PERMANENT

CJO RCO

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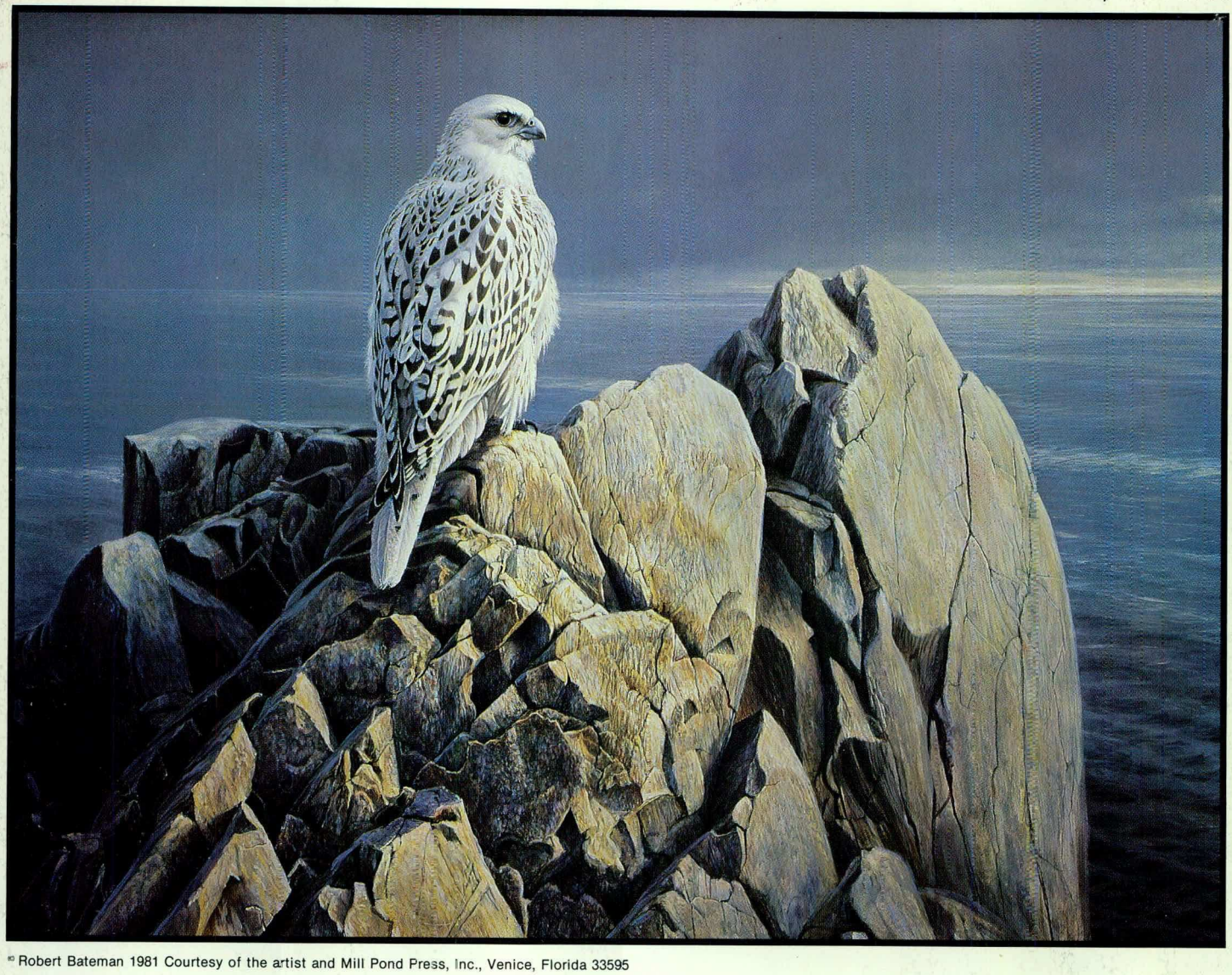

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Semaine de la vision 1-7 mars/March 1-7 Save Your Vision Week

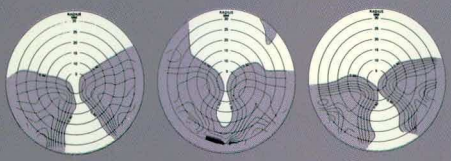
Just one of these lenses lets you earn $30,000 more profit every year...without more work and worry.

Which one? The Sola VIP.

Why? Because only the VIP can satisfy the biggest untapped market for progressives: your current flat top customers. And each time a patient makes the switch, you make $50 extra profit. Less than 3 pairs a day earns you $30,000 in just a year.

Flat top wearers want big viewing zones. Sola VIP delivers in a big way.

Multifocal wearers are used to ample viewing zones (especially at near). Only the VIP is big enough to please them.



Sola VIP™ Varilux 2® Super NoLine®

Compare us to the competition. You'll discover our near zone is up to 50% larger, our intermediate up to 36% larger than other progressives.

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It's hard to match a flat top for peripheral clarity. Except with a VIP.

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Look above. The VIP has smoother transitions from zone to zone with less concentrated distortion.

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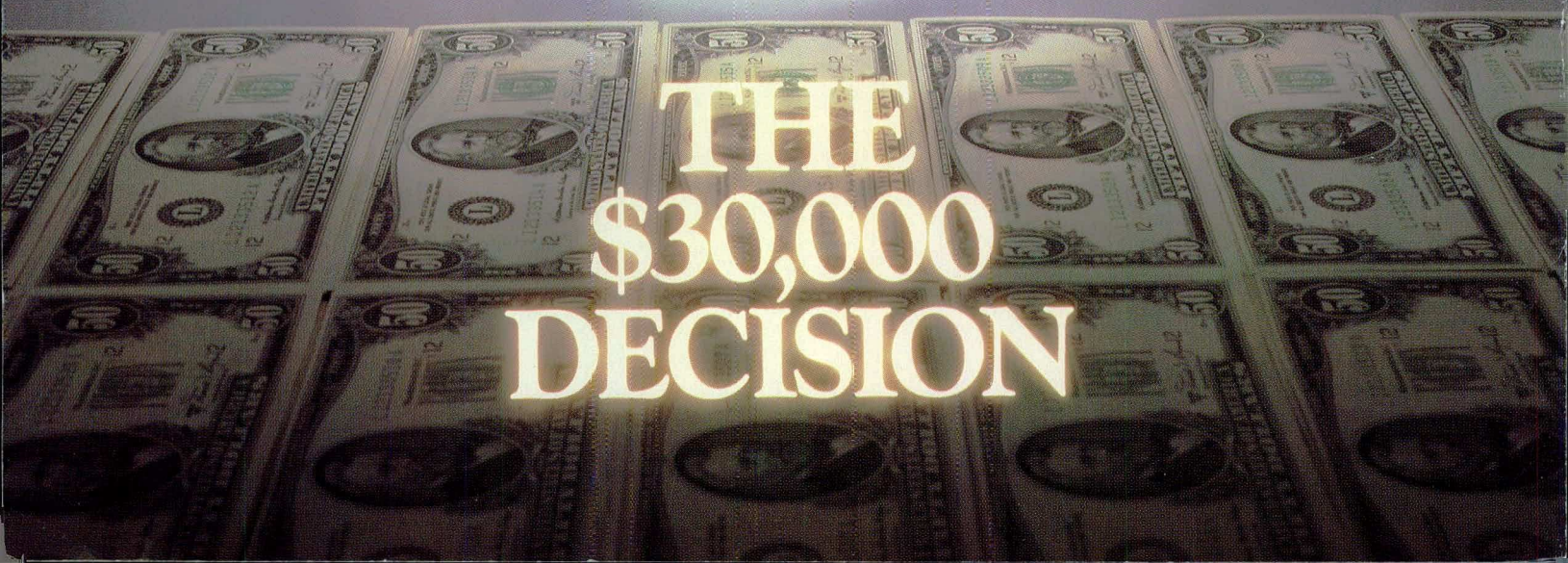
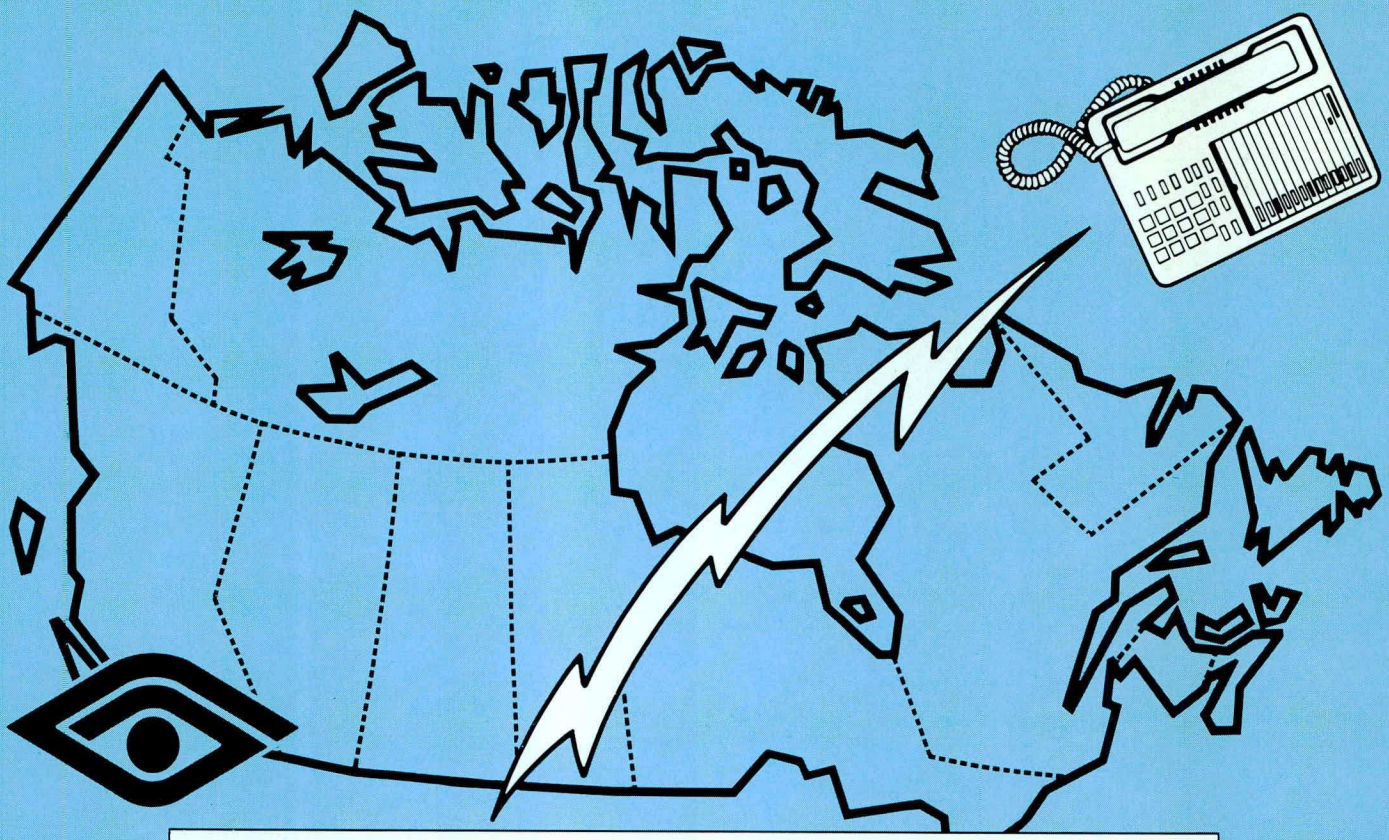




DIAL-THE-PRESIDENT 1987

Count Yourself In, in CAO's first Dial-the-President Day
Sunday, March 1, 1987
10:00 a.m.-6:00 p.m. (Eastern Standard Time)
Call **Collect** (Station to Station): (613) 738-4400

Dear Colleague,

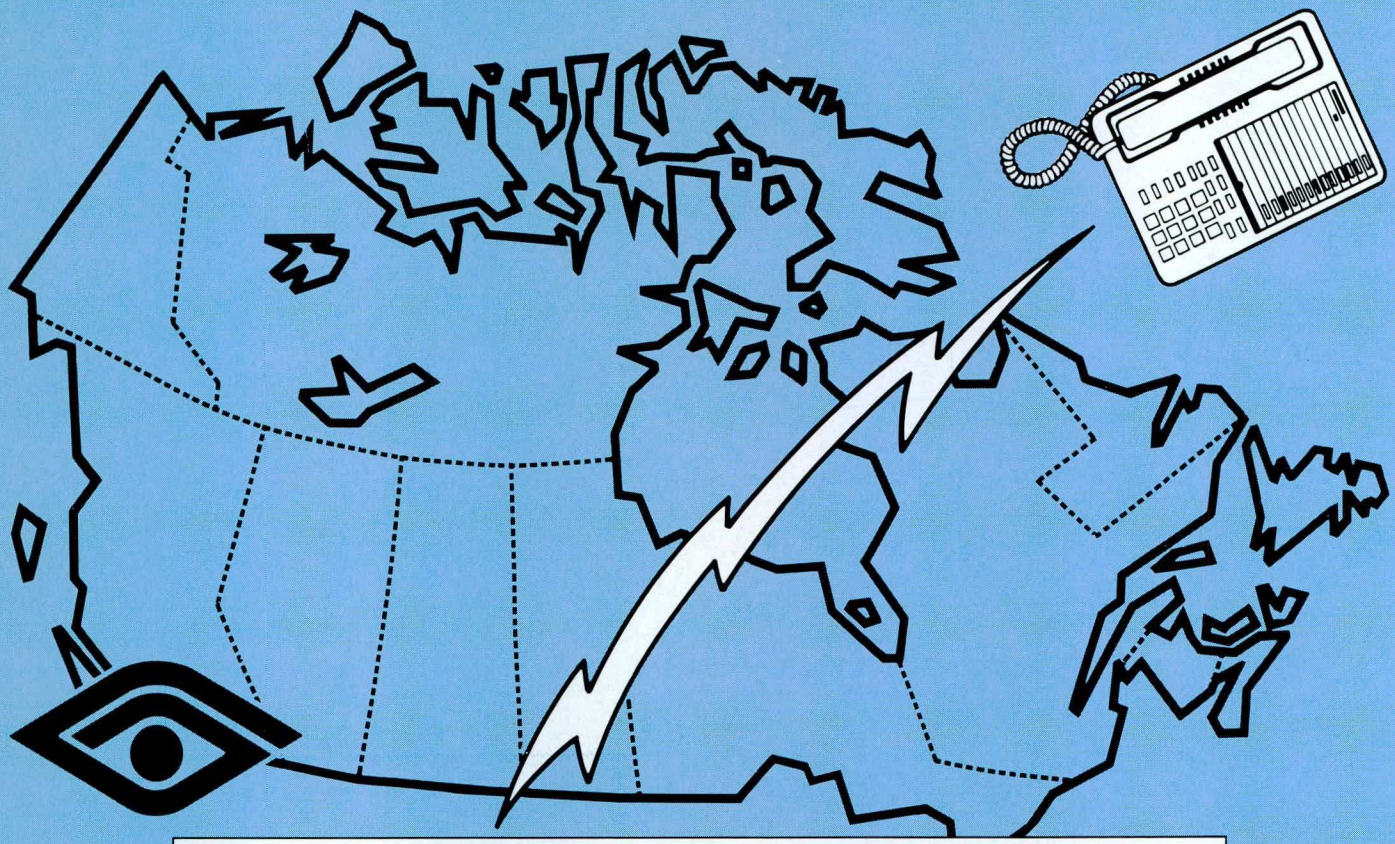
As President of our national Association, it gives me great pleasure to invite you to "Dial-the-President" and to express to me personally your concerns on issues facing Optometry today.

On Sunday, March 1 (the first day of Save Your Vision Week in Canada 1987), I invite you to call the CAO office number **collect** to share with me your ideas and concerns about things we are doing, or about things we are **not** doing and which you think we should.

Our national office line — (613) 738-4400 — will be staffed to receive your **collect** calls from 10:00 am to 6:00 pm (EST). Save Your Vision Week 1987 will be just getting underway. I look forward to hearing from you, from wherever in Canada you may wish to call.

Yours sincerely,

Dr. Scott Brisbin
President



LIGNE DIRECTE AU PRÉSIDENT 1987

Faites-vous entendre lors de la première Ligne directe au président
le dimanche 1er mars 1987
de 10 h à 18 h (heure normale de l'est)
Composez à **frais virés** (de numéro à numéro) : (613) 738-4400

Cher(e) collègue,

À titre de Président de notre association nationale, j'ai le plaisir de vous inviter à profiter de la "Ligne directe au président" pour me faire valoir personnellement vos préoccupations au sujet des questions d'actualité dans le domaine de l'optométrie.

Le dimanche, 1er mars (le premier jour de la Semaine de la vision au Canada 1987), je vous invite à composer **sans frais** le numéro du bureau de l'ACO afin de partager avec moi vos idées et vos soucis au sujet de ce que nous faisons et de ce que nous ne faisons **pas**, mais que nous devrions faire.

La ligne téléphonique de notre bureau national, au (613) 738-4400, sera à votre disposition de 10 h à 18 h (HNE). Vous pouvez appeler à **frais virés**. Ce sera alors le tout début de la Semaine de la vision 1987. J'espère avoir l'occasion de m'entretenir avec vous, où que vous soyez au Canada.

Salutations amicales,

Le président,
Dr Scott Brisbin

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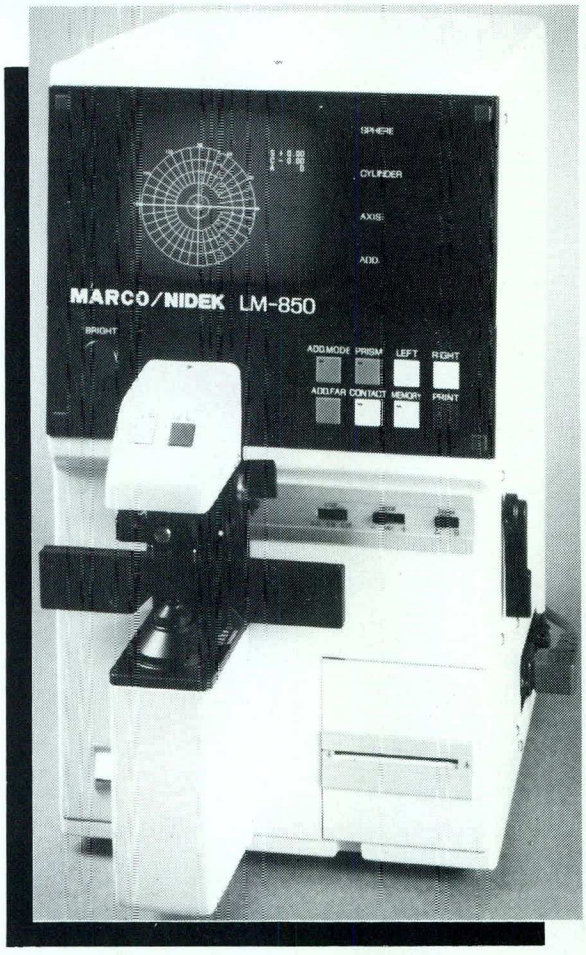

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The LM-850 also features a digital display with a continuous readout capability and sophisticated "Add" modes which make the instrument ideal for reading progressive lenses and guarantee accurate readings with any bifocal.

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Cylindrical power 0 to +/-10D in 0.01, 0.12D, or 0.25D increments
Cylinder axis 0 to 180 degrees in 1 degree increments
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PRESIDENT'S PODIUM/MOT DU PRÉSIDENT

Intraprofessional Relations

The actor on tv beamed his penlight sized laser at the chain-link fence surrounding the military base and opened up a hole big enough to crawl through. "That's some flashlight!" whispered his partner. "Just concentration", replied our hero.

More grade "b" tv drama? Perhaps. But the timing was right and the message was there. My skiing shoulder injury had insured that the last few days of the Christmas break could be spent contemplating CAO's activities of the past year and fine tuning the game plan for 1987. "Concentration" was the word that kept popping up as I listened to football, hockey and basketball pundits reveal the secret to the winner's success, and now concentration even cuts through seemingly impenetrable objects in a tv movie.

How am I going to tie these images to Canadian Optometry? Read on.

Nobody has to remind us that as a group, we are pretty small to be taken seriously by those we wish to influence. Government, the media and the public all tend to pay more heed to larger, higher profile professions. We must therefore *concentrate* every possible effort on a focused assault on our objectives. We must limit those objectives to a *concentrated* few and identify the opposition we must overcome to meet those objectives.

Certainly we must not include ourselves on the list of opponents.

A certain amount of introspection, constructive self-analysis and intraprofessional stock taking is worthwhile and essential. Squabbling amongst ourselves, however, is not only counterproductive, but a diversion we cannot afford.

My attendance at provincial Annual General Meetings has been one of the more rewarding of my intraprofessional duties these past six months. I have attempted to stimulate some self-analysis in our corporate members as well as to share information from across the country. Each visit has provided a wealth of information and insight for me. I hope that CAO, through these occasions, can augment its prime political role by helping each province learn from others' experiences, good and bad, and so *concentrate* their efforts on winning objectives.

International intraprofessional relations can also be very useful. Such exchanges can give us access to views of ourselves from the perspective of an informed, but somewhat detached, outsider. I attended the American Optometric Association's Symposium on Primary Vision Care in Atlanta, Georgia last September. An American counterpart to our Annual "Interaction" Meeting, the three-day event saw over 350 state and national optometric leaders explore and address the topic from every possible angle. Our CAO Executive carried these discussions further at a Joint Executive Meeting with our American counterparts in Toronto on December 15th. Both meetings were valuable learning experiences. It is always fascinating to see a number of similar issues facing Optometry on both sides of the border at almost the same time despite the vastly different political/health care environments in which they operate. More often than not, problems being faced in one country either were, are, or will be surfacing in the other. We can and should learn from each other's experiences.

Equally intriguing, however, are the less frequent but significant dissimilarities between the two countries' optometric professions. **One can never assume that, because something is occurring in one country, it will eventually cross the border, in either direction.**

The time I've spent exchanging ideas with American and Canadian optometric leaders I count as time well spent.

Unfortunately, not all of my intraprofessional time has been so productive. I was dismayed when I viewed in my mind the number of hours I, the CAO staff and others have had to spend attending to domestic "fires". Each time we have to take our minds off our external goals and arbitrate a gripe from one province about another, or smooth the ruffled feathers of a committee member or staff person, we dilute our potency for the real tasks that face us. When each combatant in these minor skirmishes is approached, I have yet to find one who does not share the same ultimate goal as the rest of us — that the profession of Optometry receive the recognition, respect and rewards it deserves and that it continue to be able to provide the finest primary vision care possible to the people of Canada. Neither have I heard an acceptable rationale from any individual or corporate member as to how internal squabbling will propel us closer or faster to that goal.

CAO might be likened to a team with 2500 talents distributed, however unevenly, between ten players. We are playing in a league with teams (governments, industries, other professions, etc.) made up of many more "players" with many times more "talents". Our only hope of remaining a contender in such a league lies in *concentration*. Concentration comes from all of us doing our utmost to contribute in the best way we can. Our team is not made up of clones. Part of what gives us such great potential as "little guys" is the cumulative effect of our contributions.

Player contributions can vary from financial ones to the provision of expertise. There must be, of course, a certain minimum baseline contribution by every player. But beyond that, each will contribute in his or her own unique way to our profession's cause. If team members cannot match the wealthiest's dollar contribution, they may bolster their value to the team through leadership, knowledge or manpower.

All-star teams rarely succeed against a cohesive, real team with a winning attitude. Many corporate members have some pretty impressive individual statistics worth bragging about, but when another team member falls down and the opposition scores, individual statistics don't matter as much.

