. L.D. Pickwell, President, I.O.O.L. and Director of the School of Optometry, University of Bradford.

More detailed information, including costs and brochures can be requested from:
Michael J. DiCola
c/o The Canadian Association of Optometrists
Ste. 207 - 77 Metcalfe Street
Ottawa, Ontario
K1P 5L6



London in April!

Why not a London Show Tour, Bath, Stonehenge, Stratford-Upon-Avon, Wales, Oxford, Canterbury and Dover?

In conjunction with The Frontiers of Optometry Conference, C.A.O. has arranged a number of optional tour packages through Ports of Call Travel Services in Ottawa. The London Show Tour includes six nights accommodation, continental breakfasts, three theatre tickets of your choice from a list of plays or musicals, a river cruise to Greenwich and a visit to Madame Tussaud's. The London and Country Explorer Tour includes six nights accommodation and a choice of three one-day rail tours, which include Bath and Stonehenge; Stratford and Coventry; Cardiff, Wales; Oxford and the Cotswolds; or Canterbury and Dover.

Either option includes airport transfers, a seven-day unlimited London bus and underground pass and a brief unescorted orientation tour of London. Hotel accommodation can be arranged at your choice of either a standard hotel, or a superior hotel and airfare prices will be based upon departures from Vancouver, Edmonton, Calgary, Toronto, Montreal, Ottawa or Halifax.

A COMPARISON BETWEEN THE OPTOMETRIC "OCCUPATIONAL VISION CARE PROGRAM" AND OTHER EYE SAFETY PROGRAMS

Optometric Occupational Vision Care Program	Previous Eye Safety Programs
Fully planned, organized, universal program.	Less organized, several independent variations in services and materials.
Comprehensive basic program with attractive options available.	Incomplete basic program with no provision for expansion to other services.
Unified service (optometrist provides all necessary services).	Fragmented, several independent services, often with no coordination.
Unified responsibility to patient (worker).	Separation of responsibilities to worker among several individuals.
Unified responsibility to employer.	Fragmented levels of responsibility to employer.
Professional Association capable of contracting for all Alberta's practitioners, on all aspects of the program.	Three or more groups involved, none capable of binding provincial contracts.
Professional Association capable of disciplining members.	Three or more associations or groups. Discipline less easily maintained.
Association office assists in administration.	No administrative assistance.
Complete freedom on choice of practitioner.	Often limited choice of provider of service.
Excellent geographic distribution of practitioners.	Limited geographic distribution.
Company has complete choice of material suppliers.	Often restricted to the products of one manufacturer.
Practitioner has no financial interest in materials supplied. (No disincentive to demand perfection).	Often provider of services has financial interest in materials. (Potential conflict of interest).
Complete vision and eye health examinations provided — with occupational needs stressed.	Either no vision examination or limited to known prescription wearers.
All prescriptions used are designed for occupational needs.	Prescriptions used are general purpose — often less suitable for occupational use.
All eyewear verified and individually adjusted under the direct control of the prescribing optometrist.	Eyewear often mailed by the supplier to the company. No adjustments are made, or poorly trained plant personnel may attempt to adjust the glasses. The prescribing doctor has no control over the verification or use of the eyewear.
Each employee is individually counselled in the proper use and care of the eyewear — under the direct control of the prescribing optometrist.	Counselling in the use of the finished eyewear is not possible.
All prescriptions used are current.	Outdated prescriptions often used.

AN OCCUPATIONAL VISION CARE PROGRAM THAT WORKS!

Introduction

The Alberta Optometric Association (AOA) has developed a comprehensive unified occupational vision care and eye protection program. This is the only program of its kind offering not only safety eyewear, but also a full service occupational vision program. It was designed to eliminate many of the problems existing with previously available eye safety programs and in the sixteen years of use has been found to be far superior to these other programs.

The AOA program was initiated by requests from industry for Optometry to assist them in eliminating problems they were experiencing with the programs they were using — problems such as poor worker complaince, complaints of headaches, double vision, distortions, blurred vision, sore ears or noses from the safety glasses, workers demanding the use of "hardex" lenses in dress frames, billing difficulties when services were performed by various practitioners, the provision of non-CSA approved materials, the use of general purpose prescriptions which frequently were inadequate for the worker's specific tasks, and worker misunderstandings of how or where to use the safety materials. The AOA designed its program, in consultation with industry, to reduce these problems, increasing worker compliance and resulting in a more effective occupational vision care program.