What does matter is that we all pull together in the same direction in a straight line. That's *concentration*. That's what makes the laser a potent beam of light. That's what makes a team a winner.

Happy New Year.

The Gipper

PRESIDENT'S PODIUM/MOT DU PRÉSIDENT

Les relations intraprofessionnelles

Le personnage de l'émission télévisée braque le faisceau laser de sa minilampe de poche sur la clôture à maillons qui entoure la base militaire, ouvrant une brèche suffisamment grande pour admettre une personne. "C'est toute une lampe de poche" chuchote son compagnon. "C'est une question de concentration", fait le héros de l'histoire.

Ce n'était qu'un long métrage télévisé de seconde classe, mais il tombait à point et le message était à propos. Je m'étais blessé à l'épaule lors d'un accident de ski, si bien que la seule activité à laquelle je pouvais m'adonner, au cours de mes derniers jours de vacances de Noël, était de faire une rétrospective sur l'activité de l'ACO au cours de l'année écoulée et de mijoter le plan d'action de 1987. Le mot "concentration" revenait constamment lorsque je regardais les parties de football, de hockey et de basketball, aux cours desquelles les commentateurs experts prétendaient révéler les secrets du succès des gagnants. Je voyais maintenant que la concentration permettait aussi de franchir des objets solides, du moins à la télévision.

Vous vous demandez déjà probablement comment je vais faire pour transposer ces images à l'optométrie, au Canada. Lisez plutôt.

Nul besoin de le rappeler, notre groupe est fort petit pour être pris au sérieux par les personnes que nous voulons influencer. Les gouvernements, les médias et le public ont tendance à mieux écouter les professions plus importantes, à profil plus marqué. Il nous faut donc *concentrer* tous les efforts possibles sur la réalisation organisée de nos objectifs, objectifs obligatoirement limités à un minimum *concentré*, de sorte qu'il nous faut cerner l'opposition à vaincre pour les atteindre.

Il ne faudrait pas que nous nous comptions parmi nos propres adversaires.

Il faut donc absolument faire une certaine introspection, une autoanalyse constructive et un bilan des relations interprofessionnelles. D'ailleurs, cela en vaut la peine. Les querelles internes sont non seulement néfastes, elles sont une distraction beaucoup trop coûteuse.

La participation aux asemblées annuelles générales dans les provinces a constitué l'une de mes activités intraprofessionnelles les plus satisfaisantes au cours des six derniers mois. J'ai tenté de stimuler l'autoanalyse chez les associations membres et de partager l'information disponible un peu partout au pays. Chaque visite m'a procuré une richesse d'information et de nouvelles optiques. J'espère que l'ACO, grâce à ces occasions, aura rehaussé son rôle politique premier en aidant chaque province à partager les expériences des autres, qu'elles soient bonnes ou mauvaises, afin de *concentrer* les efforts sur l'atteinte des objectifs.

Les relations internationales intraprofessionnelles peuvent également être enrichissantes. Ces échanges peuvent nous faire constater comment nous perçoivent des gens de l'extérieur, bien renseignés, mais plus neutres. J'ai assisté au symposium sur les soins primaires de la vision de l'American Optometric Association, à Atlanta (Georgie) en septembre dernier. C'est l'équivalent américain de notre "Interaction" annuelle. Plus de 350 dirigeants du monde optométrique à l'échelle des états et à l'échelle nationale ont abordé le sujet de tous les points de vue possibles. Le Conseil de l'ACO a poussé ces entretiens plus loin lors d'une réunion mixte des conseils, avec nos contreparties américaines, tenus à Toronto le 15 décembre. Les deux rencontres nous ont beaucoup appris. Il est toujours très intéressant de considérer plusieurs questions semblables auxquelles doit s'attaquer l'optométrie, des deux côtés de la frontière internationale, presque au même moment, en dépit du fait qu'elles s'inscrivent dans des environnements très distincts du point de vue politique et au plan des soins de la santé. La plupart du temps, les problèmes d'un pays sont ceux de l'autre ou le seront bientôt. Chacun peut et doit tirer un enseignement de l'expérience de l'autre.

Les différences rares, mais marquées, entre les professions optométriques des deux pays sont cependant tout aussi curieuses. **On ne saurait supposer que ce qui arrive dans un pays se produira nécessairement dans l'autre.**

Je considère comme un bon placement le temps que j'ai consacré à l'échange d'idées avec les dirigeants du monde optométrique aux États-Unis et au Canada.

Malheureusement, tous mes rapports intraprofessionnels n'ont pas été aussi productifs. J'ai commencé à me décourager lorsque j'ai pensé au nombre d'heures que le personnel de l'ACO, moi-même et plusieurs autres ont dû consacrer à éteindre les feux qui se sont déclarés chez nous. Chaque fois que nous devons détourner notre esprit de nos buts externes et nous livrer à l'arbitrage d'un différend entre provinces ou consoler un membre du Comité ou du personnel offusqué de quelque façon, nous diluons notre potentiel d'action. Lorsque je rencontre les adversaires en présence dans ce genre de querelles,je vois toujours deux personnes partageant avec nous tous le même but, celui de procurer à la profession optométrique la reconnaissance, le respect et le mérite qui lui reviennent et de faire en sorte qu'elle continue d'être en mesure d'assurer à la population du Canada les meilleurs soins primaires de la vision possibles. D'ailleurs, personne, ni parmi les particuliers, ni parmi les associations membres, n'a jusqu'ici réussi à m'expliquer comment les dissensions internes pouvaient faire mieux avancer notre cause.

L'ACO, c'est en quelque sorte une équipe de dix joueurs qui se partagent inégalement 2 500 talents. Dans notre ligue, certaines équipes, les gouvernements, les industries, les autres professions, etc., ont beaucoup plus de "joueurs" et beaucoup plus de "talent". Notre seul espoir, si nous voulons résister à la concurrence dans notre ligue, c'est la *concentration*. Concentrer, c'est faire de notre mieux pour contribuer. Tous les membres de notre équipe ne sont pas sortis du même moule. Notre grand potentiel, malgré notre taille réduite, vient de l'effet cumulatif de toutes les contributions.

Les contributions des joueurs peuvent varier : certains contribuent financièrement, d'autres apportent leur expérience et leurs connaisances. Chaque joueur doit évidemment contribuer un minimum. Au-delà de ce minimum, chacun peut faire à la cause de notre profession l'apport qui lui est propre. Les membres de l'équipe qui ne peuvent cotiser autant que les plus nantis peuvent mettre au service de l'Association leur leadership, leurs connaissances ou leur énergie.

Les équipes d'étoiles réussissent rarement à vaincre une équipe unie, cohérente, vraiment motivée pour gagner. Bien des associations membres peuvent faire état de statistiques individuelles dont elles peuvent se vanter à juste titre, mais lorsqu'un autre équipier trébuche et que l'adversaire marque un point, les données individuelles perdent beaucoup de leur valeur.

Ce qui compte, c'est que tous travaillent dans le même sens, et en même temps. C'est cela la *concentration*. C'est ce qui fait du rayon laser un faisceau de lumière puissant, c'est ce qui démarque une équipe gagnante.

Bonne et heureuse année!

Votre quart-arrière

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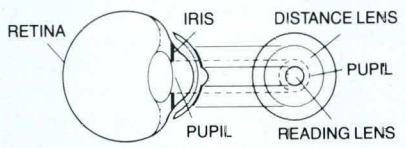

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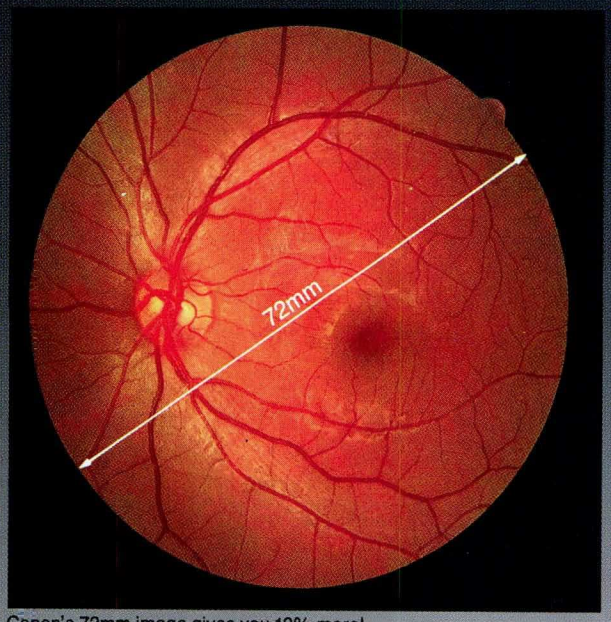

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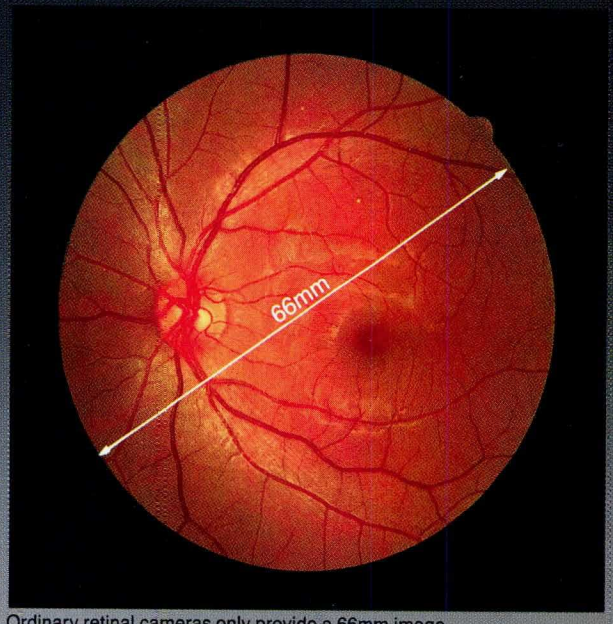

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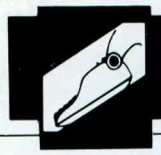

EDITORIAL/ÉDITORIAL

"Optovision"

The Editor Comments

Over the past several years, the *CJO* has been undergoing a gradual change. First, the actual *Journal* dimensions were enlarged to conform to the format of most scientific publications. This uniformity in size was favoured by librarians to facilitate storage.

Then came the retaining of graphic artists, whose designs and suggestions made the *Journal* more attractive and reduced the monotony of page after page of typewritten text. A total of four graphic artists so far have manifested their talents on our behalf and to our benefit.

Graphic artists are professional craftspeople and direct their efforts to meeting the needs and demands of their clients, whether they be publishers of magazines or newspapers, professional Journals, pamphlets or other vehicles of written communications and, over the years, these craftspeople learn the criteria which make for a pleasant and successful result.

However, different clients have different objectives in mind. The artists must call upon their past experiences and initiatives to satisfy such diverse needs. But they must also be given direction by those who retain their services so that the client's specific objectives will be met properly.

The administration cannot be faulted for its desire to continue the process of improvement in the presentation and format of the *Journal*, which is not to exclude content from the list. The decision by Council to forego tradition in approving the design for a new name was strenuously criticized in many letters received on the subject, from provincial Associations as well as individuals. All these criticisms have been noted and changes instituted.

> Never before in our many years as Editor has such a flow of letters crossed our desk with suggestions and criticisms.

But the faux pas, if in fact faux pas it was, has had several positive aspects. Never before in our many years as Editor has such a flow of letters crossed our desk with suggestions and criticisms. We interpret this reaction as a definite sign that the *Canadian Journal of Optometry* is read and appreciated despite its many shortcomings. With help from our readers, be they humble practitioners or esteemed academics, we can continue, however, to improve. That such interest be continued is our fondest hope.

Name changes are not unknown among optometric publications. Some two years ago, for example, the *Ophthalmic Optician,* official journal of the UK's Association of Optical Practitioners, became *Optometry Today.* More recently, the *Australian Journal of Optometry* became *Clinical and*

"Optovision"

Commentaire du rédacteur en chef

Depuis quelques années, la RCO évolue graduellement. D'abord, le format de la Revue a été agrandi pour qu'il soit conforme à celui de la plupart des publications scientifiques, afin de faciliter le travail des bibliothécaires qui les insèrent dans les rayons.

Nous avons ensuite retenu les services de graphistes, dont les efforts et les propositions ont rendu la Revue plus attrayante et permis de réduire la monotonie d'une suite de pages dactylographiées. Un total de quatre graphistes ont exercé leurs talents pour notre compte et à notre avantage.

Les graphistes sont des professionnels qui savent concentrer leurs efforts afin de répondre aux besoins et exigences de leurs clients, qu'il s'agisse de rédacteurs de revues ou de journaux, de revues professionnelles, de brochures ou d'autres écrits. L'expérience a montré à ces artistes quels sont les critères d'une présentation agréable et réussie.

D'autre part, tous le clients n'ont pas les mêmes objectifs en tête. L'artiste doit faire appel à son expérience et à son imagination pour répondre à des besoins divers. Il demeure cependant que son client doit lui donner une orientation afin qu'il lui soit possible d'atteindre pleinement les objectifs fixés.

On ne peut reprocher aux administrateurs d'avoir voulu continuer d'améliorer la présentation et le format de la revue, sans exclure le contenu même. Lorsque le Conseil a décidé d'abandonner la tradition et d'approuver une nouvelle désignation, il s'est attiré de nombreuses lettres de dures critiques de la part des associations provinciales comme des particuliers. Le Conseil, tenant compte de toutes ces critiques, a fait les changements qui s'imposaient.

> Au cours de mes nombreuses années à la rédaction, je n'avais jamais vu une telle avalanche de lettres de suggestions et de critiques.

Toutefois, ce faux pas, s'il faut l'appeler ainsi, a eu plusieurs répercussions positives. Au cours de mes nombreuses années à la rédaction, je n'avais jamais vu une telle avalanche de lettres de suggestions et de critiques. Cela donne certes à penser que la Revue canadienne d'optométrie est lue et appréciée, en dépit de ses faiblesses. Grâce à l'aide de nos lecteurs, qu'il s'agisse de simples praticiens ou d'universitaires réputés, l'amélioration pourra tout de même se poursuivre. Nous ne pouvons qu'espérer que l'intérêt de nos lecteurs soit soutenu.

Il n'est pas rare que les publications optométriques changent

EDITORIAL/ÉDITORIAL

Experimental Optometry. Readers will note that both changes incorporate our professional designation. Our correspondents have clearly indicated that any name change of our national Journal should retain our official designation and use either "Optometry" or "Optometrists".

A number of our correspondents had also suggested a change in orientation. Some, for example, would like it to become strictly a scientific publication with all legal, business or economic aspects — "Association" information — the subject matter of a second publication. Whether such can be implemented would seem to be a matter of finances and an assured supply of original Canadian papers. As a short term objective such a prospect appears unlikely. In the long term, well, who can see the future? The idea, however, should not be discarded.

Readers will have observed that the *Journal* has reverted to its former designation, pending a thorough study of the matter. Changes in the administration and management of the *Journal* have been instituted so that there is more ongoing optometric consultation in determining *Journal* policy.

Readers, as always, are invited to express their opinions on these several questions. *The Canadian Journal of Optometry* is your journal and should correspond to your needs as professionals and as practitioners. The *Journal* cannot be all things to all readers at all times, but if we are aware of the needs, we can direct our efforts to achieving such goals.

GMB

de nom. Il y a environ deux ans, par exemple, l'*Ophthalmic Optician,* revue officielle de l'Association des praticiens optiques du Royaume-Uni, a été rebaptisée *Optometry Today.* Plus récemment, le *Australian Journal of Optometry* est devenu *Clinical and Experimental Optometry.* Le lecteur constatera que les deux nouveaux titres contiennent le nom de la profession. Nos correspondants nous ont bien fait savoir que s'il est décidé de changer le nom de notre revue nationale, il faudra quand même retenir la désignation officielle, soit le mot optométrie, soit le mot optométriste.

Plusieurs lecteurs nous ont également suggéré de changer d'orientation. Dans certains cas, on voudrait que la publication devienne exclusivement scientifique, les questions juridiques, commerciales ou économiques — l'information intéressant les associations — pouvant faire l'objet d'une deuxième publication. Cette possibilité semble dépendre de la situation financière et d'un approvisionnement sûr en communications originales de provenance canadienne. Il ne saurait en être question à court terme. À plus longue échéance, qui vivra, verra. C'est tout de même une idée à retenir.

Le lecteur aura remarqué que la Revue a repris son ancienne désignation, jusqu'à plus ample examen de la question. Certaines modifications ont été instituées dans l'administration et la gestion de la Revue afin que la collectivité optométrique soit mieux consultée en matière de politiques de rédaction.

Comme toujours, les lecteurs sont invités à s'exprimer sur toutes ces questions. La Revue canadienne d'optométrie est votre revue et doit répondre à vos besoins comme professionnels et praticiens. La revue ne peut pas toujours plaire à tous, et à tous les points de vue, mais si nous sommes sensibles aux besoins du lecteur, nous saurons orienter nos efforts dans le sens voulu.

GMB

UK Optometry Loses Two Distinguished Practitioners

William Swaine, F.S.M.C., B.Sc., (1894-1986)

William (Billy) Swaine, one of the most distinguished men to grace optics in the twentieth century died peacefully on August 27, 1986.

Appointed Head of the Department of Ophthalmic Optics of what was then the Northampton Polytechnic Institute (in London) in 1950, he served with distinction until his retirement in 1960.

He received the Research Medal of the British Optical Association and the Yorkshire Optical Society Owen Aves Medal in 1961. From 1965 to 1969 he was a consultant to the Central Committee for Research in Ophthalmic and Dispensing Optics. He was a Fellow of the Institute of Physics.

Gerald Maurice Dunn, F.B.O.A., H.D., F.B.C.O., D.C.L.P., D. Orth, F.A.A.O.

The sudden death of Gerald Dunn on 28 August 1986 at the comparatively early age of 58 has deprived Optometry in the United Kingdom of one of its most influential figures. At the time of his death, Professor Dunn had just completed a successful five year term as Head of the Department of Optometry at The City University, London and was looking forward to a second five year term.

Among the posts Professor Dunn held were Secretary of the International Optometric and Optical League, member of the General Optical Council, Editor of The Ophthalmic Optician and British Journal of Physiological Optics, and President of the British Chapter of the American Academy of Optometry.

FEDERAL ISSUES/QUESTIONS FÉDÉRALES

Introduction

The Canadian Association of Optometrists and its ten provincial corporate members, with an eye to changing social, political and economic trends as they affect the health care delivery system, are increasingly being made aware of the importance of establishing and nurturing a responsive, effective network of political contacts at both the federal and provincial levels.

As political and health care issues affecting Optometry continue to arise with greater and greater frequency, we are being forced to compete directly with many other, more powerful interest groups for access to decision makers. CAO, at the same time, must also compete for administrative time with its own ongoing service programs as a national membership organization.

Competition for limited internal resources notwithstanding, the critical factor in responding to issues as they arise is our ability to deliver timely and coordinated communications to our target audience. While much of this work is performed by CAO staff, under the direction of the CAO President and the Federal Legislative Affairs Committee, the potential exists for a very active role by individual optometrists . . . our Optometric Keypersons.

> With the addition of a new computer network to the CAO office and the recruiting of a coordinator for CAO's governmental affairs programs, CAO's KEYPERSON program will be moving into full stride.

Shortly after the election of the Conservative Government, CAO conducted a national survey of its members to determine the extent of personal political contacts. Over 450 optometrists responded, revealing a surprisingly extensive network of practitioner/patient relationships with federally elected officials of all political stripes.

Now, with the addition of a new computer network to the CAO office and the recruiting of a coordinator for CAO's governmental affairs programs, CAO's KEYPERSON program will be moving into full stride. Based on our earlier survey, a KEYPERSON DATABASE has been established that will significantly improve our ability to maintain direct and more personalized contact with our Key O.D.'s in the field.

Early in 1987, each Member who responded to our KEYPERSON survey should expect to be contacted, to enlist his/her support for a major lobbying initiative by the Association.

Any optometrists who have not already identified themselves as Keypersons and who wish to participate in our Political Action programs are invited to contact the CAO office to apply as CAO KEYPERSONS and record the status of their political contacts and/or activity.

Political Action Update

Since June, 1986, CAO has met with, or been involved with representatives of a number of Federal Government

Introduction

Dans leur lutte pour changer les tendances sociales, politiques et économiques qui influent sur le système de soins de la santé, L'Association canadienne des optométristes et ses dix associations provinciales membres sont de plus en plus sensibilisées à l'importance d'établir et de cultiver un réseau efficace de contacts politiques aux paliers fédéral et provincial.

Étant donné le nombre croissant de questions politiques et relatives aux soins de la santé touchant l'optométrie, nous sommes contraints de concurrencer directement de nombreux autres groupes d'intérêts plus puissants pour atteindre les décideurs. De plus, à titre d'organisme de recrutement national, l'ACO doit faire concurrence à ses propres programmes de services permanents pour l'obtention de ressources administratives.

Malgré cette compétition pour des ressources internes limitées, le facteur primordial de notre intervention dans les questions d'actualité demeure notre capacité de communiquer de façon rapide et coordonnée au groupe cible. Bien que cette fonction soit en large partie assurée par les personnel de l'ACO sous la direction du président et du Comité des affaires législatives fédérales de l'ACO, nous avons la possibilité de confier un rôle très actif à bon nombre d'optométristes individuels — notre équipe de personnes-clés.

> Avec la mise en place d'un nouveau réseau informatisé au bureau de l'ACO et l'arrivée d'un coordonnateur chargé des programmes d'affaires gouvernementales de l'ACO, nous sommes maintenant prêts à lancer à fond notre programme des PERSONNES-CLÉS.

Peu après l'élection du gouvernement conservateur, l'ACO a mené un sondage d'envergure nationale auprès de ses membres afin de déterminer quelles étaient leurs contacts politiques personnels. Les résultats compilés à partir des réponses de plus de 450 optométristes participants ont révélé l'existence d'un vaste réseau de relations praticiens/patients avec des députés fédéraux de toutes les allégeances politiques.

Avec la mise en place d'un nouveau réseau informatisé au bureau de l'ACO et l'arrivée d'un coordonnateur chargé des programmes d'affaires gouvernementales de l'ACO, nous sommes maintenant prêts à lancer à fond notre programme des PERSONNES-CLÉS. À partir des résultats de notre récent sondage, nous avons établi une BASE DE DONNÉES DES PERSONNES-CLÉS qui améliorera grandement notre capacité d'entretenir des rapports directs et personnels avec nos optométristes-clés.

Au cours de la prochaine année, nous demanderons à bon nombre des membres ayant participé à notre sondage de prendre part à des campagnes de communication sélective ou générale, selon la nature de la question, dans le cadre d'initiatives particulières de lobbying qu'entreprendra l'Association.

Tout optométriste ne s'étant pas déjà proposé comme personne-clé et désirant participer à nos programmes d'action politique est invité à communiquer avec le bureau de l'ACO

FEDERAL ISSUES/QUESTIONS FÉDÉRALES

Departments regarding issues of concern to Optometrists and their patients, summarized briefly as follows:

Transport Canada — Marine Pilotage

In correspondence with the Minister, the **Hon. John Crosbie**, and through meetings with officials of **Transport Canada**, CAO has introduced recommendations to the **Pilotage Act and the General Pilotage Regulations** which would specifically include optometrists as examining practitioners for pilot candidates, and provide better optometric terms of reference for "Visual Fields".

Revenue Canada

Alerted to Revenue Canada's planned release of a replacement for the present Certification of Blindness **Form T-2201** by an Ottawa area Keyperson, CAO attempted to obtain official recognition for an optometrist's authorizing signature on the new Certification of Disability Form. This issue involved meetings and consultations with senior officials in **Revenue Canada**, **National Health and Welfare** and the **Department of Finance**, including direct correspondence with their Ministers, respectively, the **Hon. Elmer Mackay**, the **Hon. Jake Epp** and the **Hon. Michael Wilson**. CAO clearly identified in all exchanges with the Ministers that Revenue Canada's choosing to exclude Optometry from this government program must be viewed as **discriminatory** and reflective of an **inappropriate medical bias** that will be challenged.

Health and Welfare — Civil Aviation Medicine

In response to notices received from several Alberta practitioners concerning inappropriate referral practices by Health and Welfare Civil Aviation Medical Officers, CAO has contacted Health and Welfare's Civil Aviation Branch to discuss the problem, with reference to the recent changes to the **Aeronautics Act** that specifically recognizes the optometrist's role in examining the vision of civil aviation personnel. Although unresolved at this time, a schedule of meetings has been arranged that should clarify the issues we have raised.

External Affairs

The Passport Guarantor issue, once again, is receiving serious consideration by CAO as a matter needing to be resolved once and for all. CAO's Federal Affairs and Legislative Committee is preparing a coordinated plan of action that, with the assistance of our KEYPERSONS, will exert the required political pressure with the goal of obtaining our objective of passport guarantor status for optometrists.

Department of National Defence

CAO's Executive Director, Gérard Lambert, accompanied by Drs. Roland and Margaret Hansen des Groseilliers, attended

pour se porter candidat à l'équipe des PERSONNES-CLÉS de l'ACO et nous informer de ses contacts ou activités politiques.

Programme d'Action Politique

Depuis juin 1986, l'ACO a collaboré avec les représentants d'un certain nombre de ministères du gouvernement fédéral sur plusieurs questions intéressant les optométristes et leurs patients. En voici un bref résumé:

Transports Canada — Pilotage maritime

Dans ses lettres au ministre, **l'honorable John Crosbie**, et lors de rencontres avec des responsables de **Transports Canada**, l'ACO a formulé certaines recommandations relatives à **la Loi sur le pilotage et aux règlements généraux sur le pilotage**, visant à habiliter les optométristes à examiner les candidats pilotes et à accroître le rôle de l'optométrie en matière de champs de vision.

Revenu Canada

Alertée par une personne-clé de la région d'Ottawa de l'intention qu'a Revenu Canada de remplacer le présent Certificat de cécité (en annexe à **la formule T-2201**), l'ACO a tenté d'obtenir la reconnaissance officielle de la signature de l'optométriste sur le nouveau Certificat d'invalidité. À cette fin, nous avons tenu des réunions et des consultations avec les hauts fonctionnaires de **Revenu Canada**, de **Santé nationale et Bien-être social** et du **ministère des Finances**, et avons écrit directement à leur ministre respectif, soit **l'honorable Elmer Mackay**, **l'honorable Jake Epp** et **l'honorable Michael Wilson**.

Dans chacun de ses échanges avec les ministres, l'ACO a clairement laissé entendre que la décision de Revenu Canada d'exclure l'optométrie de ce programme gouvernemental est **discriminatoire** et reflète **un préjudice médical inacceptable** qui sera contesté.

Santé et Bien-être social — Médecine aéronautique civile

Informée par plusieurs praticiens de l'Alberta au sujet de pratiques d'aiguillage inappropriées par des médecins de l'aviation civile de Santé et Bien-être social, l'ACO a communiqué avec la Direction de l'aviation civile de Santé et Bien-être social pour discuter du problème, eu égard aux récentes modifications à **la Loi sur l'aéronautique** reconnaissant de façon expresse le rôle de l'optométriste dans l'examen de la vue du personnel de l'aviation civile.

Bien que les questions que nous avons soulevées ne soient toujours pas réglées, nous avons prévu une série de rencontres destinées à clarifier la situation.

Affaires extérieures

Une fois de plus, l'ACO se penche sérieusement sur le problème des répondants en matière de passeports, dans l'espoir de régler la question de façon définitive. Le Comité des affai-

FEDERAL ISSUES/QUESTIONS FÉDÉRALES

a Conservative Party fund-raiser as part of a series of "Capital Encounters", coordinated by the PC's. Attending the fund-raiser was the **Hon. Perrin Beatty, Minister of National Defence**, who proved to be already acquainted with our general concerns regarding the "ophthalmic technician role model". Subsequent correspondence to the Minister has offered to keep him apprised of our upcoming political agenda with his **Associate Minister of National Defence**, the **Hon. Paul Dick**.

Employment & Immigration

CAO also expressed a number of specific concerns over a publication released under then Minister, the **Hon. Flora MacDonald**, entitled "Job Futures", which contained inaccurate statistical and factual information about the profession of optometry. Subsequent reprintings, as a result of our input, will more accurately reflect our profession.

Alex Saunders
Governmental Affairs Coordinator, CAO

res législatives fédérales de l'ACO prépare actuellement un plan d'action coordonné qui, par l'intervention de nos PERSONNES-CLÉS, vise à exercer la pression politique nécessaire à l'atteinte de notre objectif, soit d'obtenir pour les optométristes le statut de répondants en matière de passeports. Il est on ne peut plus évident que la décision de conférer ou non le statut de répondant relève finalement du ministre. Nous concentrerons donc nos efforts sur le ministre des Affaires extérieures, l'honorable Joe Clark. Il sera très intéressant de savoir si M. Clark se contentera de suivre ses prédécesseurs libéraux ou s'il prendra position contre ce préjudice à l'égard de notre profession. Chose certaine, si l'ACO revient bredouille, ce ne sera pas par manque d'efforts de la part de notre directeur général, des membres et du personnel.

Ministère de la Défense nationale

Le directeur général de l'ACO, Gérard Lambert, accompagné des Drs Roland et Margaret Hansen des Groseilliers, a assisté à un repas-bénéfice du Parti conservateur tenu dans le cadre d'une série de rencontres coordonnées par les PC. **L'honorable Perrin Beatty, ministre de la Défense nationale**, était également présent et s'est montré bien au fait de nos préoccupations générales concernant le rôle de fonction professionnelle du technicien en ophtalmologie. Nous avons par la suite écrit au ministre et offert de la tenir au courant des questions dont l'ACO traitera bientôt avec **le ministre adjoint de la Défense nationale, l'honorable Paul Dick**. D'après nos sources privées, il semble à première vue que les conservateurs se bornent à adopter la même position de principe bureaucratique que l'ancien gouvernement libéral. L'ACO devra sans doute s'engager une fois de plus dans une lutte interminable avec le MDN.

Emploi et Immigration

L'ACO a aussi exprimé un certain nombre de préoccupations particulières à l'égard d'un document publié sous l'ancien ministre, **l'honorable Flora MacDonald**, intitulé "Emploi-Avenir", contenant des faits et des données statistiques erronés sur la profession de l'optométriste. Par suite de notre intervention, les rééditions futures refléteront mieux notre profession.

Alex Saunders
Coordonnateur des affaires gouvernementales, ACO

RESEARCH/RECHERCHE

Newer Approaches to Glaucoma Management *

W.M. Lyle * *

Abstract

Traditional drug treatment of glaucoma tends to produce sequential periods of overdose and underdose. Methods of avoiding this pulsed sequence are becoming available. The aim is to achieve zero order kinetics instead of first order kinetics. The result should be smoother control of intraocular pressure with a smaller dose of drug. Laser treatments are replacing some of the older surgical procedures for treating glaucoma. No current treatment modality is totally successful and free of problems for all patients.

Résumé

Le traitement traditionnel du glaucome par médicaments a tendance à produire des périodes séquentielles de dose excessive et de dose insuffisante. Certaines méthodes visant à éviter ces séquences pulsatoires deviennent accessibles. Leur but: atteindre la cinétique d'ordre zéro au lieu de la cinétique de premier ordre. Le résultat escompté: une maîtrise plus souple de la pression intraoculaire, par une dose réduite de médicaments. Les traitements au laser remplacent certaines interventions chirurgicales habituelles du glaucome. Aucun traitement actuel ne réussit à cent pour cent sans occasionner de problèmes à certains patients.

Glaucoma encompasses a group of diseases involving the optic nerve and resulting in a visual field loss. The glaucomatous signs (visual field reduction, damage to nerve fiber layer and sometimes disc changes) are likely to be accompanied by increased intraocular pressure. However, there is no simple relation between intraocular pressure (IOP) and impaired functioning of the optic nerve. Many eyes with an IOP over 21 mmHg never develop visual field loss from glaucoma,[1] while a few patients who do develop glaucoma have an IOP below 21 mmHg.[2] A pressure which fluctuates considerably during the day is likely to be as harmful as a constant high pressure.[3] Normal eyes show a diurnal fluctuation of about 4 mmHg but glaucomatous eyes undergo wider swings in pressure. Perfusion of the capillaries supplying the nerve head and the retina is influenced by the blood pressure and by the intraocular pressure.[4-8] A ratio between blood pressure and intraocular pressure which results in inadequate perfusion of these capillaries results in nerve fiber damage.[8, 9] Although the etiology of glaucoma remains obscure there is a strong vascular component.[8, 10]

Early confusion about the prevalence of glaucoma partly resulted from a failure to recognize that about 11% of the population have a slightly elevated IOP but of this group only 1% a year develop visual field losses.[11] Current estimates indicate that between 0.5% and 1% of the population have glaucoma[12-14] Most of those who have primary open-angle glaucoma are over 55 years of age.[7] Improved diagnostic techniques and the increasing longevity of patients will increase the number of people requiring treatment.[15]

There are many types of glaucoma but since 1940 it has been possible to divide primary glaucoma into two types based on the anatomical size of the angle between the anterior surface of the iris and the trabecular region.[4] Gonioscopy and to a lesser extent the slitlamp and penlight methods of estimating the angle width are employed.[16, 17]

The most common type is open-angle glaucoma. Gonioscopy reveals an open angle, early manifestations are insidious and drug treatment is usually lifelong. In most populations the incidence of open-angle glaucoma is more than twice that of angle-closure glaucoma.[8]

Angle-closure glaucoma occurs in eyes with a pre-existing narrow angle and is generally ameliorated by prompt surgery,[4] after the pressure has been reduced by appropriate drugs.

Drugs and surgical procedures seek to prevent damage to the optic nerve by controlling the IOP either by facilitating the escape of aqueous humor from the eye or by decreasing the rate of formation of this fluid[4] (Tables 1 and 2). This paper describes some newer approaches to the management of open-angle glaucoma including presently available drugs and some new formulations. Laser treatment of both open-angle and angle-closure glaucoma is the only surgical procedure discussed.

Fundamental Concepts of Ocular Pharmacology

When an eyedrop such as pilocarpine is instilled how much of it is physiologically available? How accurately can we predict the magnitude and time course of drug action? A drop of pilocarpine (50 to 75 μL) is many times larger than the normal tear film volume (6.5 to 8.5 μL) or the maximum capacity of the conjunctival sac (25 to 30 μL). As a result approximately 80%[22] of the instilled drop does not enter conjunctival-corneal

*Based on a paper presented at the Professional Practice Conference of the Canadian Society of Hospital Pharmacists, Toronto, February, 1985.

* *Optometrist, Ph.D., Member of Faculty, F.A.A.O. School of Optometry, University of Waterloo Waterloo, ON

Table 1
Drugs to Lower Intraocular Pressure

	Onset of pressure reduction	Duration of pressure reduction*	Decreases aqueous production (inflow)	Facilitates aqueous escape (outflow)	Extent of pressure reduction	Reported compliance	Discontinued because of unwanted effects	Had signficant unwanted effects	Comments
acetazolamide (Diamox) 270 or 127 mg (q.i.d.) orally	1/2 to 2 h; max 3 to 5 h	6 to 10 h	40 to 70%	yes	About 30%; about 10 mmHg, range 3 to 22 mmHg.	?	40 to 50% [Methazolamide (Neptazane) 50 or 100 mg t.i.d. causes fewer unwanted effects.]	yes	Gastrointestinal effects, acidosis, gout, drowsiness paresthesias, potassium depletion, kidney stones, blood dyscrasias and up to 8D of myopia. Depression has been reported.
acetazolamide (Sequel) 500 mg (b.i.d.) orally	2 h; max 8 to 18 h	22 to 39 h	50%	yes	About 10 mmHg.	?	?	?	Sustained release form.
acetazolamide 250 mg i.v.	From 5 to 10 min; max 1/2 to 4 h	1/2 to 4 h	50%	—	5 to 10 mmHg.	100%	?	?	Employed sometimes to treat an acute glaucoma episode.
carbachol 1.5% or 3% topically. (b.i.d. or t.i.d.)	4 h	8 to 12 h	probably	yes	5 to 10 mmHg.	?	?	?	Causes sweating and palpitation. Can raise IOP if angle is narrow. Ciliary spasm. Myopia. Penetrates the cornea poorly.
N-demthylated carbachol, 3% or 6% topically	?	8 h	probably	presumably	By 30 to 35%; about 10 to 12 mmHg.	?	?	few	No ciliary spasm, no decrease in acuity, no effect on pupil size.
demecarium bromide (Humorsol) 0.125% or 0.25% topically every other day. For eyes with open angles only.	30 min; max at 30 to 36 h	9 days	no	121%	45%	?	?	yes	Causes bradycardia, bronchoconstriction, ciliary spasm, increased rate of cataract development. Causes iris cysts and local congestion. Rarely used.
dipivefrin hydrochloride (Propine) (dipivalyl epinephrine) 0.1% (b.i.d.) topically	30 min; max at 4 to 8 h	similar to epinephrine i.e., about 12 h	yes Probably by 25%	yes Penetrates cornea IOX more readily than epinephrine	From 20% to 25%; about 7 mmHg.	Good	5%	yes in 8% to 25%	Intraocular effects similar to epinephrine but systemic effects less. Adverse effects on the ocular surface do occur with dipivefrin. Can cause cystoid maculopathy especially in aphakic eyes. Do not use if angle is narrow.
echothiophate iodide, (Phospholine Iodide), 0.03% or 0.06% once or twice a day, topically.	4 to 6 h; max 10 to 28 h	12 to 72 h	no effect	125%	Usually 10% range 4% to 50%; 10 to 16 mmHg.	?	?	yes	Shallows anterior chamber progressively. Cysts at pupillary margin. Cataract in 50% in 1 yr. Ciliary spasm and risk of retinal detachment. Induced myopia possibly not all due to ciliary spasm. Do not use if angle is narrow.
epinephrine, adrenalin. Many trade names. 1% or 2% (b.i.d.) topically	60 min; max 2 to 4 h	12 to 24 h	By 25% to 37% but briefly increases production for 2 to 5 h	By 50% if drug treatment is continued for some days	From 25% to 30%; 3 to 36 mmHg, mean 12 mmHg. About 50% show 5 mmHg lower IOP.	30% to 80%	20% to 70%	yes in 83%	Lowers IOP in 70% of open-angle eyes, and in 31% of secondary glaucoma cases. Can cause extrasystoles, arrhythmia, and hypertension. Allergic reactions occur in 20%.

➤

Table 1 continued

	Onset of pressure reduction	Duration of pressure reduction*	Decreases aqueous production (inflow)	Facilitates aqueous escape (outflow)	Extent of pressure reduction	Reported compliance	Discontinued because of unwanted effects	Had signficant unwanted effects	Comments
ethyl alcohol. 3 fluid ounces of spirits. (50% alcohol) (orally); 2 to 3 ml/kg spirits.	15 min; max 1 to 2 h	4 to 5 h	slightly	yes	20%. As much as 5 to 35 mmHg reduction if IOP elevated.	excellent	—	yes	Inhibits anti-diuretic hormone, raises the osmotic pressure of the plasma. Probably also has a central effect on IOP. Can be repeated but can cause intoxication.
gylcerol (glycerin) 1.5 grams/kg (orally). About ½ a cupful. Dose can be repeated if necessary. One ml of the solution contains 0.62 grams.	10 to 30 min; max 30 to 60 min	3 to 5 h	?	yes	At least 20%.	?	rarely	Unpleasant to swallow	Raises level of blood glucose and osmotic pressure. Also has a central effect on IOP. Caution if diabetic. Can cause nausea but will lower IOP if the glycerol is not lost by vomiting until 5 or 10 min after ingestion.
guanethidine (3%) plus adrenaline (0.5%) (b.i.d.) (topically). Other proportions are available. (1% to 5%) guanethidine plus 0.2% to 1% adrenaline.	1 to 2 h	12 to 24 h	yes	yes	25%; About 9 mmHg; range 2 to 10 mmHg.	good	?	?	Guanethidine produces a type of chemical sympathectomy so the epinephrine has more effect. Can cause punctate epitheliopathy: conjunctival hyperemia, pigmentation and raise blood pressure. Use only for eyes with open-angle glaucoma.
levobunolol hydrocholoride (Betagon) 0.5% once a day.	30 min; max at 2 to 4 h	16 to 24 h	yes	not likely	About 25% 7 mmHg.	?	About 5%		Like timolol blocks beta$_1$ and beta$_2$ sites. Slows heart 5 to 10 beats a min, lowers BP about 4 mmHg. Stings and may cause blepharitis.
marijuana, cannabis, tetrahydrocannabinol, Δ^9 THC (smoked). Probable dose from one cigarette is 1 mg.	within 1 h	up to 5 h	Probably dilates efferent vessels from ciliary processes and constricts afferents to to ciliary processes.	yes	15% to 24% or 20% to 40%	?	?	?	Has a central effect and lowers blood pressure so may actually worsen effect of glaucoma. Topical tetrahydrocannabinol may or may not lower IOP.
nadolol 2% topically (b.i.d.)	max at 4 h	12 h							A non-selective beta blocker. Lowers IOP about as well as 0.5 timolol b.i.d. but causes more unwanted systemic effects.
pilocarpine nitrate or hydrochloride 1% to 6%. Usually 2% (q.i.d.) topically.	30 to 60 min; max reduction evident at 75 min	4 to 8 h	up to 25% eventually	over 30%	10 to 40% 5 to 10 mmHg	50 to 70%	30%	yes	Lowers IOP in 80% with open or closed angle. Shallows anterior chamber by about 10% promptly. Causes up to 10D myopia. Decreases AC/A by 20%. Hastens cataract formation; poorer vision in dim illumination.
pilocarpine Ocusert® Topically once a week.	max 2 h.	7 to 9 days	probably	probably	Lower IOP in a.m. than with pilo 2%.	Better than with drops.	38%	few	Releases pilocarpine at 20 or 40 μg/hr for a week. Causes 0.5 to 1.4D of myopia in young patients, may fall out; costs more.

➤

Table 1 continued

	Onset of pressure reduction	Duration of pressure reduction*	Decreases aqueous production (inflow)	Facilitates aqueous escape (outflow)	Extent of pressure reduction	Reported compliance	Discontinued because of unwanted effects	Had signficant unwanted effects	Comments
physostigmine, eserine, 0.25% or 0.5% solutions (q. 4 or 6 hr) or 0.25% ointment (hs.) Topically.	15 min	8 to 12 h	?	slightly	?	?	?	?	Ciliary spasms. Poorer vision in dim illumination. No longer used to treat glaucoma
thymoxamine HC1 0.1% to 0.5% (topically)				slightly	very little			not at these low concentrations.	Is an alpha$_1$ blocker useful in angle-closure glaucoma. Reverses phenylephrine mydriasis. Causes miosis.
timolol maleate (Timoptic) 0.25% or 0.5% (b.i.d.) topically	20 min; max 1 to 2 h	7 to 14 h	15% to 40%	Possibly with long term use but this is doubtful.	20% to 30%; 2 to 16 mmHg.	90%	9% (or in about 40% of those who get side effects.)	15% to 23% bradycardia, asthma, bronchitis	About 10% do not respond and 25% do not respond adequately. Lowers IOP in over 80% of open-angle cases but pressure tends to escape from control to some extent in a few months. Timolol is less effective in other types of glaucoma. Can cause bradycardia, hypotension, syncope, worsen asthma and bronchitis and cause mental depression.

*When administered at the usually indicated dose and recommended regimen. All values are based on reports by a number of investigators and are approximations because of various clinical variables.

tissues but rather flows into the nasolacrimal duct (within 30 s) or down the cheeks.[18-22] With a normal blink rate and instillation of a much smaller drop up to 80% more of the drug remains in the ocular area for 5 min.[23]

From 12% to 25% of the tear fluid is replaced every minute by new secretion. (Table 3). The normal tear production rate is 1.2 to 3.8 μL/min but can reach 5.7 μL/min or more[24, 25] following irritation or rapid blinking (the latter also hastens tear drainage.[18]) Some of the instilled drug enters the conjunctival tissue and its blood vessels[26] but most of the drop does not penetrate the eye.[27] It is possible to predict how much drug has penetrated the cornea at any time after drug instillation — providing the instillation is performed correctly and tear production and blink rates are known. For example less than 1% of the pilocarpine in an aqueous solution enters the cornea.[28] Pilocarpine reaches its peak concentration in corneal epithelium within 2 min,[29] in cornea in 15 min[28] and in aqueous in 35 min.[30] For most drugs less than 0.1% of the instilled drug penetrates the cornea and actually enters the anterior chamber.[20, 31-34] Drug concentration in the anterior chamber rises rapidly during the first 10 to 20 min reaches a peak in 20 to 40 min and then begins to decline.[34] Initially the rate of decline is rapid but then becomes slower i.e. first order kinetics are observed. The concurrent or prior application of benzalkonium chloride (0.01% or 0.001%) or other preservatives can damage the epithelium and increase pilocarpine penetration into the aqueous by as much as 50%.[20] Elimination of topically instilled aqueous solutions of pilocarpine from the tear film occurs at a steady rate (most is lost in 30 min[35]). Instilled drops become diluted by tear fluid to half their original strength in 45 s and typically reach 1/1000 of their initial concentration in 8 min.[36]

Many ocular drugs are more effective in an eye with a lightly pigmented iris[37] possibly because pigmented tissues bind the drug more firmly[38] or because the rate of drug hydrolysis is faster in heavily pigmented eyes.[39-42] Heavily pigmented irides are more dense,[42] so penetration of the drug is impeded. Peak drug effect is reached later and persists longer in dark eyes.[43, 44] The pharmacologic action of pilocarpine (4%) or epinephrine (2%) is more pronounced (i.e. decreased IOP) in lightly pigmented than in heavily pigmented subjects.[45] Similar pharmacokinetics apply to most topically instilled ocular drugs.[44]

Most drugs when taken orally undergo extensive metabolism by the liver so that less than 50% of the drug reaches the systemic circulation. Topically instilled drugs bypass liver metabolism and enter the blood stream directly via the capillaries of the nasolacrimal passage. Drugs instilled on the eye reach peak concentrations in the blood in about 90 min.[33]

Drugs to Control Glaucoma

(a) **Parasympathomimetics (Cholinergics)**

For over 100 years, pilocarpine has been used to promote the escape of aqueous humor from the eye.[4] A drop of a 2% aqueous solution of pilocarpine is effective for only 6 h thus requiring four applications daily.[16] Pilocarpine is usually effective[46] but poor compliance[46a] is a common problem because of the need for frequent instillations and the side effects such as headache, blurred vision (induced myopia), reduced vision in dim light and reduced vision when cataract is present.[15, 47, 48] In most patients the side effects diminish after a week on the drug. Multiple daily instillation

of a drug and its preservatives can induce an allergic response or produce cumulative damage to the corneal epithelium.[49]

(b) **Sympathomimetics (Adrenergics)**

Epinephrine, an adrenergic agent, also has a long history of use in the treatment of glaucoma.[4, 46] Its topical use was abandoned for a time because, by producing mydriasis, it precipitated angle closure in a few eyes. The use of epinephrine was resumed (about 1945) when practitioners became able to identify those eyes which had anatomically narrow angles. Adrenergic agents such as epinephrine are believed to lower the IOP by increasing aqueous outflow and by slightly decreasing aqueous production.[4, 15, 50, 51] Possibly epinephrine also promotes the endogenous production of prostaglandins.[52] The pressure lowering effect of epinephrine is blocked by concurrent administration of indomethacin an inhibitor of cyclo-oxygenase and prostaglandin production.