Objectives

The AOA had two primary objectives for its program. The first was to provide comprehensive occupational vision care. That is — ensuring that the workers visual abilities were equal to the requirements that his occupation demanded. This would eliminate those accidents caused by insufficient visual abilities or by fatigue created by excessive visual demands.

The second objective was to ensure the provision of the correct safety

The practitioner has full control over the positioning and design of the eyewear (particularly important for multifocals or special purpose glasses).	The practitioner often has no control over the position or design of the eyewear.
Safety frames are individually chosen — considering occupational hazards, suitability for lens prescription, job demands, fitting characteristics and appearance, under the direct control of the prescribing optometrist.	Safety frames are often handed out with little or no thought given to the necessary variables — often by untrained personnel.
In all cases, the appropriate materials are defined in advance. The patient receives only those materials determined to be suitable for his occupation.	Control over materials is poor. The employees often receive materials that are not suitable for their needs. (i.e. photochromatic lenses, sunglasses, non-safety frames or lenses).
Programs to educate workers and managements in the objectives, organization and reasons for the program are offered.	No such programs are available.
This program has been proven to increase worker compliance and satisfaction.	These programs have been proven to have very poor compliance and are a source of intense worker dissatisfaction.
This program has been proven to reduce eye injuries and to identify previously undiagnosed vision and health problems.	This program also reduces eye injuries, but allows more injuries than does the A.O.A. program and makes no attempt to identify vision and health problems.
This program reduces injuries caused by inadequate vision or by visual fatigue.	This program ignores injuries resulting from inadequate vision.

eyewear, verified as to its accuracy and individually fitted and adjusted to the worker — reducing eye accidents and the complaints associated with incorrect or ill-fitting safety glasses and thereby improving worker compliance with company safety practices.

Basic Professional Services

The professional aspect of the program consists of three basic parts. The first is the provision of a complete occupational vision examination by the worker's optometrist. This examination is similar to a regular eye examination but concentrates extensively upon the worker's occupational needs. The spectacle prescription provided following this examination is designed for the worker's occupational use, which frequently differs from general purpose requirements.

The second aspect is the design, ordering, verification and delivery of the appropriate safety glasses. Following the examination, the worker is assisted in the selection of the best fitting safety frame and the choice is made of the best lens design, including the placement of any multifocal segments. The spectacles are then ordered from the laboratory. Upon completion, the glasses are returned to the optometrist's office where they are checked to ensure that all aspects of the frame and lenses are as ordered. When the glasses are correct, the worker is contacted to return to the optometrist's office where the glasses are individually adjusted to ensure a comfortable fit and to ensure that the lenses are properly positioned for best use. The patient is encouraged to return for subsequent adjustments should they be necessary.

The third aspect of the professional program is that of counselling at the time of the examination, the frame selection and of the delivery of the glasses. The patient is repeatedly counselled about the reasons for and in the use of the new safety glasses. All these professional aspects of the program are provided in the optometrist's office, under the direct control of the worker's optometrist.

Additional Professional Services

In addition of the basic professional services, the AOA can offer two additional services to a company. The first is the provision of seminars to management and workers on the need for, the uses of, and the qualities of safety eyewear. Our experience has shown that a very significant proportion of the difficulties encountered in eye safety programs is due to worker misunderstanding and ignorance of the safety materials and of their purposes. When seminars have been conducted to show the workers the factors involved in protective eyewear, the companies have reported a very significant increase in worker satisfaction with the program and in the worker's use of the eyewear.

The second additional service which can be provided is the on-the-job survey of the vision demands of each job function. This includes such factors as focusing requirements, binocular requirements, colour vision requirements, field of vision requirements, depth perception requirements, lighting conditions and the hazards that the worker may face. The report of such a survey can be instrumental in determining the level or levels of eye protection required, the design of the best lenses to enable the worker to meet the vision requirements and the determination of the vision requirements for entry into a particular job function.

The charges for these additional professional services would be calculated on a consultation basis.

Employer Contract

In order to obtain these optometric services the interested company enters into an annual contract with the Alberta Optometric Association. The Optometry Act specifies that this Association can enter into contracts which are binding upon all optometrists in Alberta. This guarantees the company that similar services will be provided by any optometrist for the fees agreed to in the contract. As a result, company workers can choose to obtain services from any optometrist in the province. An added advantage is that, with optometric offices located in 73 centres throughout Alberta, professional services are relatively accessible even to workers in more remote parts of the province.