Adrenergic drugs have several advantages over pilocarpine because they require only twice a day instillation, do not blur the vision and dilate rather than constrict the pupil. This helps vision in dim light and permits patients with cataract to make the best use of their remaining vision.[15] Epinephrine (1%) when given to a patient who is receiving pilocarpine usually lowers the IOP even further.[4] However epinephrine can raise blood pressure, cause adrenochrome pigment deposits in ocular tissues[53] and cause cystoid macular edema[4, 51] (in about 20% of aphakic eyes,[54]) so caution is advised.

(c) **Beta Adrenergic Blocking Agents**

Paradoxically both stimulating and blocking certain adrenergic receptor sites in the eye will lower IOP.[17] In the past seven years timolol maleate, a non-selective "β-blocker", has become widely used to treat glaucoma.[4] Timolol (0.25% or 0.5%) when instilled twice a day lowers the IOP without affecting pupil size or accommodation. Timolol decreases aqueous production and smooths out diurnal variations in pressure.[55, 56] The action of timolol persists longer in heavily pigmented eyes.[57] However, the ability of timolol to control the IOP diminishes slowly after some months of therapy.[58] Timolol can be added to the regimen of those receiving topical pilocarpine or oral acetazolamide but may or may not help when given to those who are receiving topical epinephrine.[50, 59] When used with epinephrine, the epinephrine should be instilled before the timolol.[50, 60] Timolol slows the heart rate, especially in patients with heart disease and can precipitate an asthma attack and bronchitis in patients with respiratory disease. At least a dozen other adrenergic blockers are presently being investigated for the control of IOP[15], for example, levobunolol, betaxolol, metipranolol and nadolol.

(d) **Carbonic Anhydrase Inhibitors**

Acetazolamide or methazolamide can be administered orally to treat glaucoma.[46] Acetazolamide can also be given intravenously. Carbonic anhydrase inhibitors are used primarily to lower very high IOP in acute angle-closure glaucoma prior to surgery. Carbonic anhydrase inhibitors, which are also diuretics, decrease aqueous production but their unwanted effects (drowsiness, headache, anorexia, nausea, lethargy, transient myopia, paresthesias and rarely renal calculi and blood dyscrasias) make their long term use undesirable.[61] Attempts to develop topical preparations of carbonic anhydrase inhibitors have created some interest.[62]

Other methods (some experimental) of administering drugs to treat ocular conditions are:

- subconjunctival injection[63]
- a spray system;[64] with aerosols
- iontophoresis, the use of a direct electric current to cause drug ions to penetrate tissue. Duke-Elder[65] provides a long list of drugs, including pilocarpine, which have been administered this way.

Table 2
Aqueous Humor Production and Outflow in the Normal Adult Eye

- capacity of the anterior chamber = 190 to 265 μL (about 4 to 5.5 drops).
- capacity of the posterior chamber = 60 μL (about 1.0 drop) (Capacity of the vitreous chamber is about 4.4 mL).
- total volume of aqueous in an eye = 250 to 325 μL (about 5.0 to 6.5 drops).
- aqueous production rate = 2 to 3.5 μL/min = 120 to 210 μL/hr (each eye). The rate is lower during sleep and declines with increasing age.
- total daily production of aqueous = 3 mL (about 60 drops each eye).
- aqueous outflow by the trabecular route is 2.4 to 3.0 μL/min (each eye). Aqueous outflow facility declines slightly with increasing age.
- aqueous outflow by the uveoscleral route is 0.2 to 0.5 μL/min (each eye). This route provides 5 to 15% of the total aqueous outflow.
- aqueous turnover time is 80 to 120 min.
- aqueous turnover rate is about 1.5%/min.
- in normal eyes the diurnal variation in IOP is 4 to 6.5 mmHg.

Prolonging Drug Release

In an effort to minimize the problems associated with repeated instillation of drugs (which subject the patient to a cycle of overdoses and underdoses) various methods have been designed to prolong the duration of the effect of single doses.[25, 66-70] Fifteen minutes after drug instillation the proportion of drug remaining in the conjunctival sac was shown[69] to depend on the vehicle and for the following vehicles was: saline 23%, methylcellulose 24%, polyvinyl alcohol 30%, and ointment 38%. Pilocarpine in an aqueous vehicle is lost from the tears at rate of at about 10% a minute.[44] Another study[20] compared drug retention time with various vehicles and reported for aqueous 60 s; for 0.5% hydroxypropyl methylcellulose 140 s, for 1% hydroxypropyl methylcellulose 210 s; and for 1.4% polyvinyl alcohol 70 s.

Ideally a controlled drug delivery system[22, 70-72] should:

- require less frequent administration
- avoid the overdose/underdose sequence
- diminish the extent of the fluctuations in IOP
- require less total drug per day
- produce fewer unwanted effects
- avoid the use of preservatives

Table 3
Tear Production and Tear Drainage in the Normal Eye

- total tear volume is 6.5 to 8.5 μL (each eye).
- tear production rate is from 1.2 to 3.8 μL/min (usually 2.5 μL/min) but can reach 5.7 μL/min (each eye). Tear production during sleep is negligible. Tear production declines as age increases.
- daily tear production is from 1.7 to 8.2 mL (about 35 to 145 drops) (each eye).
- tear fluid turnover time is 4 to 6 min.
- tear turnover rate is 12% to 25%/min, generally about 15%/min.
- maximum capacity of the conjunctival sac of an adult is 25 to 30 μL, providing blinking does not occur. A typical drop of pilocarpine contains about 50 μL so half is immediately spilled out. Blinking and drainage into the puncta soon reduce the quantity of fluid retained in the conjunctival cul-de-sac to about half the maximum capacity value, i.e. to about 12 μL in an adult eye.
- normal blink rate is 10 to 20/min. Each blink expresses one to two microliters of fluid from the tear volume.
- maximum capacity of the conjunctival sac of a child is up to 10 uL, providing blinking does not occur.
- about 2% of the tear fluid is lost by evaporation and the remainder enters the nasolacrimal drainage pathway.
- absorptive surface of the conjunctiva of an adult is about 16 cm^2 each eye. Surface area of the cornea is about 1.5 cm^2.
- tears contain 1% protein, have a pH of 7.1 to 7.6, a surface tension of 40 dyne/cm and an osmolarity of about 300 mOsm/L. Probably eyes with a tear tonicity above 312 mOsm/L will be associated with dry eye symptoms.
- the tears have some buffering capacity. Instilled solutions in the pH range 6.5 to 9 cause little discomfort.

- permit use of newer drugs, some of which have such short half-lives that they would require too frequent administration.
- improve compliance. Patient compliance is notoriously poor especially for pilocarpine.[46a]

Formulations employed to prolong drug release or increase corneal penetration include:

(a) **Ointment vehicles**
The turnover rate of a drug in an ointment in the conjunctival cul-de-sac[19] is about 0.5%/min compared to at least 50%/min for a drug in solution.[24, 36] Ointments retain a lipid soluble drug in the tear film nine or ten times as long as an aqueous solution.[19, 73, 74] Pilocarpine is lost from an ointment about 20 times slower than from an oily vehicle.[44] Ointments prolong drug contact with the ocular surface[19, 44, 67, 74] are less diluted by tears and less readily drained away. Often a given drug will be prescribed in an aqueous solution for use during the day and in an ointment for use at night.[18, 70, 75] Ointments (especially, large doses) produce a greasy appearance, and blur the vision slightly.[22, 71, 75, 76]

(b) **Soluble gel vehicles**
A gel vehicle, poloxamer 407 (a polymer of ethylene oxide and propylene oxide), when combined with pilocarpine, enables a single night-time dose to control IOP for 24 h.[76-78] Poloxamer gels become more viscous when they reach body temperature but the drug-gel combination dissolves in the tears in less than 5 min.[79] Compliance is improved but drug delivery is still somewhat pulsed.[78]

Pilocarpine 4% in a gel vehicle, carbopol 940 (Pilogel, Pilopine H.S.) was introduced by Alcon. The gel contains a carboxylated (acrylic) polymer and the preservative is benzalkonium chloride 0.008%. A half-inch ribbon of gel applied at bedtime controlled IOP for 24 h.[80] Pilopine H.S. controlled IOP with once a day administration but 10 to 28% of eyes developed a persistent superficial corneal haze.[78, 78a] Viscous preparations and gels increase bioavailability since they provide about 8 h exposure to the drug. Very little aqueous solution of a drug remains in contact with the cornea for longer than 15 min.[81]

A carboxypolymethylene gel (Gel Tears) has been developed by Alcon for the treatment of dry eyes.[82] This polymer of acrylic acid has an ointment-like consistency and remains in the conjunctival sac for 6 to 12 h where it melts and absorbs and retains fluid. Gel Tears could serve as a drug vehicle.

(c) **Addition of soluble polymers to the drug**
Hydroxypropyl methylcellulose (0.5%)[75, 80] and polyvinyl alcohol (1.4%)[22, 35, 66, 68, 69, 83-86] increase tear viscosity and delay tear drainage.[62] Adding one of these agents to a drug will extend the duration of contact time by 8 or 10 min[87, 88] but provides minimal clinical benefit.[18, 89-92] The bioavailability of pilocarpine increases two fold when the drug has a hydroxypropyl methylcellulose vehicle compared to an aqueous vehicle.[44] Pilocel (Professional Pharmacol Co.) contained methylcellulose while Isopto vehicle (Alcon) uses 0.5% hydroxypropyl methylcellulose. Retention time of drugs placed in the conjunctival cul-de-sac is mostly determined by the rate of tear production.[92] The Adsorbobase vehicle (Alcon) with 1.67% polyvinyl pyrrolidone and other soluble polymers plus 1% hydroxypropyl methylcellulose prolongs drug bioavailability.[20, 93] Adsorbocarpine (Burton Parsons) given twice a day achieved better control of IOP than regular pilocarpine administered four times a day.[94] Soluble polymers increase the thickness of the tear film.[95] A drug in an aqueous solution enters the nose in 60 s but in polyvinyl alcohol it requires 70 s and in 0.5% methylcellulose 140 s.[96] Even when combined with methylcellulose twice a day dosing with pilocarpine is inadequate.[97, 98] A polyvinyl alcohol vehicle has been reported to provide longer drug contact time than a methylcellulose vehicle,[86] but not all investigators agree.[66]A polyvinyl alcohol vehicle produces a concentration of the drug in the anterior chamber which is 4 times higher than that produced by an aqueous vehicle.[83] Viscous solutions (60 cps) increase the amount of drug absorbed by a factor of 2 or 3.[99]

(d) **Aqueous emulsion**
When pilocarpine is bound in an aqueous emulsion to a polymer salt (i.e. in Piloplex by Allergan), 80%

of the drug is released in 6 h as compared to 80% in one hour from an aqueous solution.[31, 77, 100, 101] This 3.4% pilocarpine emulsion permits twice a day administration[102] and lowers IOP by about 8%. The maximum effect occurs 12 to 14 h after application, therefore treatment is still somewhat pulsed. Combining pilocarpine with a polymeric vehicle produces a clinical benefit,[103] but the improvement is small.[20] Pilocarpine has been prepared as a water-in-oil emulsion, and controlled IOP with twice a day applications.[98] Piloplex produces a slight blurring of vision.[101] Emulsifying agents are potentially toxic to the corneal epithelium.

(e) **Oily vehicles**

Oily vehicles for pilocarpine have also been suggested.[43, 90] Oily preparations (e.g. with castor oil) are more comfortable and achieve good control of IOP with twice a day application.[91] In oily solutions the pilocarpine is non-ionized and therefore penetrates the corneal epithelium readily.[43] Oil suspensions retain the drug in the tear film about 3 times longer than aqueous solutions.[19]

(f) **Presoaked matrices**

Soft contact lenses[35, 104-110] soaked in 2% pilocarpine release 50% to 90% of the drug within 30 min yet keep IOP controlled for nearly 24 h.[19, 110] The half-life of most water soluble drugs in hydrophilic matrices is 20 to 30 min.[18, 69] About 80% of the pilocarpine is released in one hour from drug-soaked contact lenses, [35] but complete elution of the drug requires 4-1/2 to 5 h.[21, 111, Ellis et al.[106] found that use of contact lenses did not increase the concentration of pilocarpine in the anterior chamber of rabbits at 30 min. The effect of pilocarpine lasts about three times longer when it is administered by a pilocarpine-soaked contact lens than by instillation of an aqueous solution.[35] Although pulsed administration occurs when using the contact lens method[70, 75] drug bioavailability is increased and the total daily dose of pilocarpine required to control the IOP is less than that provided in an aqueous solution.

Polyvinyl alcohol disks impregnated with pilocarpine were developed in Russia.[22] They were worn in the conjunctival sac for 3 h then removed. The drug effect was prolonged but the disks were uncomfortable to wear.[72] Six hours after insertion the drug concentration in the anterior chamber was 17 times greater than when the drug was instilled in an aqueous vehicle.[72] Drug-impregnated polyvinyl alcohol membranes have been designed to dissolve in 30 to 90 min.[84] Others[85] have employed 50 mm long rods of acrylic plastic which have had one end dipped into a solution of the drug and then dried. The disposable rod releases its thin layer of drug when the rod is rotated briefly in the conjunctival sac. The advantages of such a system are that preservatives are not required and a smaller quantity of the drug (e.g. 500 ug of pilocarpine) is needed.

(g) **Lamellae and other soluble drug inserts**

Soluble, solid-state drug carriers such as gelatin wafers containing atropine have been available for years.[36] Soluble ophthalmic drug inserts made from polymers of acrylamide, ethylacrylate and vinyl pyrrolidone were developed in Russia,[22, 84] and contained 2.6 mg of pilocarpine. The disc dissolved in 30 to 90 min but provided a longer pulse of drug availability.[22] Pilocarpine (2%) in a matrix of hydroxypropyl cellulose lowered IOP for 24 h although the disc itself dissolved within 12 h.[71] Soluble inserts prolong drug contact time[112] but the effect is still pulsed.[108]

Small rods of hydroxypropyl cellulose (Lacrisert by Merck Sharp & Dohme) have been developed to treat dry eyes.[113, 114] (See also Gel Tears).

(h) **Drug adsorbed onto particles**

Pilocarpine can be adsorbed onto 0.3 μm diameter particles of cellulose acetate hydrogen phthalate latex.[71] An aqueous suspension of these particles has a low viscosity so it can be instilled as eyedrops. When instilled the change in pH causes the latex particles to coagulate and resist drainage from the eye. The drug then leaches from the particles during the next 4 h. Other aqueous suspensions consist of fine particles of the drug held in a dispersed form in an aqueous medium, which allows the particles to remain for a long time in the conjunctival sac.[18]

(i) **Collagen inserts**

Inserts made of soluble, succinylated, enzyme-solubilized collagen containing a drug are under investigation.[109] The oval 6 × 12 mm wafer dissolves in 6 or 7 h,[109] rapidly at first then more slowly so a slow pulsed effect is produced.[114]

(j) **Incorporating the drug in liposomes**

Liposomes are small (0.01 to 10 μm) uni-or multilamellar spheres of lipid enclosing an aqueous drop.[115, 116] Liposomes are made by combining phospholipids (normally insoluble) with water by means of dispersion with high energy sound waves. The liposomes enhance corneal penetration by adsorbing to the corneal epithelium[115, 117] and the drug enters cells by endocytosis. This formulation works better than an aqueous solution for penicillin (4× better), idoxuridine and inulin but not for epinephrine.[118] Liposomes are relatively unstable and expensive. When liposomes are 1.5 μm or less in diameter they disappear almost as rapidly as an aqueous solution.[117]

(k) **Use of a prodrug**

Dipivalyl epinephrine (Propine) becomes converted to epinephrine and pivalic acid within the eyeball by enzymes in the cornea and aqueous humor.[4, 71, 119, 120] The released epinephrine then acts in the usual way in the eye and the pivalic acid is non toxic.[18] Propine enters the eye at least 10× more readily[18] than epinephrine so a much smaller dose is required (one drop of 0.1% vs. 1%). There are fewer unwanted systemic effects[119] but the probability of unwanted ocular effects (especially maculopathy and pigment deposition) is about the same as with epinephrine.[15]

(l) **Chemical modification to enhance penetration**

Removing a methyl group from the quaternary nitrogen of carbachol improves[121] the corneal penetration of the drug. After 20 min the concentration of the instilled N-demethylated carbachol in the aqueous humor reached about 0.25%.

(m) **Combination with adrenergic blocking agents**

Guanethidine initially acts as an adrenergic agent and produces a fall

in IOP. However, the hypotensive action is brief since guanethidine depletes adrenergic drug-sensitive sites of their normal levels of catecholamines and the IOP then returns to the pretreatment level.[15] If a small quantity of epinephrine is now instilled, the IOP falls again for several hours. This procedure makes use of the phenomenon of "denervation supersensitivity". By combining guanethidine (1%) and epinephrine (1%) the effect of epinephrine is potentiated and the IOP is lowered.[123] Hoyng and Dake[123] using 8% guanethidine and 0.5% adrenaline achieved about 10% reduction in IOP with twice a day instillation. Aqueous outflow is improved by over 40%.[124] Tachyphylaxis does not seem to develop.[15] Even 1% guanethidine combined with 0.2% epinephrine lowered IOP more than timolol did. However, side effects such as conjunctival hyperemia and punctate epitheliopathy are more of a problem with the guanethidine-epinephrine combination.[124]

Systems Designed to Provide Controlled Release of Drugs

The goal for newer methods of drug administration is to achieve a delivery such that the amount of drug released per unit time is independent of the amount remaining i.e. zero order, as opposed to first order kinetics.[70-72] The following systems have been reported:

(a) **Diffusional systems, reservoir devices**
In this system the drug is enclosed in a barrier membrane having a specified thickness which allows drug release at a controlled rate either 20 μg/hr or 40 μg/hr for a week.[37] Ocusert (R) by Alza Corp. contains pilocarpine bound to alginic acid and enclosed in a hydrophobic, ethylene-vinyl acetate polymer membrane which allows the drug out but not water in.[28] Drug release is a little higher in the first 30 min but then stabilizes,[28, 70, 109, 125] and the drug effect persists for a day or so after the Ocusert is removed. The total daily dose is $^1/_{10}$ to $^1/_5$ that of the dose provided by 4 times a day drops[37, 70, 75, 125] and thus causes less miosis, myopia and shallowing of the anterior chamber.[37, 48, 126] About 70% of patients can use Ocuserts comfortably.[70] In a few cases the device falls out without the patient noticing it.[63]

(b) **Osmotic systems, pumping devices**
Osmotic pumps can provide continuous drug delivery.[127] A salt is enclosed in a semi-permeable pocket occupying a small space at one end of the unit and separated by an elastic wall from the drug which is in an impermeable pocket at the other end. As the salt takes up water the salt-containing compartment swells and forces the drug out through a small opening in the drug pocket.[70] Therapeutic levels of drug release can be maintained for two weeks when an osmotic pump unit is worn in the conjunctival sac.

(c) **Bioerodible systems, three types are mentioned**
i. The drug is incorporated in an erodible hydrophobic matrix[116] from which it is released by surface hydrolysis from contact with the tears.[71] While remaining in the conjunctival sac the system is consumed layer by layer but very little leaching of the drug occurs.[70] Drug administration remains at a constant rate until the device is almost completely eroded.
ii. biodegradable polymer systems
The drug is attached to a polymer by a hydrolytically labile linkage and is released by hydrolysis of this linkage and by drug diffusion through the matrix. The polymer dissolves in 5 to 24 h.[83, 128]
iii. ionic interaction systems
This system depends upon an ionic interaction between a salt of the drug and a soluble polymer matrix. A hydroxypropyl cellulose matrix linked to pilocarpine pamoate will release only the pilocarpine.[71]

Other Methods of Controlling IOP

(a) Smoking marihuana has been promoted as a means of reducing IOP but the effect is modest and transient,[129, 130] and the side effects and legality of its use present problems.[131, 132] To control glaucoma would require smoking 6 cigarettes a day.[129] Topical application of Δ^9 tetrahydrocannabinol (THC) does not lower IOP,[132, 133] however attempts are being made to develop a marihuana derivative for topical application. Intravenous THC will lower IOP dramatically but is not practical. Oral ingestion of THC lowers IOP[130] and can be effective in control of glaucoma.[129]

(b) Experiments at Cornell University in 1984 indicated that the application of ultrasound to the sclera near the limbus could reduce IOP. The production of aqueous appears to be decreased and aqueous outflow from the eye increased but the mechanism is unknown. Retrobulbar anesthesia is required.

(c) Cryotherapy (cyclocryothermy) has been tried especially in aphakic patients. The aim is to damage the ciliary processes enough to diminish aqueous production.[134] This procedure may be used when other methods of controlling IOP have failed but there is a risk of producing phthisis.

(d) Laser trabeculoplasty or trabeculopexy can be performed for patients with open-angle glaucoma, who have failed to respond to maximal medical therapy. Trabeculoplasty involves putting a series of laser burns (up to 100) in the mid-trabecular region. Presumably each burn causes local shrinkage of trabecular tissue and thereby causes adjacent regions to become more porous. The argon laser emits dichromatic radiation in the wavelength bands 488 and 514 nm and these wavelengths are absorbed by melanin, hemoglobin, and xanthophyll.[135] Peak absorption by melanin is at 450 nm. Some use an argon laser producing monochromic green (514.5 nm), or argon blue (488 nm) or krypton yellow (568.2 nm) or red (647.1 nm). A few weeks after the initial transient rise in IOP (probably due to release of prostaglandins) the IOP falls 7 to 10 mm Hg in about 85% of eyes. Laser trabeculoplasty is also effective in eyes with pigmentary glaucoma or with pseudoexfoliation glaucoma and is more effective in phakic eyes than in aphakic eyes. Some loss of IOP control occurs in time.[136, 137] Continued glaucoma medication is often required and there is a risk of downgrowth of endothelial cells from the cornea.

For patients with angle-closure glaucoma traditional surgery has involved cutting a hole in the iris near its root, a peripheral iridectomy. It is possible to use a laser[138] to produce

a hole in the iris. This is called a laser iridotomy. Q-switched Nd:YAG laser (blue-green, 582 nm) or Q-switched ruby laser[139] iridotomies have success rates of over 75%. YAG lasers cause mechanical disruption of tissue. Continuous wave argon lasers produce an iridotomy by a thermal process and require less energy than the ruby laser.[140] The technique is not easy, the small hole sometimes closes spontaneously in about a month, and the long term effects are not known. The small lens opacity which forms seems to be stationary.[139] The technique can not be done if the cornea is hazy. The laser beam might accidently damage the macula. There is a small transient rise in pressure and sometimes mild iritis but the operation is easy on the patient, requires no general anesthetic, is performed as an outpatient procedure, and avoids the risks of regular surgery.

Lasers are also used for treating other glaucoma-related conditions. A trabeculectomy i.e. removal of a block of scleral and trabecular tissue can be done by a laser. This surgery improves aqueous outflow by allowing the aqueous to have direct access to subconjunctival and scleral tissues where it is readily absorbed in the same manner as after conventional filtration surgery.

Conclusion

The treatment of glaucoma presents challenges to all those involved. At present most glaucoma patients receive timolol or pilocarpine. Too often the patient fails to instill the drug as instructed.[46a, 141] Some benefit from adrenergic drugs and many new beta blockers are being studied. Although reduction of IOP does not always halt the progression of field loss it is currently the only therapeutic approach available. One of the principal benefits sought by new formulations and ways of administering drugs is the improvement of compliance. Improved methods of drug delivery, more effective drugs and the use of laser surgery in selected cases offer more dependable and effective control of IOP than was available a decade ago.

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CLINICAL RESEARCH/RECHERCHE CLINIQUE

Use of University of Waterloo Distance Visual Acuity Charts

G.C. Woo *
H. Bohnsack * *
J.G. Strong * * *

Abstract

Several versions of the University of Waterloo distance visual acuity chart have been in use for some time. This report summarizes the design features of these charts. Instruction on the use of a 4M and a 6M chart has been provided. The principal advantages of using this chart at various distances is also explained.

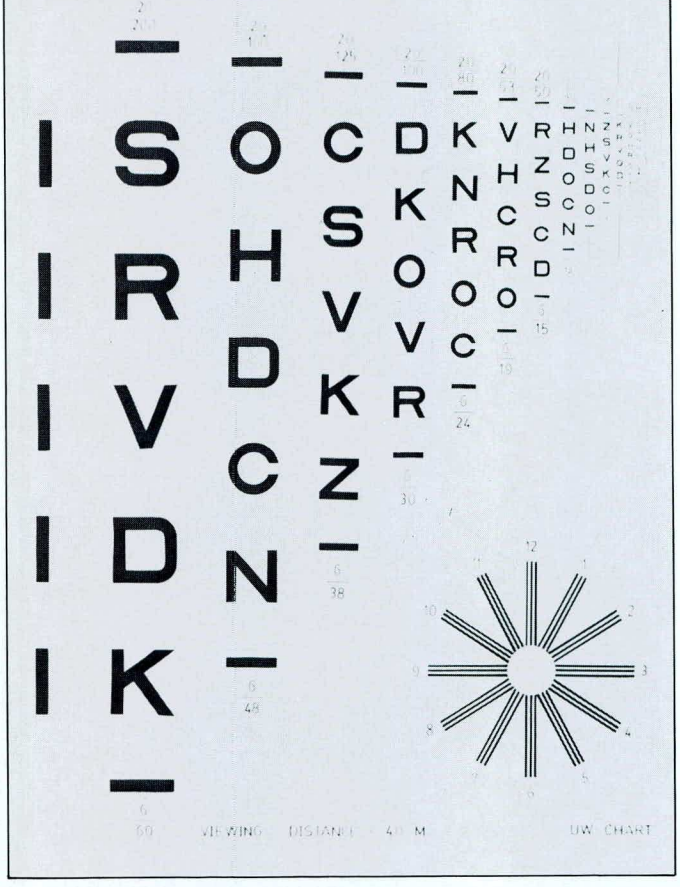
Résumé

Plusieurs versions de la carte d'acuité visuelle à distance mise au point par l'Université de Waterloo sont en usage depuis plusieurs années. Ce rapport résume les caractéristiques de conception de cette carte. On y trouve des instructions sur l'emploi de la carte de 4M et de celle de 6M. On explique également les principaux avantages de l'emploi de ces cartes à diverses distances.

Metrication of visual acuity charts has been advocated for some time in Canada.[1] There is a national steering committee on SI units.[2] Most practitioners, however, continue to use Imperial Snellen acuity notations for distance vision. Hospital records on visual acuity are usually in metric notation probably due to directives issued by the authority. There is no formal survey on the adoption of metric visual acuities among optometrists. The School of Optometry Clinic at the University of Waterloo has recently adopted a policy that all distance visual acuities shall be recorded in metric notation. In the transition period, conversion charts are available in all clinic rooms. Manufacturers of acuity charts have not kept pace with the change. An exception is the University of Waterloo distance acuity chart which has both Imperial and metric notations. Its design has been discussed in detail.[3] The purpose of this note is to introduce some important features of this chart in addition to describing the use of several versions of this chart.

Version I of the University of Waterloo distance acuity chart is shown in Figure 1. Each vertical acuity row consists of five Sloan letters. The selection of these letters ensures equalization of interrow legibilities.[3, 4] Interletter spacing is uniformly controlled for each acuity row. Contour interaction is controlled for all letters including those at the beginning and at the

UW Distance Visual Acuity Chart I



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The School of Optometry Clinic at the University of Waterloo has recently adopted a policy that all distance visual acuities shall be recorded in metric notation.

end of each row. An in house clinical trial of this chart of normal subjects compares favorably with the established Bailey-Lovie logMAR chart. We have been using this chart in our low vision clinic for some time. Occasionally, some subjects tend to read the interaction bar as an alphabet as well. Our experience has been favourable. A reversal letter version has been used in conjunction with a mirror with similar success. Consistent and reliable visual acuities can be elicited from all types of low vision patients at different distances. Three versions of the distance chart have been in use for some time. A brief description of the use of these charts follows.

Use of the University of Waterloo Distance Visual Acuity Chart Versions I and II

The University of Waterloo Distance Visual Acuity Charts I and II are calibrated for use at 4.0m at which distance it measures acuities ranging from 6/3 (20/10) to 6/60 (20/200) in steps of 0.1 log unit. The difference between I and II is the arrangement of the Sloan letters of equal legibility. Recommended illuminances for the distance chart are between 130-215 lux.[5]

Acuities less than 6/60 (20/200) can readily be measured for low vision patients if they are walked up to discrete testing distances which are closer than 4.0m by a multiple of 0.1 log unit. Alternatively, the chart can be moved closer to the patient at specific intervals.

These distances are as follows:

No. of log units closer	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Distance (m)	4.0	3.2	2.5	2.0	1.6	1.3	1.0	.80	.63	.50	.40
(ft)	13'2"	10'6"	8'2"	6'6"	5'3"	4'3"	3'3"	2'7"	2'	1'8"	1'4"

These distances need not be memorized since their sequence is the same as the 6m (20 ft.) Snellen fraction denominators, but 10 times smaller. When denominators beyond the 6/3 (20/10) line are required (such as when the patient must be walked up to a distance closer than 1.0m), the examiner can refer to the denominators to the right of 20/100 for the continuation of the progression.

Each of these 0.1 log unit steps closer to the chart will enable the patient to read one further line. Therefore, the line read by a patient from a given number of log units closer than the 4.0m actually corresponds to an acuity which is that many log units poorer.

The progession of visual acuity values beyond 6/60 (20/200) is readily seen by referring to the 20 ft Snellen denominators to the left of the 6/6 (20/20) line.

Thus, the 6/60 (20/200) line read at a distance of 2.5m corresponds to an acuity of 6/90 (20/320) since 2.5m is .2 log units closer than 4.0m and 6/90 (20/320) is .2 log units poorer than 20/200. (Refer to 6/9 (20/32) which is two columns to the left of 6/6 (20/20).)

Alternatively, a conversion table may be used:

Visual Acuity Conversion Table for 4.0m Chart

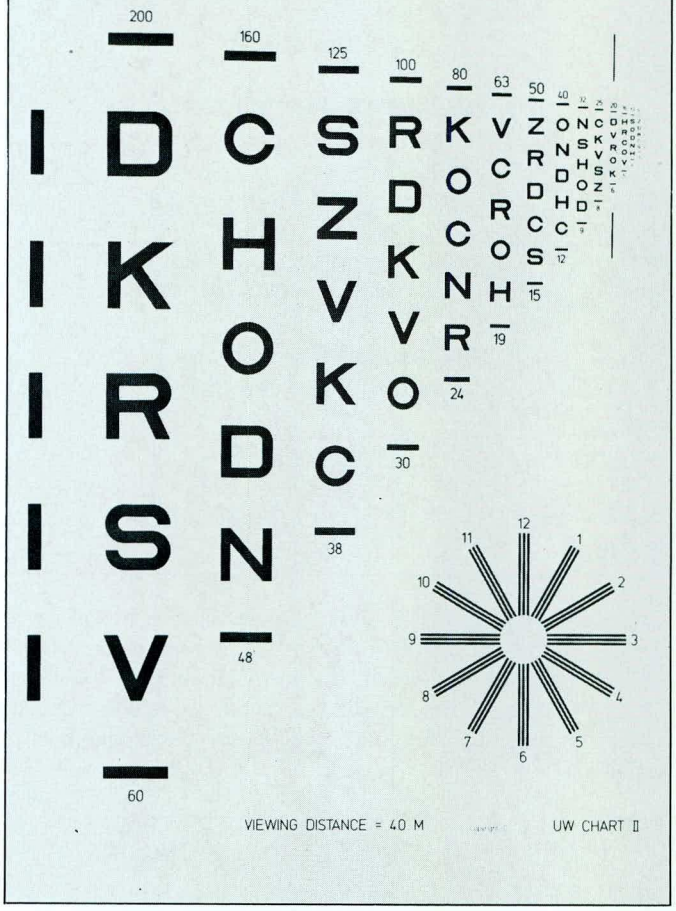
6m Snellen Denominators Testing Distances (m)

Smallest Line Read	4.0	3.2	2.5	2.0	1.6	1.3	1.0	.80
1 (6/60)	60	80	90	120	150	190	240	300
2 (6/48)	48	60	80	90	120	150	190	240
3 (6/38)	38	48	60	80	90	120	150	190

20 ft. Snellen Denominators Testing Distances (ft)

Smallest Line Read	13'2"	10'6"	8'2"	6'6"	5'3"	4'3"	3'3"	2'7"
1 (20/200)	200	250	320	400	500	630	800	1000
2 (2/160)	160	200	250	320	400	500	630	800
3 (20/125)	125	160	200	250	320	400	500	630

UW Distance Visual Acuity Chart II



Version III

The University of Waterloo Distance Visual Acuity Chart III is calibrated for use at 6.0m at which distance it measures acuities ranging from 6/38 (20/125) to better than 6/3 (20/10) in steps of 0.1 log unit.

Acuities poorer than 6/38 (20/124) can readily be measured by walking the patient up to distances which are closer than 6.0m by a multiple of 0.1 log unit.

The distances are as follows:

No. of log units closer	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Testing Distance (m)	6.0	4.8	3.8	3.0	2.4	1.9	1.5	1.2	0.9	0.8	0.6
(ft)	19'8"	15'8"	12'5"	9'10"	7'10"	6'3"	4'11'	3'11'	3'1"	2'6"	2'

These distances need not be memorized since their sequence is the same as the 6m Snellen denominators, but 10 times smaller.

Each of these 0.1 log unit steps closer to the chart will enable the patient to read one further line. Therefore, the line read by a patient a given number of log units closer than 6.0m actually represents an acuity which is that number of log units poorer.

The progession of the visual acuity values beyond 6/60 (20/200) is readily found by referring to the 6m (20 ft) Snellen denominators left of the 6/6 (20/20) line.

Thus the 6/38 (20/125) line read at a distance of 3.8m corresponds to an acuity of 6/60 (20/200), since 3.8m is .2 log units closer than 6.0m and 6/60 (20/200) is 2 lines poorer than 6/38 (20/125). Alternatively a conversion table may be used:

Visual Acuity Conversion Table for 6.0m Chart

6m Snellen Denominators Testing Distances (m)

Smallest Line Read	6.0	4.8	3.8	3.0	2.4	1.9	1.5	1.2	0.9
1 6/38	38	48	60	80	90	120	150	190	240
2 6/30	30	38	48	60	80	90	120	150	190
3 6/24	24	30	38	48	60	80	90	120	150

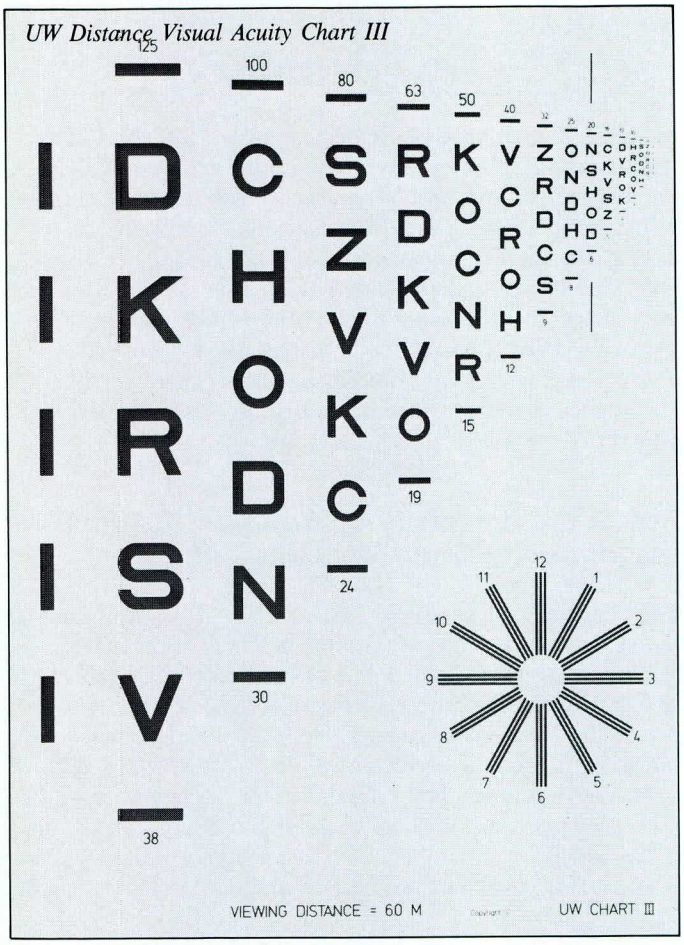
20ft. Snellen Denominators Testing Distances (ft.)

Smallest Line Read	19'8"	15'9"	12'6"	9'10"	7'10"	6'3"	4'11"	3'11"	2'11"
1 20/125	125	160	200	250	320	400	500	630	800
2 20/100	100	125	160	200	250	320	400	500	630
3 20/80	80	100	125	160	200	250	320	400	500

Versions IV and V are low contrast charts. It has been reported that some low vision patients who can discern high contrast letters cannot identify the same letters on a low contrast chart.[6] Usually these findings are associated with reduced contrast sensitivity function and poor electrodiagnostic responses.

> It has been reported that some low vision patients who can discern high contrast letters cannot identify the same letters on a low contrast chart.

A low contrast chart of approximately 0.09-0.1 has been screen printed and a clinical trial of the chart is being conducted at the Centre for Sight Enhancement. The specific low contrast is achieved by matching the diluted black ink visually with a pre-selected grey sample. In this case, the eye actually serves as a photometer. The procedure to use the low contrast chart is identical to the regular high contrast (approximately 0.9-0.95) chart.



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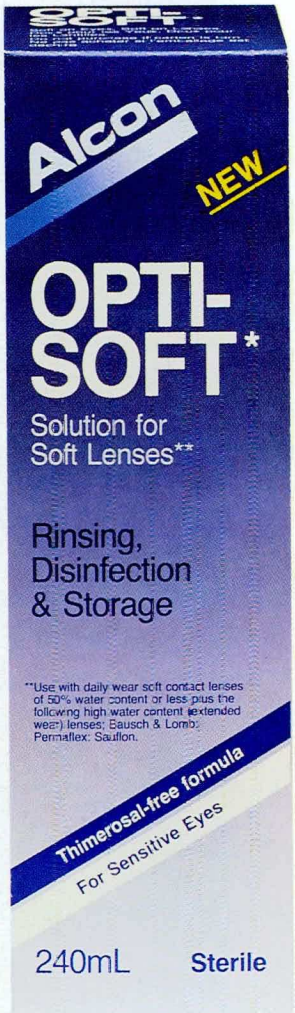

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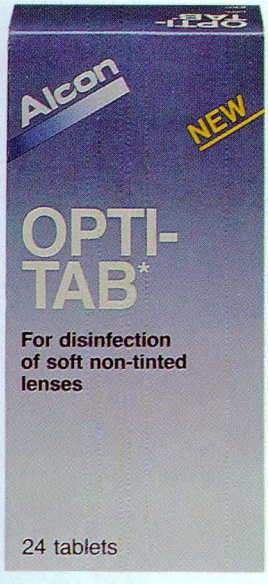

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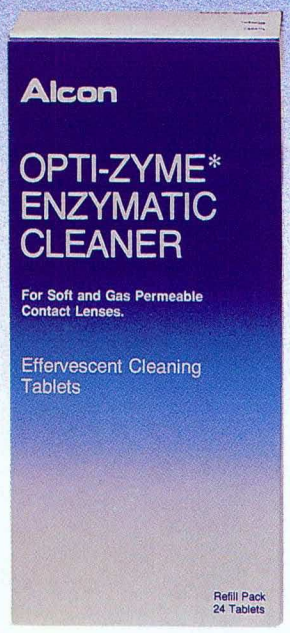

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Compression Testing of Three Soft Lens Polymers with a Simulated Fingernail

J. G. Attridge *
D. S. Weaver * *

Abstract

An analysis of the mechanical properties of finished lenses utilizing compression testing identifies factors contributing to soft lens damage. Sauflon 70, Snoflex 50, and Toyo 515 PolyHEMA lenses, all of plano power and equal thicknesses were compressed within the optical zone by loads exerted by a simulated fingernail made of guitar pick material. Six lenses of each polymer were used for each of three tests. It was found that Toyo 515 PolyHEMA had a relatively lower compressive strength than the other two non-HEMA materials; that the Sauflon 70 had the least ability to recover once compressed; and that all three polymers did not appear to recover their previous compression strength after undergoing a dehydration/rehydration cycle. In the case of the Toyo 515 lenses, this last result was confirmed statistically.

The problem of soft lens damage is perplexing to practitioners and frustrating to patients. In most practices, every few days a patient complains that a lens has broken for no apparent reason. No matter how meticulous a practitioner may be in instructing his patients in caring for lenses, the problem of soft lens damage continues. One wonders whether great differences exist in the durability of different types of lenses, or whether heretofore unknown factors contribute to soft lens damage.

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Up to now, replacement rates in longitudinal studies have provided manufacturers with a deduced durability of their lenses in a given population,[1,5]. Reports of direct mechanical testing, including comparative studies, are difficult to find in the literature for either finished lenses or larger samples of material,[8,9]. It is worth noting that, the American Society for Testing and Materials (A.S.T.M.), has no reports whatever of tests on soft lens polymers.

When it has been documented, the most commonly used index of durability for soft lens material has been the tensile test, which involves stretching the material to the breaking point. However, it is very difficult to compare such test results without knowing whether a standardized procedure was employed. Table 1 demonstrates the considerable variation in the reported tensile strength values of HEMA material.

A better approach in studying the tendency for soft lens damage might be to subject finished lenses to the types of stresses more similar to those normally encountered in use. Tensile testing is not perfectly relevant since typical wearers do not stretch their lenses. Moreover, tensile testing is not usually performed on finished lenses, but on larger specimens of material. Thus, while tensile strength may be a customary determination for materials in general, it should be questioned as an index for tendency to damage in soft lens materials.

This paper hypothesizes that soft lens damage occurs when a discontinuity is produced in the material by the pressure of a sharp object against it, resulting in a nick or cut. Once developed, this nick may extend as a result of tension on the lens in handling, so that the whole lens is torn. The most frequent sharp object which might come into contact with a soft lens is the edge of a fingernail. As well, fingertips, tongs or tops of storage cases may occasionally compress lenses.

Although the problem of possible fingernail damage has been known since soft lenses were first introduced, to the best of the authors' knowledge it has never been investigated by any direct testing methods. The compression testing described in this paper not only simulates more closely the real life situation

Résumé

Une analyse des propriétés mécaniques de lentilles finies à l'aide d'essais de compression fait ressortir les facteurs qui contribuent à l'endommagement des lentilles souples. Les lentilles Sauflon 70, Snoflex 50 et Toyo 515 PolyHEMA, toutes planes et d'égale épaisseur ont été comprimées dans les limites de la plage optique par une charge exercée par un ongle simulé fait d'un médiator de guitariste. Six lentilles de chaque polymère ont été soumises à l'essai. On a déterminé que la lentille Toyo 515 polyHEMA avait une résistance relativement plus faible à la compression que les deux autres, qui ne sont pas de la catégorie HEMA. On a également constaté que la lentille Sauflon 70 était la moins capable de reprendre sa forme une fois comprimée et que les trois polymères semblent incapables de retrouver leur résistance à la compression après un cycle de déshydratation et d'hydradation. Dans le cas de la lentille Toyo 515, ce dernier résultat est confirmé par la statistique.

whereby soft lenses are damaged, but also provides additional information otherwise unapparent from tensile testing alone.

As load is added to a contact lens, using a simulated fingernail, there are two stages of deformation that occur before the "break" point: elastic deformation which is recoverable, and plastic deformation, which is irrecoverable[7]. When the "break" point, or failure point is reached using the experimental technique herein described, the tester does not "crash" through the material as it might in the case of a test of a brittle substance, but rather cuts just enough of it to produce a small perforation. The "break" point can only be determined by a careful examination of the lens each time a load is added.

As load is added to a contact lens, using a simulated fingernail, there are two stages of deformation that occur before the "break" point.

Soft lenses made from three polymers were tested; each was nominally plano power, .13 mm thick and 8.4 mm in base curve. Two of the three were 14.0 mm diameter and the third 14.3 mm. Plano power produced an optical zone of uniform thickness allowing testing to take place anywhere within it. The wet thickness of the lenses was nominally .13 mm, based on the calibrated dry thickness and the expected expansion factor on hydration. Since Nakajima[6] had previously reported that the tensile strength of hydrogel material declines with age, all lenses were tested within fourteen days of the day they arrived from the laboratory.

The first polymer tested was poly(methylmethacrylate-N-vinyl-opyrrolidone) with water content adjusted to 70%. This is Sauflon 70 or Lidofilcon A, and is produced in the United States by American Medical Optics. The second was a terpolymer composed of "G-Mema" methylmethacrylate and vinyl pyrrolidone with a water content of 52.5%. It is known as Snoflex 50, and is produced by Smith and Nephew Optics of the United Kingdom. The third was a polyHEMA material of 2 hydroxyethylmethacrylate, 35.6% water, known as Toyo 515, and produced by Toyo Contact Lens Co. in Japan.

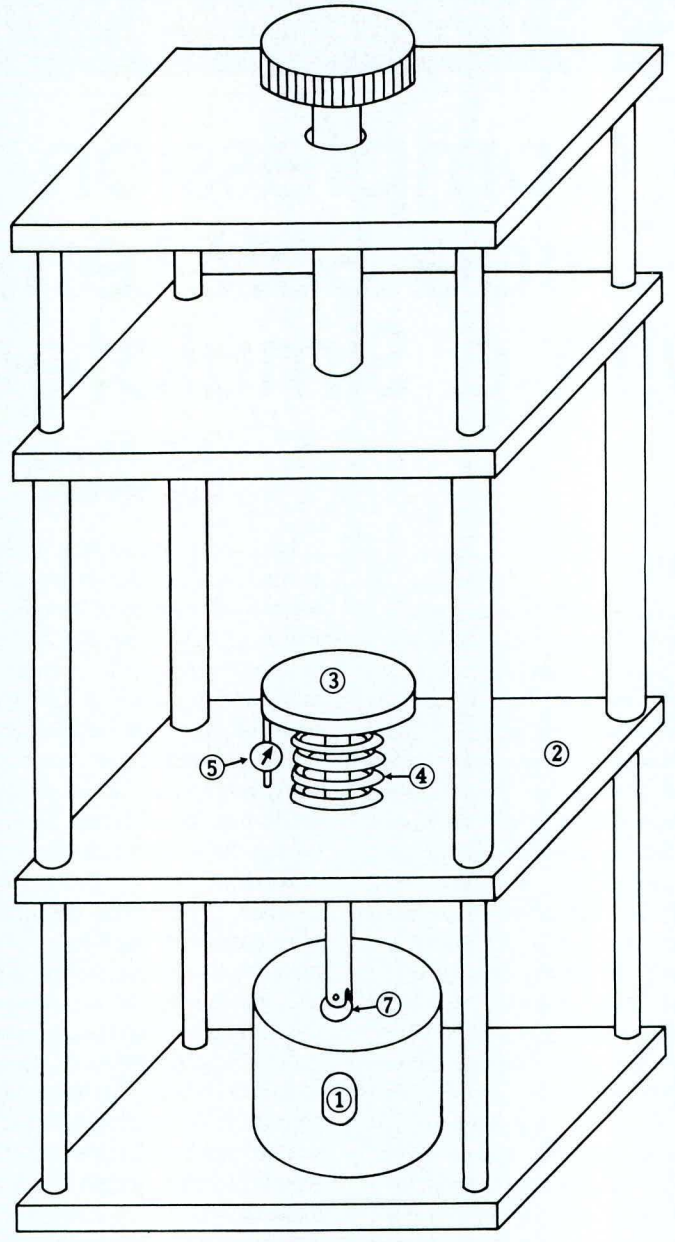

Figure 1

Table 1
Reported Tensile Strength Data for Conventional HEMA Material

Source	Tensile Strength in Units Given	Tensile Strength in Kg/cm²
Hales[11]	48 p.s.i.	3.4
Hosaka (PolyHEMA I)[9]	12.2 kgm/cm²	12.2
Hosaka (PolyHEMA II)[9]	10.4 kgm/cm²	10.4
Tighe[8]	$\simeq 0.5 \times 10^7$ dynes/cm² $\simeq$	5.1
Smith & Nephew Optics (company literature)	6.5 kgm/cm²	6.5
Syntex Ophthalmics (company literature)	1.3×10^7 dynes/cm²	13.0

Three parts are involved in this research:

Part I.