Materials are provided by a wholesale laboratory with which the company contracts separately, usually on a tender basis. The optometrist, therefore, has no financial involvement in the provision of the materials and there is no potential conflict of interest when, upon verification, glasses are found to be incorrect and need to be sent back to the laboratory to be redone. If the company prefers, the AOA will provide the tendering. The company then has the benefit of choosing from the materials provided by those laboratories who supply competitive bids.

Association Office Administration

In order to simplify the administrative procedures for the company, the AOA provincial office provides several services. After professional services have been performed and the worker has received his safety glasses, the optometrist sends a detailed statement of account to the AOA office where the fees are checked to ensure accurate billing for the services performed. Each month the AOA staff compiles all statements from all the optometrists and submits to the company a single statement providing information about which workers received service, which optometrists were billing, and the total fees involved. The company sends a single cheque to the AOA office where Association staff send out a cheque to each individual optometrist on the company's behalf. The AOA office also provides the company with a single point of assistance if there should be any questions or problems. If, for instance, a problem should arise with a particular optometrist, the company need not deal with that optometrist, but can simply contact the AOA office and the problem will be handled by the office staff, or by a member of the Occupational Vision Committee.

There is an administration fee charged to the company for these services. Since the Association is a non-profit organization it attempts to set these charges at a rate just sufficient to recover cost.

Starting the Program

Upon entering into a contract with the Alberta Optometric Association the company must designate all those workers that it deems to be visually "at risk". This should include all workers whose job requires them to work, even part of the time, in areas where eye protection is required. (This may follow an on-site survey of vision requirements). All of those who have been so designated are then directed to undergo the full professional services. This is initiated by providing each worker with an "authorization form" which he or she must give to the optometrist when presenting for an examination. (Authorization forms are designed by the company in consultation with the AOA). Services will not be performed without the presentation of the proper form. All "at risk" workers, whether or not they normally wear glasses, must receive the full services in order to ensure that the worker's visual abilities are, in fact, equal to the requirements demanded by his occupation.

Experience with other eye protection plans had demonstrated that the majority of worker complaints arise due to inaccuracies in the batch-produced "zero power" or "plano" hand-out glasses. An additional advantage of the optometric program is that the workers respect and value their plano glasses when they realize that the glasses have been designed, fitted, verified and adjusted for their individual use. This results in far fewer replacements, with resultant savings to the company and eliminates the safety hazards caused by inaccurate lenses. New employees entering "at risk" occupations are put through the program at the earliest possible opportunity, preferably as part of the hiring process.

It is recommended that management personnel be included in the program so that they may obtain safety glasses which they would wear on the job as an example to the workers.

It is further recommended that, at the start of the program, the company schedule information seminars for the workers to reinforce their knowledge of the purpose and requirements of the safety eyewear. Seminars should be held periodically thereafter with all new employees.

Recently, the AOA had to reassess its requirement that all "at risk" workers be included in the full program. The significantly reduced profits of industry in these recessionary times has had the effect of reducing spending on safety programs of all kinds, including vision and eye protection programs. Many companies that wished to use the comprehensive AOA program were unable to afford the initial cost of the full program for all "at risk" workers. As a result, the AOA now offers a second level program in which utilization of the program by individual employees is optional. All companies are encouraged to contract for the full mandatory program, but this intermediate step has allowed several companies to benefit from the AOA Occupational Vision Care and Eye Protection Program who would otherwise not have been able to afford the professional program.

Conclusion

The Alberta Occupational Vision Care Program is successful. It is successful because, rather than relying on hand-out glasses and threats to get workers to wear them, the program promotes a full professional service that meets the individual worker's needs and makes a concerted effort to gain worker understanding. We highly recommend it as a model to other optometric Associations.

J. Craig McQueen, O.D.
President
Alberta Optometric Association

Summary of C.O.E.T.F. Grants since 1980

The following summary shows just how much the C.O.E.T.F. has grown in the four years since it began according grants to optometric education projects. In 1980, the Trustees awarded one grant, for the sum of $2,400.00. In 1983, a total of 14 projects were funded with grants totalling $62,792.00, 26 times the amount awarded only four years earlier!

As one scans the list of projects and recipients, one can't help but see how well the Trustees have, over the years, consistently selected projects that are in keeping with the stated objectives of the Fund (Refer to the September, 1982 CJO, Vol. 44, No. 3, P. 144) and, as a result, how much benefit has accrued to the public, and to this profession through the valuable research and public vision care projects undertaken by Canadian practitioners on the Fund's behalf.