(a) A determination of the relative compression strength of the three polymers being tested.

(b) A graphical presentation of the relative softness and elasticity of each.

Part II.

A determination of the facility of each material to recover once compression has taken place upon it.

Part III.

A determination of the change in compressive strength of the three polymers after they have been dehydrated for a given time and subsequently rehydrated.

Apparatus (See Figures 1 and 2)

The lens to be tested rests on an acrylic template[1] set in position at the bottom of a specially designed beaker containing normal saline solution. The beaker rests firmly on a circular cut out area on the base. The "stage" area[2] is supported by a post at each of the four corners, and is designed so it can be racked up or down by turning a knob at the top of the apparatus. Because the shaft with the simulated fingernail is supported at this level, the raising action of the stage effectively raises the simulator. A circular platform[3] on which weights can be added, lies perpendicular to the upper end of the shaft. A spring[4], serving to counterbalance the weight of the platform, lies between the platform and the stage. Also mounted on this level is a dial gauge[5] that records the displacement of the platform to the accuracy of 1/1000th of a mm. Teflon bushings[6], utilized to minimize friction, support the shaft in a vertical position. The last 15 mm of the shaft act as the support area for the simulated fingernail[7]. This part of the shaft is split lengthwise and one half cut out to serve as the "support plate" for the fingernail. A set screw runs through a small hole in the plate and the fingernail into a threaded hole in the shaft. The shaft and supporting posts are made of steel drill rod, and the horizontal levels and platform built of aluminum. Before testing can be carried out, the vertical centreline of the shaft and acrylic template must be made to coincide.

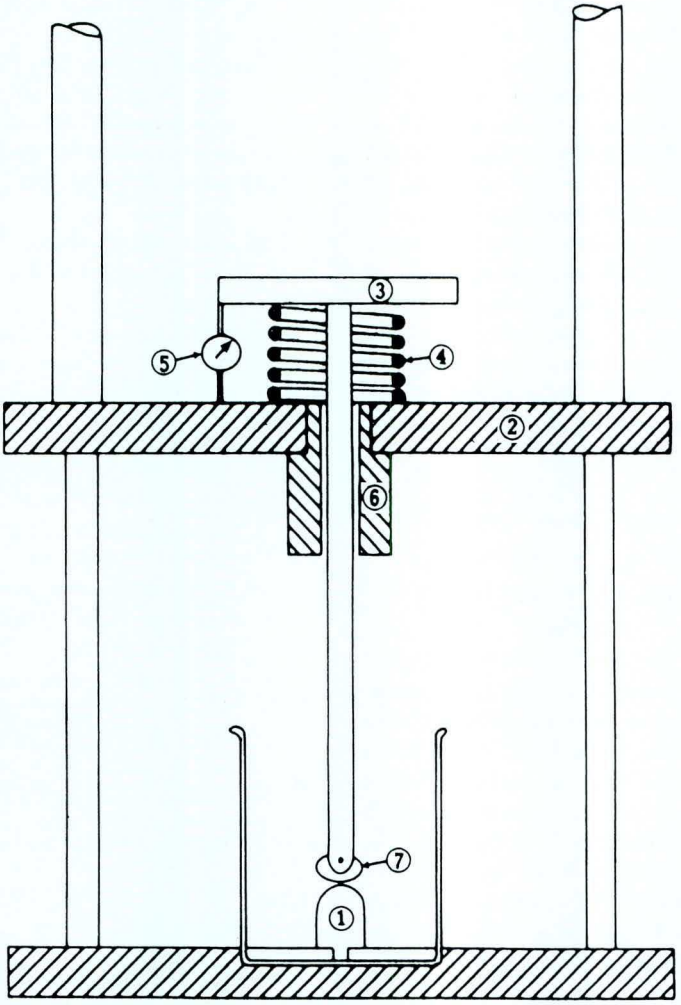

Figure 2

> The material utilized as the fingernail simulator was a black Gibson "thin" guitar pick.

The material utilized as the fingernail simulator was a black Gibson "thin" guitar pick, which is much stiffer than any soft lens material and similar in mechanical properties to the human fingernail. The thickness and edge contour of a new pick was also similar to that of an uncut fingernail. The pick had to be cut and a hole drilled into it in order to be fitted onto the shaft. Two mm of it extended below the support plate, as shown in Figure 3. In an attempt to maintain consistency in the edge contour of the pick as the testing continued, a new pick was fitted on the testing apparatus each time a different polymer was tested.

The weights used in this experiment belonged to a pressure gauge calibration apparatus which was produced by Chandler Engineering Company of Tulsa, Oklahoma. They were cylindrical metal interlocking weights, each with a hole in the centre. They consisted of 1 at 63 gm, 1 at 126 gm, 4 at 252 gm, and 2 at 1260 gm.

The above were occasionally supplemented by weights from a standard Ohaus scientific weight set. Of these, the most frequently used were the 50, 100 and 200 gm loads.

In graphing displacement with respect to load, the most reliable results were obtained using the interlocking weights. Using these, once the load was positioned in the centre of the platform, the centre of gravity would be maintained directly over the loading pick.

Methods in Preparation for Testing:

1. The lenses to be tested were inspected for damage and then verified for plano

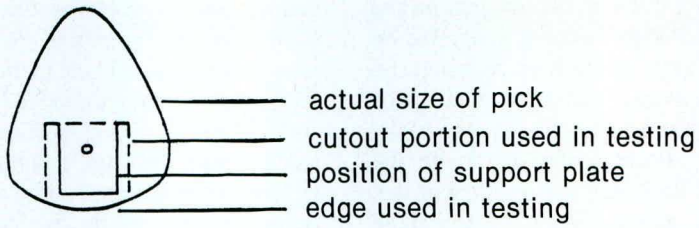

Figure 3

power in the lensometer, and for approximate base curve on the hydrovue lens analyser.[10]

2. The guitar pick material, after being examined for defects was cut to the shape and size shown in Figure 3, and mounted on the shaft of the tester.
3. The template was mounted on the bottom of the beaker corresponding to the base curve of the lenses to be tested. (Toyo 515 lenses measured 8.8 mm base curve, the other two polymers were 8.4 mm base curve).
4. The beaker was filled with normal saline, such that the template was at least 5 mm below the surface.
5. The 63 gm cylindrical weight was centred on the testing platform. This served to bring the platform down to the action button of the gauge, and to overcome most of the friction within the gauge.
6. A test lens was removed from its container and blotted with tissue. An indelible mark was put at the edge of the lens opposite which the lens was to be tested. Tests were avoided within 2.5 mm of a previous compression mark.
7. The lens was mounted with its verified base curve on the template so that the tester would make contact at the point desired.
8. While looking through the beaker, the observer would screw down the stage until the pick just made contact with the lens. If a space existed between the action button on the dial gauge and the platform, the initial contact point had been passed. A 50 gm load was applied to the centre of the platform to standardize the starting point. The tip of a WEN electrical engraver/vibrator was then put in contact with the horizontal support bar of the gauge beyond the vertical pillar supporting the gauge. This vibrator assisted the gauge to move freely by minimizing the effects of friction in the bushing. While the vibrator was operating, the stage was screwed back to the point that the 50 gm load produced a displacement of .01 mm.
9. Loading could now take place.

In loading it was important not to drop the weights one on top of the other as they were added. One was let go only when the interlocking portions were in perfect contact. With the total load in place, the vibrator/engraver was used to free up the gauge. Having completed an individual test, the weights were carefully removed, the stage screwed up and the lens removed from the template. It was dried, and then inspected in front of a bright fluorescent source with a +20.00 Diopter trial lens. Recall that the sample lens tested had to be inspected for damage after each load application.

When lens failure occurred, there were characteristic ragged tear marks at the break. A lens completely split exhibited an unmistakable reflective line. Unbroken lenses exhibited a compression line only. If they were rewetted and flexed at right angles to the break, a split would not be induced.

> The load values obtained should not be considered absolute for a number of reasons.

In Parts I and III of this experiment, testing was repeated using different loads in a bracketing technique until a not broken/broken sequence was obtained. In Part II, various loads were added which had been determined by pretesting. The graph produced in Part I was produced by recording the displacement reading on the gauge, (with the assistance of the vibrator) as each load was added. This graph, Figure 5, is the average of six lenses of each of the three polymers. The usual increment of testing was 252 gm, although smaller increments were attempted early in the experiment in the hope of refining the results. The maximum load that could be accommodated by the apparatus was 3150 gm. (See Figure 4.)

Before describing the results of the testing, it should be pointed out that the load values obtained should not be considered absolute for a number of reasons. First of all, the artificial starting point using a 50 gm load to produce a displacement of .01 mm introduced a small error. Also, the unreliable gauge values were found when the displacement exceeded the thickness of the lens being tested, indicating the testing apparatus was being compressed as well as the lens. Finally, friction could not be totally eliminated, even though the teflon bushings permitted the shaft to move quite freely.

Results

Part I: Relative Compression Strength of the Three Polymers Tested:

(a) Six lenses of each polymer were tested.

All six lenses of Sauflon 70 remained unperforated when the maximum load of 3150 gm was applied to the tester.

All six of Snoflex 50 also remained unperforated with the same 3150 gm load.

The loads that produced perforation with Toyo 515 polyHEMA were less than 3150 gm.

This failure load data for the Toyo 515 lenses is recorded according to the following scheme:

$$\bar{X}_{min} < \bar{X}_m < \bar{X}_{max}$$

where $\bar{X}_{min}$ is the six trial average of the maximum load (gm) in which failure did not occur.

$\bar{X}_{max}$ is the six trial average of the minimum load (gm) in which failure occurred.

$\bar{X}_m$ is the estimated average failure load (gm) (the median between $\bar{X}_{min}$ and $\bar{X}_{max}$)

here, $\bar{X}_{min} = 1810$

$\bar{X}_{max} = 1930$

Thus, $1810 < \bar{X}_m < 1930$

and $\bar{X}_m = 1870$

(b) In Figure 5, deflection (mm) is plotted with respect to mass (gm) for the three polymers. The Y axis value is limited to .15 mm since deflection values

above this were considered unreliable as they exceeded lens thickness. The slope is similar for all three polymers, indicating they exhibit similar elastic properties. However, it will be noted that the deflection is consistently greater per load with Sauflon 70, indicating it to be the softest material of the three. Snoflex 50 appears to be the hardest.

Part II: Facility of Each Material to Recover Completely Once Compressed

Again, six lenses of each polymer were tested. Different loads, the range of which had been predetermined, were applied at different points within the optical zone of each lens. The lenses were returned to their containers in saline and then removed 24 hours later for inspection. The lenses were blotted and examined with a +20D. lens over a bright fluorescent source. It was noted which loads had still left a compression mark on the lens, and which did not.

Recording the data in a similar fashion to that of Part 1,

$$\overline{P}_{min} < \overline{P}_{m} < \overline{P}_{max}$$

where $\overline{P}_{min}$ is the six trial average of the maximum load that did not produce a compression mark after 24 hours.

$\overline{P}_{max}$ is the six trial average of the minimum load that just produced a compression mark after 24 hours.

$\overline{P}_{m}$ is the estimated average load that just produced a compression mark after 24 hours, (the median between P_{min} and P_{max}).

The data found (in gm) can be summarized as follows:

	$\overline{P}_{min}$	$\overline{P}_{m}$	$\overline{P}_{max}$
Sauflon 70	96	122	147
Snoflex 50	1220	1390	1550
Toyo 515	840	950	1070

Part III: Compression Strength of the Three Polymers After They Had Been Allowed to Dehydrate and Were Rehydrated Again:

In the initial pretesting of the apparatus using Toyo 515 lenses taken from office stock there was enormous variability found in the load required to perforate a lens. Then it was remembered that some of these lenses had dried out in their containers and had been rehydrated. According to Douglas Keller[12] of the McMaster Institute for Polymer Production Technology, polymer chains can break in a shrink (dehydrate)/swell (hydrate) cycle. If it could be established that the compression strength of soft lenses is less after undergoing a dehydration/rehydration cycle, it would have practical significance for both wearers and practitioners. Hence the rationale for this part of the experiment.

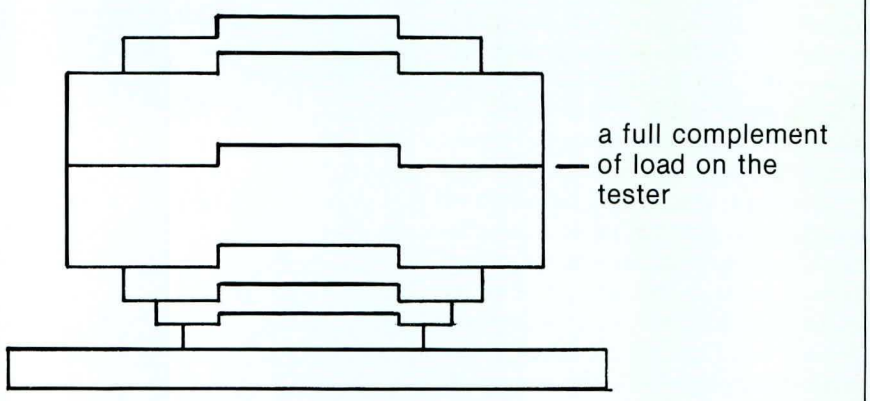

Figure 4

On the bottom of a large ice cube tray, wooden slats 1/8'' thick supported a piece of fibreglass screen. On this screen rested the cubical divider which was used to separate the lenses. Six lenses of each polymer were placed concave down on the screen and left to dry for a period of 48 hours. The testing room, 10' × 8' × 8' contained an Electrohome dehumidifier which prevented the relative humidity from exceeding 40%. At the end of the drying period, normal saline was added to the tray until the lenses easily floated. After 12 hours the lenses were turned over and submerged in the saline. Twelve hours later they were returned to their original containers and taken to the laboratory for testing.

Results

Sauflon 70:

Five of the six lenses remained unperforated when subjected to a load of 3150 gm. One lens broke with a load between 2490 and 2900 gm.

Snoflex 50:

Four lenses withstood 3150 gm. Two broke with a load between 2900 and 3150 gm.

Toyo 515 Poly HEMA:

where x_m, is the estimated average failure (breaking) load:

$$949 < \overline{X}_{m}, < 1220$$

and thus

$$\overline{X}_{m}, = 1080$$

Note that this is about half the value found for $\overline{X}_{m}$ in Part I. (In Part 1, $\overline{X}_{m} = 1870.$)

Enlarging The Two Test Samples of the Toyo 515 Lenses to 12 Lenses Each:

Six more lenses that had gone through the dehydration/rehydration cycle were also tested, and the results included with those of the previous six.

For these 12,

$$727 < \overline{X}_{m}, < 988$$

$$X_{m}, = 857 \quad \sigma_{n} - 1 = 371$$

(Sample standard deviation)

Six more ''normal'' lenses had also been tested as a result of the work in Part II. In doing Part II, the minimum load required to leave a compression mark after 24 hours was very close to the failure load. These failure loads were also recorded and included with those found in Part I. Thus for the 12 ''normal'' lenses,

$$1520 < \overline{X}_{m} < 1720$$

$$\overline{X}_{m} = 1620 \quad \sigma_{n} - 1 = 452$$

A pictorial representation of the two samples of twelve lenses is represented in Figure 6. Note that the dehydration/rehydration cycle weakened the lenses significantly.

Discussion

Hosaka et al.[9] reported that the tensile strength of Sauflon 70 was greater than that of the two polyHEMA materials. The present study demonstrates the superior compressive strength of certain nonHEMA polymers over a polyHEMA.

In the past, certain investigators have assumed that the strength of a soft contact lens varies inversely with the proportion of water in the lens. This is not necessarily the case. As demonstrated, polymers of high water content can be produced having remarkable compressive strength.

> Polymers of high water content can be produced having remarkable compressive strength.

Part II was an attempt to determine the load required to produce the limit of elastic deformation of the material. The evidence presented indicates this load to be greatest in the case of the Snoflex 50 material. As shown, remarkably low loads leave a compression mark on Sauflon 70 lenses even after 24 hours.

The third part of the experiment dealt with the difference in compressive strength between normal lenses and those which had undergone dehydration followed by rehydration. In the case of the Sauflon 70 and Snoflex 50 lens materials, it would appear that the dehydrated lenses were less strong, but with the small sample, the difference could not be supported statistically. In the case of the Toyo 515 lenses, whether the samples compared were the initial six lenses tested, or the combined groups of twelve, the results were the same: those that had gone through the dehydration/rehydration cycle exhibited a lower compressive strength than did normal Toyo 515 PolyHEMA lenses. The difference between either pair of two test samples was confirmed statistically to the 0.1% level by a student's t test. Bar graphs (Figure 6) illustrate the difference between the two distributions of twelve.

Lastly, in this study of mechanical properties of soft lenses, consider compressive strength versus tensile strength. The cross sectional area involved in this simulated fingernail compression testing was approximately 1 sq. mm., (i.e. thickness of tester = 0.45 mm × length of the mark on the lens = 2.2 mm). The lowest average breaking load was found with Toyo 515 PolyHEMA in Part III, being about 860 gm, which, on interpolation from the graph in Figure 5, would indicate the tester produced a perforation before compressing the lens to its full thickness. Thus the sources of error for this result would be limited to the zeroing problem, and friction, which would not affect significantly its magnitude. It is recognized that the testing described is a simulated fingernail compressive load rather than pure compression testing. However, the 860 gm/mm^2 = 86 kg/cm^2 far exceeds in magnitude any value for tensile strength listed in Table 1, suggesting that the compressive strength of soft lens material is greater than its tensile strength.

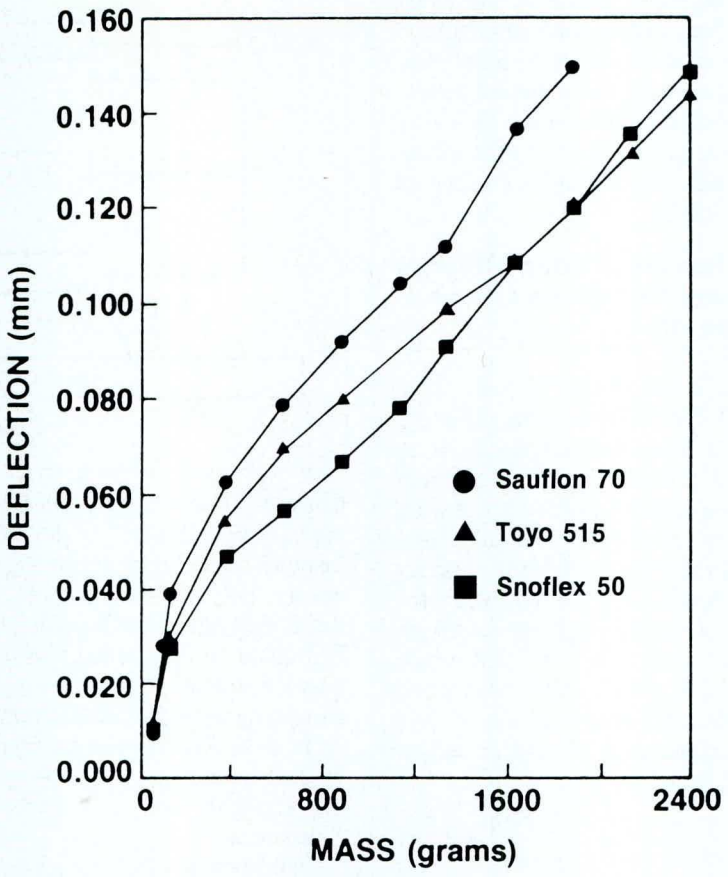

Figure 5

Conclusions

A technique of compression testing for soft lens materials was developed which the authors feel more closely simulates the conditions of lens failure than tensile testing. Actual plano power lenses were studied rather than larger bulk specimens, and the central uniform thickness regions were loaded to ensure that comparison between different materials was valid. It is recognized that lens failures often initiate at the edges but these usually have quite different geometries from one another and, in any event, would be extremely difficult to load properly.

> All three types of lens material tested seemed less strong after they had been dehydrated and hydrated again.

The compression testing demonstrated that the two non-HEMA lenses, Sauflon 70 and Snoflex 50, have a greater compressive strength than Toyo 515 PolyHEMA. It has also been shown that Sauflon 70 material, while having great compressive strength is rather soft, whereas Snowflex 50 material exhibits comparable compressive strength together with a better tendency to recover once deformed. The minimum load leaving a compression mark after 24

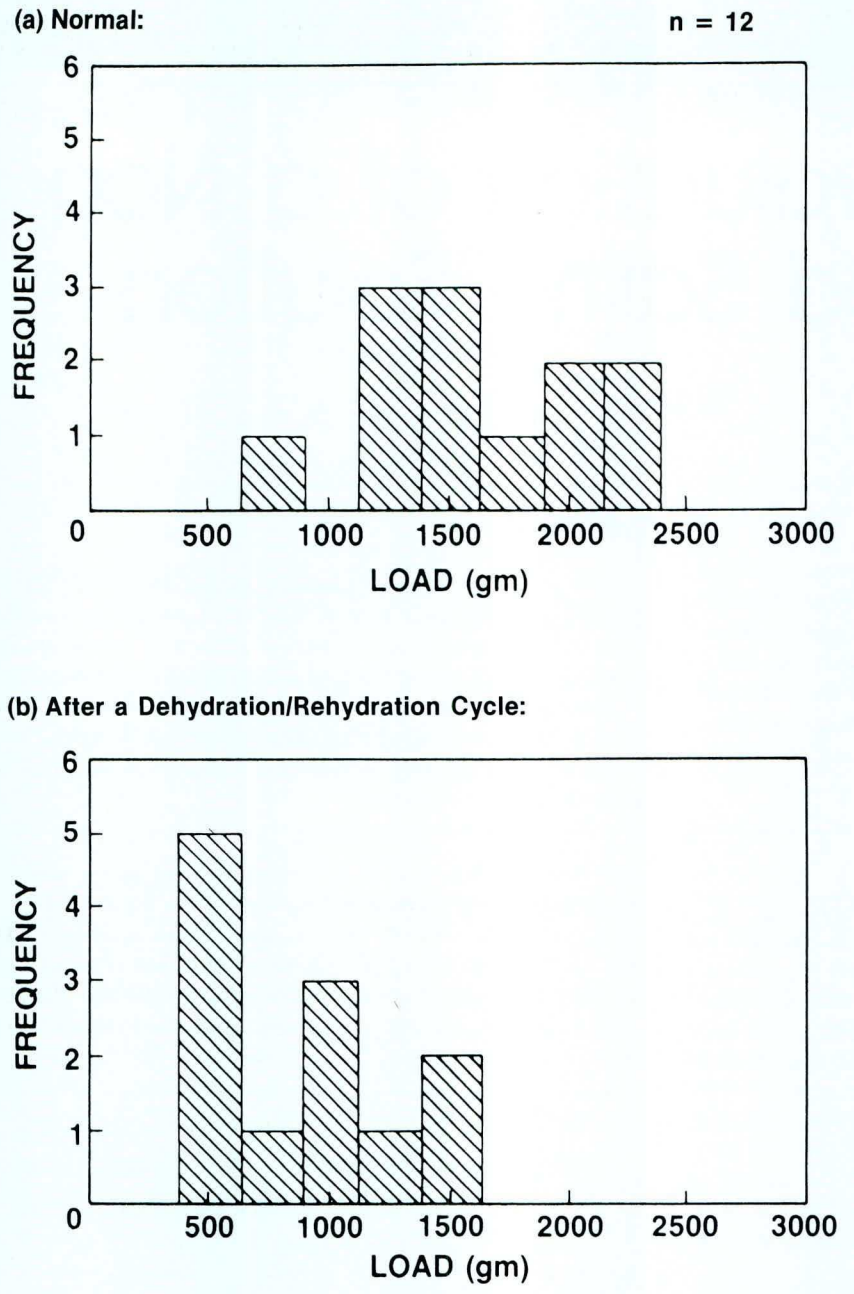

Figure 6 Distribution of Breaking Loads for Toyo 515 Polyhema Material

hours was closest to the point of failure in the case of the Toyo 515 PolyHEMA. All three types of lens material tested seemed less strong after they had been dehydrated and hydrated again: in the case of the Toyo 515 PolyHEMA, this was confirmed statistically.

Implications for Practitioners and Soft Lens Wearers:

It would seem apparent that soft lenses, particularly those made of Toyo 515 Poly HEMA material, must not be allowed to dry out or they will be significantly weaker when they are rehydrated. This means that any spare lenses or trial lenses should be stored in a screw top container to prevent evaporation over time, and the saline level inside monitored periodically. Likewise, lenses put in temporary carrying cases need to be completely immersed to avoid the shrinkage that is associated with drying.

Secondly, as this study demonstrated that certain lenses are more easily damaged by fingernail pressure, and others more easily deformed by it, wearers would reduce the likelihood of either detrimental effect if they kept their fingernails short. Wearers who repeatedly damage their lenses could be given special tongs with soft rubber tips that would facilitate the handling of their lenses.

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CLINICAL RESEARCH/RECHERCHE CLINIQUE

Clinical Evaluation of a Non Preserved Saline Solution

B. Levy *

Abstract

With the advent of more and more contact lens pharmaceutical care products, and the manufacture of hydrophilic lenses which, by their nature, absorb and retain fluids, the question of the sterility of contact lenses is more important than ever. This evaluation assesses the clinical efficacy of Lens Plus, a non preserved saline solution, with a variety of heat and chemical disinfection systems.

Résumé

Avec la prolifération des produits pharmaceutiques d'entretien des lentilles et la mise en marché de lentilles hydrophiles qui, de par leur nature même, absorbent et retiennent les fluides, la question de la stérilité des lentilles de contact est plus importante que jamais. Cette évaluation détermine l'efficacité clinique de Lens Plus, une solution de trempage non préservée, avec une variété de systèmes d'aseptisation thermiques et chimiques.

Introduction

All contact lenses which are currently approved for human eyes in Canada can only be worn if certain procedures are followed to maintain their sterility. This has led to the manufacture of a large number of solutions specifically designed to clean, disinfect and dissolve protein from worn lenses. Since lenses must come into contact with these solutions and then be re-inserted into the eye, it is essential that the care products be free from contamination by pathogens which may be harmful. The question of sterility became more important with the advent of hydrophilic materials, which by their nature could absorb fluids and easily become contaminated. Many systems are now available to prevent contamination of lenses.

Disinfection of lenses is carried out by one of two methods, heat or chemical. Surfacant cleaning has always been done using chemicals. In order to keep these chemicals pathogen free, preservatives have been developed and used for many years in the majority of these systems. Although these solutions remained pathogen free, patients began to develop hypersensitivity reactions to the various preservatives, in varying degrees and with varying severity.[1, 2] The frequency of such reactions, although relatively low, led to the development of effective systems which were preservative free, or with alternative preservatives in which the frequency of reactions was reduced.

One of the mainstay solutions in all hydrophilic lens systems is saline. In order for all hydrophilic lenses to remain in a wearable state, they need to remain in a fluid environment at all times.

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Optometric Institute
Toronto, Ontario

The best fluid for this has proven to be 0.9% saline solution, preferably at a pH similar to the tears (7.4). Most of the currently available systems use preserved saline solutions which fail to meet the above pH requirement.[3] The object of this evaluation is to determine the clinical efficacy of a non preserved saline (Lens Plus), with different systems and lenses.

In order for all hydrophilic lenses to remain in a wearable state, they need to remain in a fluid environment at all times.

Method

90 patients from 10 offices in different geographical areas throughout Canada were randomly enrolled in a clinical evaluation of Lens Plus saline. Lens Plus was used in conjunction with several different systems encompassing both heat and chemical disinfection. The preservatives and disinfectants with which it was used are listed in Table 1. Table 2 shows the types of lenses which patients were wearing during the evaluation. Patients were instructed to carry on with their currently used system, but to substitute Lens Plus for rinsing in the case of chemical disinfection, storage and rinsing for thermal disinfection and for use with enzyme tablets in all systems for protein removal. All patients rinsed with Lens Plus prior to insertion. Patients were problem free on entry, with no positive biomicroscopic findings. Patients were examined monthly for any adverse biomicroscopic findings which could be related to the use of

Lens Plus. Patients were asked to comment on their experiences with the solution, with regard to comfort, any differences from previous solutions used and any problems relating to its use. Responses and findings were recorded and graded on a standard form for ease of recording and analysis.

Table 1

LENS PLUS	
CHEMICAL	THERMAL
Sorbic Acid	Thimerosal
Thimerosal	Sorbic Acid
Polyquat	
H202	

Table 2

LENS TYPES	
HEMA	GMA
38% H20	38% H20
70% H20	
55% H20	

Results

Over the 90 day period of the evaluation, no adverse ocular response was noted by any of the practitioners which could be attributed to the use of Lens Plus. Patient response to the use of Lens Plus as compared to saline previously used, indicated a preference by 70% for the Lens Plus. Thirty percent found no difference.

The 70% preference was mostly related to a reduction of stinging during insertion. One patient of the ninety reported that Lens Plus was less comfortable than the previous saline and reported that it felt 'drier'.

Ease and convenience of use was preferred by 90% of the patients. The 10% who did not find the system easy and convenient, reported difficulty with use of the aerosol nozzle, especially when the saline level was low or the can had to be tipped. Cost of the aerosol can as opposed to other systems was found to be a problem by 5% of the patients. No adverse reactions were reported, which could be correlated with the combined use of Lens Plus with different preservatives or lenses.

Discussion

A 90 day clinical evaluation of a non preserved aerosol saline system, used by 90 patients, indicated that the majority preferred Lens Plus over previous systems for a variety of reasons. All patients used Lens Plus for rinsing prior to insertion of their lenses and for dissolving protein removal tablets. A significant finding was the subjective report of increased comfort by 70% of the patients on insertion. This may be related to the neutral pH of Lens Plus as compared to other saline solutions which had been used by the group entered into the study. Convenience, ease of use and maintenance of sterility by virtue of the aerosol system, appear to be positive factors in the use of Lens Plus. No positive biomicroscopic findings were found relating to the use of Lens Plus. There were no differences found when correlated with different preservatives, disinfectants or lens materials and water contents. Notwithstanding the difficulty in carrying out a clinical study of this nature, and the pitfalls relating to the analysis of the data, it does appear that Lens Plus is safe and effective and well received by patients as an adjunct to other systems.

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RESEARCH/RECHERCHE

Efficacy of Traffic Signal Indicators

S.L. Mintz *

Abstract

Surveys were conducted to determine if there is a problem with motorists determining the direction indicated by traffic light signal arrows. Canadian optometrists were asked if their patients report this problem during a visual examination. Drivers were queried about difficulty with the arrows and under what circumstances the difficulties occurred. Traffic engineers were requested to comment on the use of traffic light arrows in their jurisdictions and whether or not they perceive a problem with visibility. The results indicate that many Canadians, and Manitobans in particular, reported difficulty with the arrows.

Résumé

On a effectué des sondages afin de savoir si les automobilistes éprouvent de la difficulté à déterminer la direction dans laquelle pointent les flèches des feux de circulation. On a demandé aux optométristes canadiens si leurs patients signalaient le problème au cours des examens de la vision. On a questionné les automobilistes au sujet des difficultés posées par les flèches et on leur a demandé dans quelles circonstances ces difficultés se produisaient. On a également interrogé les ingénieurs de la circulation au sujet de l'emploi des flèches sur les feux de circulation dans leur secteur et on leur a demandé si la visibilité semblait poser des problèmes. D'après les résultats, bien des Canadiens, notamment les Manitobains, ont de la difficulté avec les flèches.

Over several years of private optometric practice in Winnipeg, the author was confronted by a large number of patients who expressed complaints about difficulty which they experienced in determining the direction indicated by traffic light signal arrows. This concern was raised with the Roads and Transportation Association of Canada (RTAC) which initiated Project 129 **Efficacy of Direction-Indicating Traffic Signals.** The first step in the project was to determine, by various means, if the driving public and/or traffic engineers perceived that a problem did exist in this area, how widespread the problem was, and how serious the problem was.

> At the present time only six signal lights are recognized for use in Canada.

Background

The Manual of Uniform Traffic Control Devices in Canada (MUTCDC) sets standards for (among other devices) traffic light signals in use in Canada. This manual has been formulated and approved by the Committee on Traffic Control Devices in Canada which has representation from all provincial and many municipal traffic departments. At the present time only six signal lights are recognized for use in Canada. These include the usual red, amber, and green signals in which the entire circular lens area is illuminated (known in the industry as 'ball red', 'ball amber', and 'ball green' signal lights). In addition, the MUTCDC permits the use of 'arrow green' signal lights in which a large part of the circular lens area is blacked out leaving only an arrow shape to be illuminated. ['Arrow red' and 'arrow amber' signal lights are used in some places in the United States but are not accepted as standards here.] These 'arrow green' signal lights may be oriented with the arrowhead directed up, to the right, or to the left (indicating permissive directions of travel). There is, however considerable variation across Canada in the actual dimensions of the arrow, how it is used (i.e. flashing or non-flashing), and under what circumstances it is used.

Method

The initial stage of the project consisted of a series of questionnaires designed to answer the questions raised above. A committee consisting of two optometrists and two traffic engineers met several times to design the questionnaires. A professor of psychology was consulted on the suitability of the questions asked. As a consequence of these meetings, three questionnaires were produced.

One questionnaire (Fig. 1) was to be directed at providers of vision care in Canada. The Canadian Ophthalmological Society was requested to participate but were unable to because of the lack of an official publication through which the survey could be distributed. The questionnaire was distributed to optometrists through the Canadian Journal of Optometry. The questionnaire was published twice through the years 1981-82. The optometrists were requested to mail in a postage pre-paid card which summarized the answers to the survey questions.

**Optometrist, Winnipeg, MB.*

Fig. 1

CAO TRAFFIC LIGHT VISIBILITY SURVEY

As the representative of the CAO on the Roads and Transportation Association of Canada, I have undertaken a study of the visibility of arrows used in traffic lights. These traffic light arrows are available in many patterns but the most common ones indicate one direction per signal unit. These arrows may be displayed with red or amber lights or may be displayed alone. One signal light may consist of a solid red, solid amber, and solid green lights along with one or more of the following: an arrow pointing to the right; an arrow pointing to the left; an arrow pointing up (indicating straight ahead movement).

The initial phase of my study is to determine whether or not a problem exists among drivers in determining the direction indicated by the arrow(s). With this in mind, I am soliciting your assistance by answering a couple of questions below. You may, if you wish, provide further assistance by spending a four-week period keeping more precise statistics of those who present themselves with a complaint of difficulty with the traffic lights (Please do not ask patients if they have problems with the arrows; wait for them to mention the problem).

Your co-operation is much appreciated.

---

1. Within an average month, approximately how many patients have volunteered information that they have difficulty determining the direction indicated by traffic light arrows:
   a. no patients
   b. 1-5 patients
   c. 6-10 patients
   d. 11-15 patients
   e. 16-20 patients
   f. 21 or more patients
   g. unable to answer (i.e. no arrows in community, or unaware of a problem with arrows)

2. Of those patients noted in 1. (above), approximately what percentage would you say present themselves to you with acuity of $^{20}/_{40}$ or better (i.e. acuity measured as the patient is normally driving before any correction you may prescribe).

3. City, municipality, or location of your main office (i.e. where the majority of your patients are seen).

4. (Optional) Name and Address.

Please forward all replies, within 60 days, to:
Dr. Steven Mintz
212A Regent Ave. W.
WINNIPEG, Manitoba
R2C 9Z9

TRAFFIC LIGHT SURVEY

Please check the appropriate answer for Questions 1, 2, and 3. Question 4 is optional.

1. (a) no patients ____
   (b) 1-5 patients ____
   (c) 6-10 patients ____
   (d) 11-15 patients ____
   (e) 16-20 patients ____
   (f) 21 or more patients ____
   (g) unable to answer ____

2. (a) 0-25% ____
   (b) 26-50% ____
   (c) 51-75% ____
   (d) 76-100% ____
   (e) unable to answer ____

3. City or municipality of main office

   _____

   Approx. no. of patients per mo. ____

4. (Optional) Name & Address

   _____

   _____

A second questionnaire (Fig. 2) was produced in quantity and forwarded to the Department of Highways in each province and territory. Approximately 2000 were sent to Ontario and Quebec and 1000 to each other province. The Departments were requested to distribute a portion of their allocation of questionnaires to the Motor Vehicle Branch (MVB) in each major city in their jurisdiction. The Departments were encouraged to duplicate the questionnaires in greater quantities if they so desired. It was requested that all drivers who reported in person to renew their drivers licence within a specified month would be asked to fill in the questionnaire while present at the MVB office. Quebec and PEI stated that they did not wish to participate in this survey and Newfoundland and Northwest Territories did not respond in any form.

The third questionnaire (Fig. 3) took the form of a survey of traffic engineers in the larger municipalities in Canada. This portion was undertaken by the City of Winnipeg, Streets and Traffic Division some jurisdictions being contacted by telephone and some by mail.

A higher percentage of Manitoban Optometrists reported that their patients had difficulty with arrows more frequently than did optometrists from other provinces.

Results and Conclusions

Part I: Optometrist Survey

Responses were received from 73 Optometrists distributed across Canada (Table I) representing 45 different communities (Table II) [Two respondents, who did not indicate in which municipality or province they practiced in are not included in these tables]. Of these, only 15 reported that they had encountered patients who had mentioned a difficulty with determining the direction indicated by traffic light signal arrows (Table III). A higher percentage of Manitoban Optometrists reported that their patients had difficulty with arrows more frequently than did optometrists from other provinces.

Those optometrists who responded that their patients experienced difficulty also estimated the percentage of these patients who fell within certain visual acuity ranges (Table IV). Most significantly, it appears that a very large proportion of those who reported such difficulty had visual acuity of 20/40 or better. In other words, the majority of the patients seen by these optometrists had visual acuity as good or better than the minimum requirement for driving **and yet experienced**

Table I

Number of replies from Optometrists

Province	B.C.	Alta	Sask	Man	Ont	Que	N.B.	N.S.	PEI	Newf
Replies	4.	10.	7	8	31	5	4	2	0	1
Problems	0	1	1	6	5	1	1	0	0	0
%	0.0	10.0	14.3	75.0	16.1	20.0	25.0	0.0	0.0	0.0

Table II

Number of communities represented by reports from Optometrists

Province	B.C.	Alta	Sask	Man	Ont	Que	N.B.	N.S.	PEI	Newf
# Cities	3	6	3	4	19	5	3	1	0	1

Table III

Patients each month reporting to optometrists difficulty with arrows

# of Patients	None	1-5	6-10	11-15	16-20	20 +	unable to answer
# of replies	57	15	3	0	0	0	6

Table IV

Visual Acuity of those reporting difficulty

% of patients reporting difficulty who have 20/40 acuity or better	0-25%	26-50%	51-75%	76-100%	unable to answer
# of replies from optometrists	4	0	6	8	0

Fig. 2

MOTORISTS: Traffic Engineers and Optometrists are conducting a Canada-wide driver survey. Please help us by completing this questionaire, You need not sign it. Thank you for your cooperation.

1. Do you experience difficulty determining the direction indicated by traffic signal light arrows?
   a. Yes ___ b. No ___
2. If "yes" above, when do you experience this difficulty? (Indicate more than one if necessary)
   a. Day time ___ b. Night time ___ c. Dusk or dawn ___
3. Do you normally wear eyeglasses or contact lenses while driving?
   a. Yes ___ b. No ___
4. Please comment, if possible, on what you feel the difficulty is with the arrows and why you have a problem determining arrow direction.

   _____

   _____

   _____
5. What city or town do you live in or spend most of your time driving in?

   _____

Table V

Driver Responses by Province

Province	Total # Replies	Drivers reporting visibility problem		Time of day at which arrow visibility is poorest		
		Number	Percent	Day	Night	Dusk/Dawn
Yukon Territory	39	1	3%	1	0	0
British Columbia	186	13	7%	7	3	8
Alberta	616	31	5%	12	4	7
Saskatchewan	528	41	8%	17	3	16
Manitoba	711	172	24%	129	48	85
Ontario	990	52	5%	34	10	25
New Brunswick	481	60	12%	25	22	27
Nova Scotia	472	46	10%	22	8	14
TOTAL	4023	416	10%	247	98	182
(% reporting problems at specified time of day)				(47%)	(19%)	(34%)

Table VI

Responses of drivers (with glasses) by Province

Province	Total # Replies	Drivers reporting arrow visibility problem		Drivers reporting no visibility problem	
		No. with	% with glass	No. with	% with glass.
Yukon Territory	39	1	100%	39	43%
British Columbia	186	13	63%	173	12%
Alberta	616	11	35%	228	39%
Saskatchewan	528	23	56%	238	49%
Manitoba	711	79	46%	196	36%
Ontario	990	27	52%	172	18%
New Brunswick	481	20	33%	170	40%
Nova Scotia	472	18	39%	56	13%

some difficulty in determining the direction indicated by the arrows. There were not sufficient replies from the optometrists in any one community to relate these findings to those in the other surveys.

Part II: Driver Survey

A total of 4,023 responses were received from 7 provinces and 1 territory. Table V shows the provincial summary. More than 50 communities were represented in the survey and many responses were received from rural motorists. Only those municipalities from which at least 25 responses were received have been included in this portion of the study (Table VII). Of the 22 jurisdictions in this category, only 7 had a higher percentage of positive response to the question of visibility difficulty than the national average. Winnipeg led the list with 27.59% of the respondents replying in the affirmative to question 1, with Edmundston a distant second at 17.65%. Only three other municipalities had more than a 10% affirmative response to this question.

More reported having experienced these problems in the daytime than reported problems at night or in twilight.

Applying the X^2 (Chi-squared) test shows that there is not a significant difference between the responses in Winnipeg and Edmundston. For a more accurate comparison cities of similar sizes should be used. Victoria is the city comparable in size to Winnipeg which has the highest percentage positive response. When these two cities are compared using the X^2 test, the differences are significant at the 0.001 level. When the results are compared on province-by-province basis (Table V), it is shown that there is a significant difference ($p < 0.001$) between Manitoba and New Brunswick, the two provinces with the highest percentage of positive responses.

These analyses show that there are definitely more problems experienced with traffic light arrows among the drivers in Manitoba (and perhaps to a lesser extent in Winnipeg) than in the other surveyed areas of Canada.

Another significant result was that of all those responding positively to experiencing arrow difficulty, that more reported having experienced these problems in the daytime than reported problems at night or in twilight. [Note that, in many cases, respondents indicated problems under more than one lighting condition. Also, many did not

Table VII

Driver Responses by Municipalities (with over 25 responses)

City	Total # Replies	Drivers reporting visibility problem		Time of day at which arrow visibility is poorest		
		Number	Percent*	Day	Night	Dusk/Dawn
Whitehorse	37	1	3%	1	0	0
Victoria	112	11	10%	5	1	6
Dawson Creek	28	0	—	—	—	—
Edmonton	188	17	9%	5	3	3
Calgary	248	5	2%	2	1	0
Medicine Hat	44	2	5%	2	0	0
Red Deer	36	2	6%	2	0	1
Lethbridge	34	0	—	—	—	—
Regina	214	16	7%	7	3	3
Saskatoon	184	14	8%	7	0	8
Prince Albert	65	2	3%	1	0	0
Moose Jaw	57	9	16%	2	0	5
Winnipeg	598	165	28%	122	46	83
Brandon	47	2	4%	2	1	1
Ottawa	303	1	<1%	1	0	0
Toronto (Metro.)	202	5	2%	3	2	4
London	39	3	8%	1	1	0
St. John	315	40	13%	13	16	16
Edmundston	51	9	18%	9	0	8
Bathurst	50	8	16%	1	6	2
Campbellton	27	0	—	—	—	—
Halifax	357	30	8%	17	5	10
Total (22 cities)	3,236	340	11%	203	85	150
(% reporting problems at specified time of day)				(47%)	(19%)	(34%)

*rounded to the nearest percentage point

Table VIII

Use of Traffic Signal Arrow Indications

Jurisdiction	# of signals	# with arrows	% with arrows	Use flashing L. arrow
Halifax	88	45	51%	Not at all intersec.
Hamilton	294	8	2%	Not at all intersec.
Montreal	1500	150	10%	Not at all intersec.
Ottawa	430	65-108	15%-25%	Not at all intersec.
Toronto	1450	50	3%	Not at all intersec.
Winnipeg	485	130	29%	110 intersec with Left arrow; 30 with flashing ball green.
Regina	105	60-70	57%-66%	Flashing arrow if conflict-free; Flash. arrow on advanced green; Solid arrow with red = conflict
Saskatoon	126	40-60	32%-48%	Flashing arrow with ball green or solid arrow alone
Calgary	435	100	23%	N/A
Victoria	110-120	20-30	17%-27%	Use solid arrow with amber and red; Flash. arrow with ball green

Jurisdiction	Flashing ball means same as solid green with flashing arrow?	Are Solid arrows, either left, right or vertical used?	Do these mean a conflict-free right-of-way?
Halifax	Flashing arrow is redundant	All	N/A
Hamilton	Yes	All	N/A
Montreal	N/A*	All	N/A
Ottawa	No: Flashing arrow never used	All	N/A
Toronto	No	All	N/A
Winnipeg	Yes	All	Yes
Regina	No: Flashing ball green never used	For left turn onto a one-way Street	No
Saskatoon	No: Flashing ball green never used	N/A	Yes
Calgary	No: Flashing ball green never used	At some intersections	N/A
Victoria	No: Flashing ball green never used	All	N/A

*N/A means not answered

Jurisdiction	Are arrows used when not conflict-free?	More than one arrow used on same signal	Do you feel there is problem with arrows?
Halifax	Yes	Yes	Yes
Hamilton	Yes	No: Separate signals for each direction	No
Montreal	No	Yes	Yes
Ottawa	Yes	Yes	No
Toronto	Yes	Yes, rarely	No
Winnipeg	no	Yes	Yes
Regina	Yes	No	Yes: suggest changing to 12" arrows
Saskatoon	N/A*	No	N/A
Calgary	N/A	N/A	Probably problem with efficiency, not safety
Victoria	N/A	No	Yes; inadequate signal size (8" used now)

*N/A means not answered

Table IX

Comparison of drivers' response to engineers' response

Jurisdiction	% use of arrows	% drivers reporting problems
Halifax	51%	8%
Hamilton	2%	—
Ottawa	15-25%	0.3%
Montreal	10%	—
Toronto	3%	2%
Winnipeg	29%	28%
Regina	57-66%	7%
Saskatoon	32-48%	8%
Calgary	23%	2%
Victoria	16-27%	10%

Fig. 3 **TRAFFIC SIGNAL ARROWS QUESTIONNAIRE**

1. Jurisdiction:
   Name of Respondent:
   Address:
2. Approximate No. of Signals:

   How many intersections have arrow indications in your jurisdiction?
3. Do you use a flashing left-pointing green arrow indication?