We urge your continued support of the Canadian Optometric Education Trust Fund. Information about any aspects of the Fund — pledges, awards, donor recognition and the purpose of the Fund, can be obtained from the C.O.E.T.F., c/o The Canadian Association of Optometrists, Ste. 207 - 77 Metcalfe Street, Ottawa, Ontario K1P 5L6.

1980

Dr. J.V. Lovasik, Waterloo ($2,400.00) to support a research assistant.

Total 1980 Awards
$2,400.00

1981

Dr. A. Devon/Dr. M. Long, Thunder Bay ($2,500.00) for promotion of Eye Health Care and provision of Vision Care Services to 1981 Canada Games athletes.

Dr. W. Lyle, Waterloo ($1,500.00) for a Contact Lens Solutions Study.

Dr. S. Mintz, Winnipeg ($532.00) for a Traffic Signal Direction Indicator study.

Dr. G. Woo, Waterloo ($3,500.00) to acquire a Contrast Sensitivity Unit.

Total 1981 Awards
$8,032.00

1982

Dr. W.R. Bobier, Cambridge, England ($15,000.00) first year Ph.D. program.

Optometric Institute of Toronto ($7,500.00) to equip a low vision facility.

Dr. C.S. Hayes, Saskatoon ($7,500.00) to conduct a pre-school screening program.

Dr. J. Jantzi, Surrey, B.C. ($4,000.00) to study corneal lesions caused by improperly prescribed contact lenses received from unqualified personnel.

Dr. J. Letourneau/Dr. R. Giroux, Montreal ($6,950.00) for a study entitled "Traitement de l'insuffisance de convergence et du strabisme."

Dr. P. Simonet, Montreal ($3,430.00) for a project entitled "Amélioration de la fonction visuelle chez le handicapé visuel."

Dr. J.V. Lovasik/Dr. M.E. Woodruff, Waterloo ($12,583.00) to study ocular indicators of diabetes mellitus in juveniles.

Dr. W. Lyle, Waterloo ($1,200.00) to produce a paper on over-the-counter ophthalmic preparations.

Dr. E.J. Fisher, Waterloo ($4,000.00) to review and create a bibliography of *The Canadian Optometrist.*

Dr. T.D. Williams, Waterloo ($2,250.00) to support a Research Assistant.

Dr. W. Larson, Montreal ($2,675.00) to construct equipment for testing stereoacuity.

Total 1982 Awards
$67,088.00

1983

Dr. W.R. Bobier, Cambridge, England ($15,000.00) second year Ph.D. program.

Dr. J. Bender/Dr. M. Spafford, Waterloo ($7,000.00) Master's degree salary support.

Dr. M. Callender, Waterloo ($3,200.00) research support to study corneal respiration associated with extended periods of contact lens wear.

Dr. R. Chou, Waterloo ($3,300.00) first year Ph.D. program.

Dr. J. Gresset/Dr. P. Simonet, Montreal ($2,220.00) for a statistical study on a visually-handicapped population.

Dr. J. Jantzi, Surrey, B.C. ($5,000.00) to conduct initial research into methods of making low vision services available on a national level.

Dr. W. Larson, Montreal ($4,000.00) to construct an instrument for the measurement of accommodative convergence.

Dr. J.V. Lovasik/Dr. M.E. Woodruff, Waterloo ($4,087.00) to conclude the study of ocular indicators of diabetes mellitis in juveniles.

Dr. W. Lyle, Waterloo ($2,000.00) to study the potential effects of arthritis on the eye.

Dr. G. Mousa, Waterloo ($2,250.00) to study control of glare for the VDT user under fluorescent light.

New Brunswick Vision Assessment Program ($5,000.00) for a Vision Care Screening Program for Nursing Home Residents.

Nova Scotia Association of Optometrists ($2,300.00) for a Vision Screening Project for School Children in a Rural Area of Nova Scotia.

Optometric Institute of Toronto ($4,000.00) to acquire a high-resolution video camera and recorder.

Dr. J. Sivak, Waterloo ($3,435.00) to study optical and biochemical effects of aging on the lens of the eye.

Total 1983 Awards
$62,792.00

Total Awards to Date
$140,312.00

(Summary prepared by M.J. DiCola)

COETF TARGET — $3,000,000

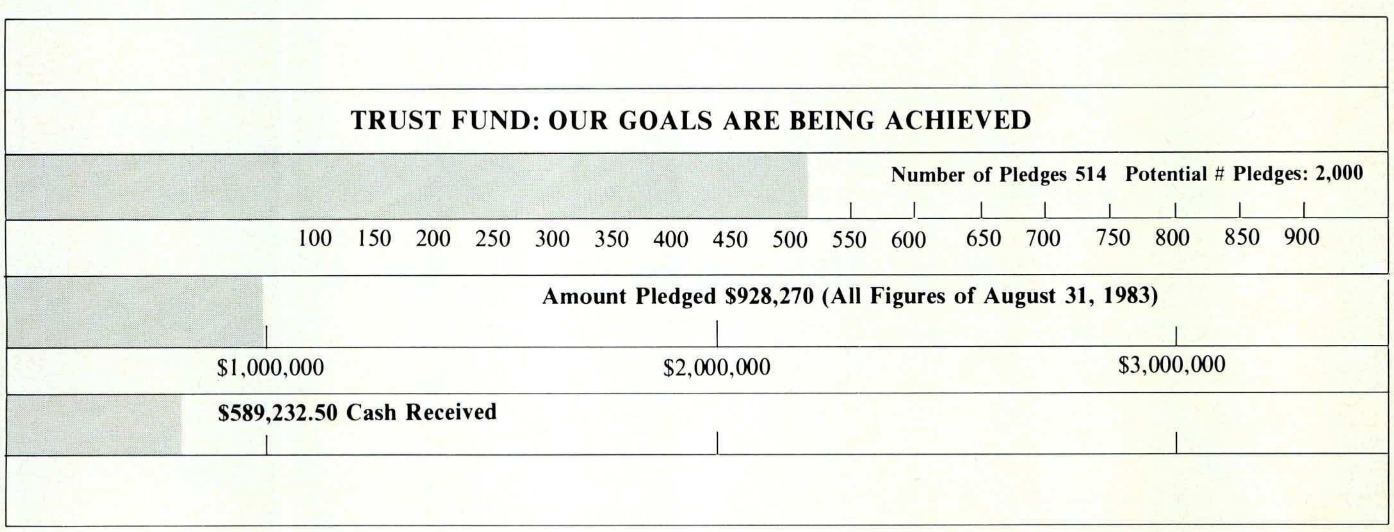
BASED ON AVERAGE $2,215 Pledge per member

Target Percentage Achieved August 31, 1983

B.C.	38%	$409,896.
Alta.	36%	409,896.
Sask.	71%	197,192.
Man.	54%	161,742.
Ont.	15%	1,522,151.
N.B.	69%	126,292.
N.S.	41%	99,704.
P.E.I.	16%	13,293.
Nfld.	65%	59,822.
		$3,000,000

Provincial Performance

	No. of Pledges	Amount Pledged	Amount Received	Per Member Average Pledge
B.C.	73	154,500.00	103,700.00	2116.00
Alta.	51	145,930.00	78,530.00	2861.00
Sask.	54	140,480.00	92,280.00	2601.00
Man.	41	86,680.00	64,320.00	2114.00
Ont.	202	232,010.00	155,860.00	1148.00
N.B.	45	87,200.00	42,702.50	1937.00
N.S.	29	40,470.00	27,620.00	1395.00
P.E.I.	1	2,100.00	2,100.00	2100.00
Nfld.	18	38,900.00	22,120.00	2161.00
	514	**$928,270.00**	**$589,232.50**	



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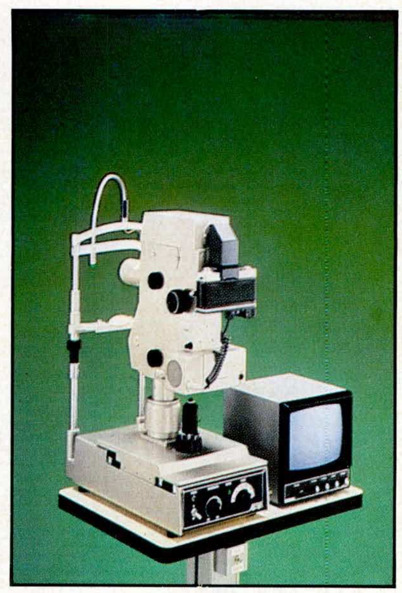

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