   At all intersections?

   Or Only At Some Locations:
4. As far as you are concerned, do you consider the "Flashing Ball Green" exactly the same as a solid ball green with flashing left-pointing green arrow?
5. Do you use solid (non-flashing) arrow indications, either left, vertical or right-pointing?

   If so, do those arrows assign exclusive, conflict-free right-of-way to drivers?
6. Do you use any arrows, flashing or otherwise, in any situation which assigns drivers right-of-way that is *not* conflict-free; that is, do you use any arrows to tell drivers "You may turn in the direction of this arrow, but watch out for motorists and/or pedestrians which may get in your way?"
7. Do you place more than one arrow indication in each signal face — and show the same "message" at all times in the left and right hand signal heads?
   or
   Do you provide a separate signal head(s) for left turn motorists only, with mutually exclusive red, amber, green indications?
8. Generally, do you feel that there is a problem with regards to the visibility of traffic arrow signals?

indicate a time where problems occurred.] These differences were significant at the 0.001 level. It appears that the difficulty increases directly with an increase in ambient light.

No significant correlation could be found between difficulty with the arrows and whether or not the driver normally wore corrective lenses.

Table VI shows, by provinces, the numbers and percentages of the respondants who normally wear corrective lenses. No significant correlation could be found between those that do wear glasses and those that don't as it relates to their difficulty to perceive the directionality of the arrows.

Part III: Traffic Engineers Survey

Traffic authorities in a total of 10 major cities in seven provinces responded to the survey request. The results of the survey are displayed in Table VIII. It is difficult to draw conclusions from this portion except to demonstrate the variability in how the different jurisdictions view the same traffic light situation. The MUTCDC referred to above specifies the conditions under which the various signal indications (such as left-turn arrow) should be used. It is clear, however, that the municipalities in this survey had very different interpretations of the proper use of the same device.

When this table is compared to the results of the drivers survey (Table IX), no particular pattern becomes apparent. Winnipeg uses a lower percentage of arrow indications than Halifax, Regina and Saskatoon and higher than the other surveyed jurisdictions yet more of its drivers reported problems than in any other of the communities. Consequently, problems with the arrows can not be related solely to the frequency of the use of the arrows.

Summary

The surveys do indicate that a significant proportion of the drivers in Canada (10%) perceive a difficulty in determining the direction indicated by signal arrows. Manitobans, in particular, experience this problem to a greater extent. No determination can be made with regards to why this problem occurs although it must be noted that there is lack of uniformity among traffic authorities *vis-a-vis* the meaning and placement of traffic light signal arrows. However, this study points out the need for further research to delineate why the problem occurs and what can be done to alleviate it. The author is currently endeavoring to do just this.

PROFILES IN HISTORY/RÉTROSPECTIVE

Museum Musings

E.J. Fisher *

The historical collection at the Museum of Visual Science and Optometry at the University of Waterloo originated forty years ago with the accumulation of a few antique spectacles and instruments at the College of Optometry in Toronto. Over the ensuing years many additions of artifacts have been made to the collection primarily by optometrists and ophthalmic laboratory representatives. When the Optometry building was opened in 1973, space was set aside for the display of such artifacts. A report of the general arrangement of the museum has already appeared in the Canadian Journal of Optometry.[1]

Exhibits have been increased by the acquisition of additional display cabinets and greater use has been made of the allotted space.

Recently a number of changes have been made in the museum exhibit and storage areas. Exhibits have been increased by the acquisition of additional display cabinets and greater use has been made of the allotted space. Most of the collection has been catalogued in accordance with Museum standards, and this work is continuing. Some account of these changes may be of interest. A general view of part of the museum display area is given in Figure 1.

Graduation Pictures

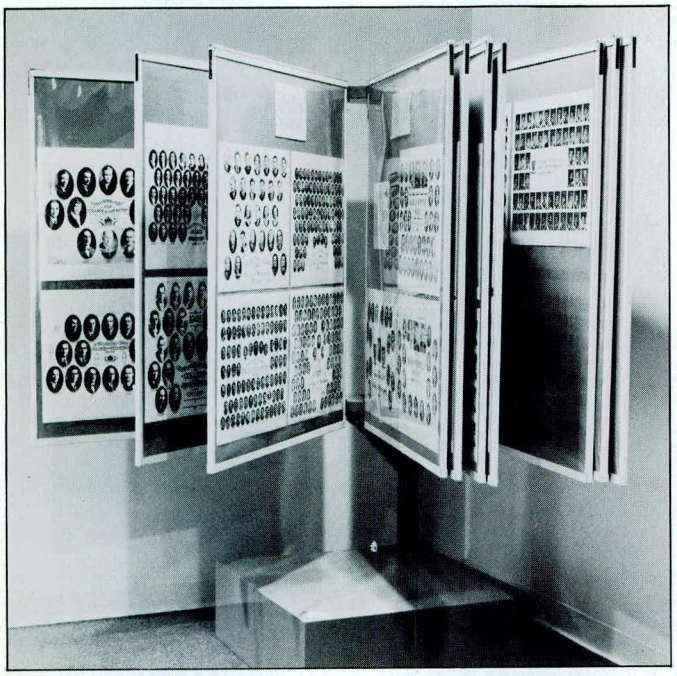
The University of Waterloo Optometry Students Association contributed free-standing 'SwingPlan' display rack in 1985. Subsequently, class graduation pictures of every year from the first graduating class in 1926 to the present were obtained, reproduced in a standard size and placed on display. There were two classes which did not have these composite pictures available, so only the names of the graduates of those years could be recorded. In the case of the class of 1951, it was learned that the photographer had declared bankruptcy before the pictures were produced, and could not be traced. The class of 1961 contained only five students and they decided not to have pictures taken. In addition to the class pictures, the rack contains a brief account of the history of Optometric education in Canada as it relates to the present School of Optometry. This display is permanent and can accommodate all graduation pictures until the year 2009. Much interest has been shown in this exhibit by visiting graduates and their families, as well as undergraduates.

General View of part of the exhibit area.

Spectacle Collection

The Museum possesses a very fine assortment of spectacles dating from the early 18th century. The collection has been augmented from time to time by a great many people, but one major contributor was Dr. Clifford C. Tait who practised in Toronto for many years from 1920. His collection contained more than 125 different examples of spectacles and eyeglasses. In 1970 he donated his entire collection to the museum. There are now more than 800 pairs of spectacles and eyeglasses in the museum. These items, together with some spectacle cases are displayed in a set of fitting drawers which have been modified for security. This display case is shown in the accompanying photographs.

**M.A., D.Sc. F.A.A.O.,*
Waterloo, ON



"Swingplan" display of composite graduation pictures.

1860 stereoscope in viewing position.

Some of the 18th century spectacles on display include several made from sterling silver and hallmarked to indicate the maker, date and place of manufacture. A number of the 18th century spectacles have double eyewires, hinged so that they can be swung into place to provide reading correction or radiation protection if desired. Two or three pair are stamped with the name of McAllister, the Philadelphia optician who was among the first to provide ophthalmic care in the United States in the early 19th century. Some early Chinese spectacles are also in the museum collection.

Some of the 18th century spectacles on display include several made from sterling silver and hallmarked to indicate the maker, date and place of manufacture.

Eyeglasses, lorgnettes, oxfords, and pince nez of the period from 1890 to 1920 form a special section. A pair of German respirator spectacles from the first World War has a worn metal case enclosing needle, thread and spare ear loops of cotton tape, with instructions in German explaining the method of use. By contrast, a pair of American combat spectacles from the Vietnamese war era has plastic ear loops which appear indestructible. Many other interesting spectacles and eyeglasses are shown. Each one is labelled with a brief description, and the approximate date. The lenses range from the split "Franklin" type bifocals, Perfection and cement bifocals, and even a pair of cement trifocals.

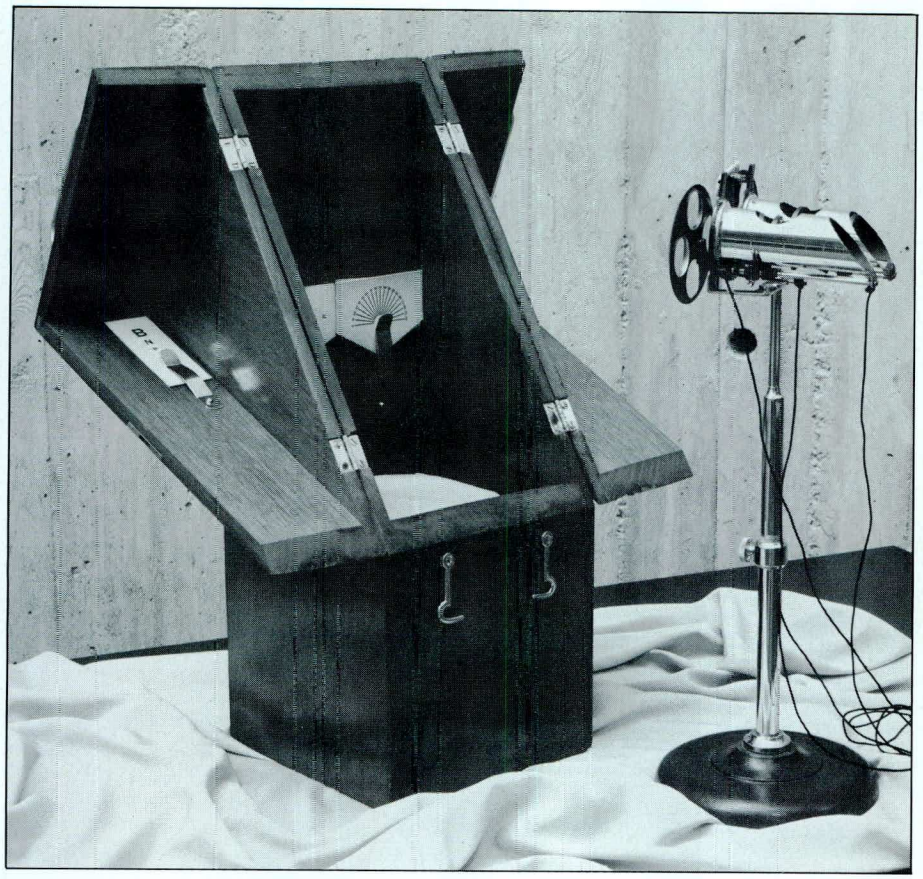
Instrument Display

A number of early ophthalmic instruments of very ingenious design have been restored and are on display. The museum has a great number of early ophthalmometers, ski-ophthalmoscopes, phoroptors, and training instruments. Since most readers will be familiar with these, a few lesser known and unusual devices will be described.

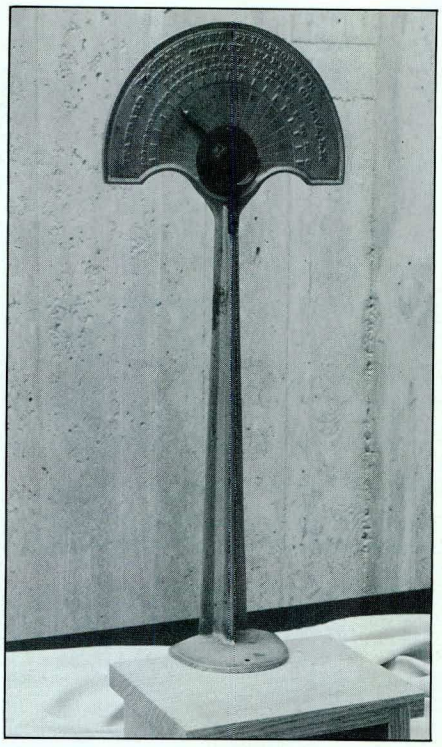
An English stereoscope and photograph viewing device dated about 1860 has been donated together with stereoscopic cards and early photographs taken in England and Europe. Perhaps it should be noted that the lens stereoscope was developed by Sir David Brewster and only came into general use about 1850. This particular instrument is made from wood, richly carved, and folds into a compact case as shown. Opened, it may be used as a focusing stereoscope or a large magnifier and adjusted for comfortable elevation. There is an opening in the top of the stereoscope section to provide illumination for the cards. A number of the accompanying stereograms show interiors of some of Europe's noted cathedrals, and with the stereoscopic effect is excellent. The top portion, which consists of a simple magnifier, also produces good clarity of the image.

An English stereoscope and photograph viewing device dated about 1860 has been donated together with stereoscopic cards and early photographs taken in England and Europe.

An interesting examination aid is the Skiameter developed by Andrew J. Cross



Skiameter of Andrew J. Cross.



Prisometer for measuring ametropia subjectively.

about 1900 and described in his book "Dynamic Skiametry in Theory and Practice".[2] This device consists of two tubes each containing a type of zoom lens system. The tubes can be separated to provide proper inter-pupillary distance. The lenses are controlled by cords which extend to one meter from the patient's eyes. The examiner is able to manipulate the lenses to produce varying effective power by means of the cords. Three auxiliary lenses of −1.00, −3.00 and −6.00 D. are available for each eye to provide for myopic correction. The lenses in the tubes are angled slightly to avoid reflections from the surfaces. Using this instrument it is possible to determine the refractive error. The entire instrument is on an adjustable table stand, and comes enclosed in a specially designed mahogany case.

Yet another interesting early instrument is the prisoptometer patented in 1886 by the Standard Optical Company of Geneva, New York. This was a subjective device, and is described in The Optician's Manual, Volume 1.[3] The instrument consists of a double prism which can be rotated to different axis positions. The patient views through the eyepiece and observes a white circle on a black background at a distance of some 6 metres. Two circles will be seen due to the prisms. If they overlap, the patient is myopic and concave lenses are placed in the lens wells until the two circles move out to just touch each other. If the two circles are separated, the patient is hyperopic and convex lenses will cause the circles to come closer to each other.

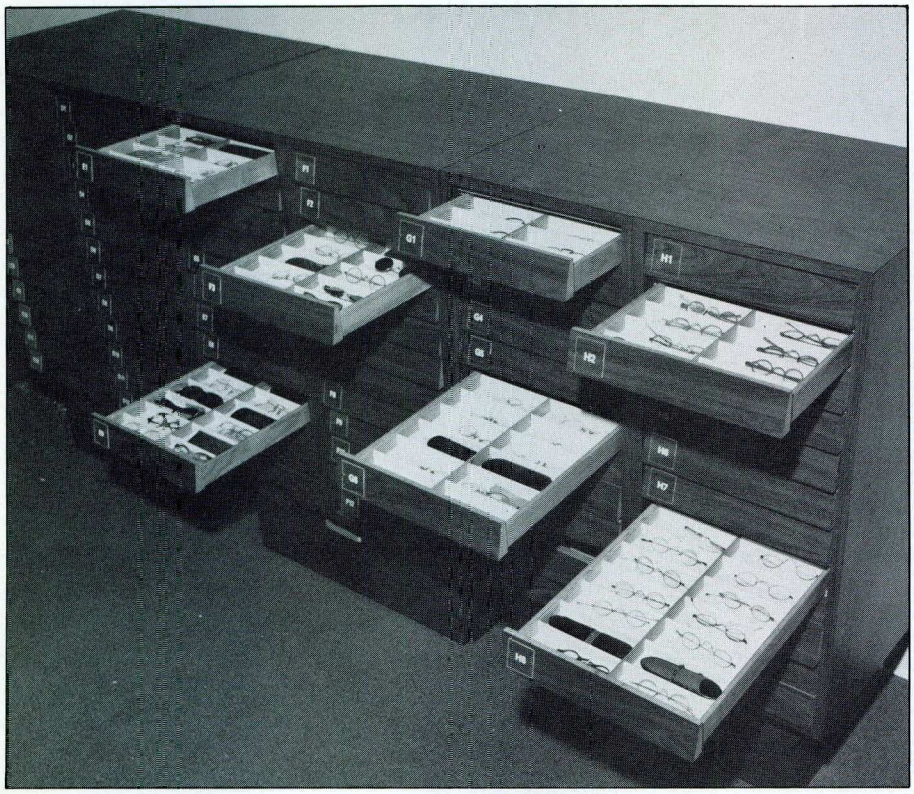
Appropriate spherical lens power is added until the two circles just touch. Rotation of the prisms will disclose any astigmatism, and the axis, and appropriate cylinder power is added to cause the two circles to appear to be in contact.

Curiously, two similar devices were donated to the museum only two weeks after the first one was received. The later additions were called ametropometers, and were made by the Johnson Optical Company of Detroit. They were patented in 1902.

Books

A large number of early books have been contributed. Many of these are of considerable historic interest. There is an excellent copy of the original translation of Donders work "On the Anomalies of Accommodation and Refraction of the Eye". This English translation was made in 1864, and published by the New Sydenham Society. A facsimile edition of this translation was printed 100 years later. This original copy in the museum is particularly unique since it is inscribed on the fly leaf "To Dr. F.B. Loring from H.B.L., June 16 '78". Dr. Loring is well known as the inventor of a plain mirror reflecting ophthalmoscope with a focusing lens system which first appeared in the 1880's.

Another set of books is the English translation of Helmholtz's "Physiological Optics" completed by Professor J.C. Southhall of the Physics Department at Columbia University and published by the Optical Society of America. Professor Southall was in charge of the Optometry program there. While these books are fairly common, this particular copy is autographed by Professor Southall for Warren J. Maxwell, who studied and lectured at Columbia in 1925 and 1926. Maxwell later practised in Fredericton, New Brunswick until his death in 1954 and was very active in both the provincial and national associations.



Display case of spectacle collection.

Other early books of some interest which are found in the museum include:

Lawson, The Eye — 1873
Second edition
(Signed "Presented to F.P. Cooke by Dr. W.G. Scott, Hull, May, 1892")

Wright, J.W. Ophthalmology
Trauger, Columbus 1896

Maddox, E.E. Tests and Studies of the Ocular Muscles
Wright and Co., Bristol 1898

Tscherning, M. Physiological Optics
Keystone Press, Philadelphia 1904

Worth, C. Squint Blakiston's
Philadelphia 1906

Sheard, C. Dynamic Ocular Tests
Lawrence Press, Columbus 1917

> Every continent is represented on the guest list, as well as every Canadian province and many States.

The Museum serves a large and varied audience. Apart from the students in Optometry, there are classes from other departments in the University who attend lectures in the adjacent Visual Science Demonstration theatre and look over the exhibits between lectures. Many local groups of senior citizens, recreational, school and church organizations are given special tours. Casual visitors are welcomed frequently and are requested to sign the guest register. Every continent is represented on the guest list, as well as every Canadian province and many States.

It would be of considerable benefit to the continued improvement of the Museum of Visual Science and Optometry if all readers would be alert to locate any unusual optical instruments, documents, licenses, certificates, books or other artifacts which may have historical significance to visual science or the profession. Even postage stamps having some optical connection would augment the present collection. Continued contributions to the museum will help to preserve and document the early history of Optometry in Canada. It is suggested that contact be made with the writer before sending any larger pieces in order to confirm that they are not duplications.

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Continued from page 191.

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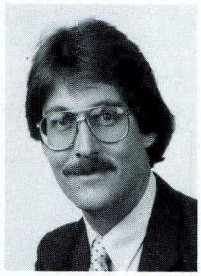

John Potter, O.D. will present "Age-Related Macular Degeneration," "Flashes and Floaters and What To Do About Them," and "Binocular Indirect Ophthalmoscopy Workshop." Dr. Potter is Chief of Optometric Service at the V.A. Outpatient Clinic in Las Vegas; Assistant Professor of Optometry at the Southern California College of Optometry; and editor of **Journal of Optometric Education.**

Our OptiFair '87 seminar program is designed to keep your practice profitable and professionally up-to-date. We offer a wide range of topics on business management, professional practice, contact lenses, eye health, nutrition, marketing and dispensing.

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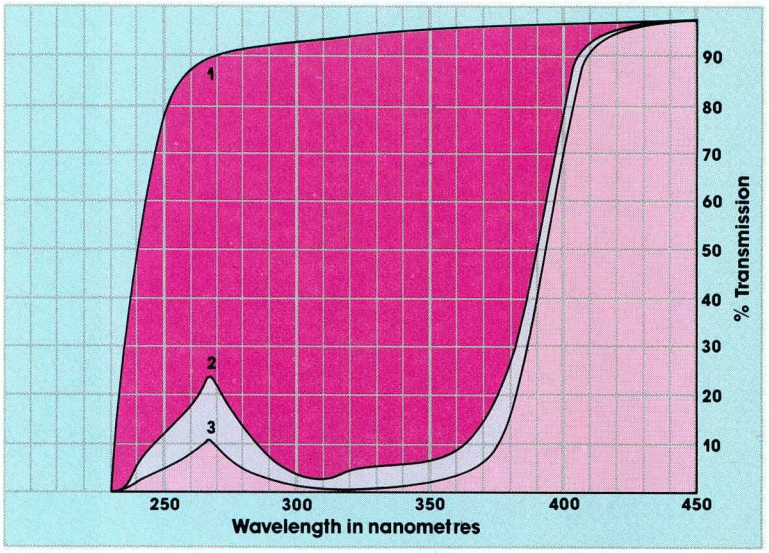
Introducing
Permaflex® UV (surfilcon A) Hydrophilic Contact Lenses
The first hydrophilic soft contact lens to protect against UV radiation.

Unique lens composition absorbs UV radiation. UV-absorbing chromophores are chemically copolymerized and integrated into the Permaflex UV monomer. These chromophores act as receptors that absorb incoming UV wavelengths. Once absorbed, UV radiation is neutralized and transferred back into the air. Permaflex UV lenses effectively filter UV transmission by preventing UV radiation from passing through to the inner layers of the eye (see graph).



Percentage of UV transmission with Permaflex UV lenses vs. unblocked UV lenses.[1]

1. **Unblocked soft contact lens** (−3.00 Dioptres)
2. **UV-Blocked Permaflex** (−3.00 Dioptres)
3. **UV-Blocked Permaflex** (+6.00 Dioptres)

Constant protection against a constant hazard. UV radiation from the sun is always present – studies show that even on cloudy days UV radiation is intense, since clouds do not completely block it out, but rather, reflect large amounts for greater exposure.[2] Indoors, UV radiation comes from a variety of sources, including computer terminals and fluorescent lighting.[2-4] There are no positive benefits associated with UV radiation, only negative effects, such as cataract formation, darkening of the eye's lens over time, photokeratitis, and erythema.[2-4] Since Permaflex UV lenses are not tinted, patients can wear them all the time for constant protection without any changes in color perception.

UV protection plus all the benefits of Permaflex Natural 74 Lenses. There's only one visible difference between Permaflex UV lenses and Permaflex Natural 74 lenses: Permaflex UV lenses are specially marked with a blue dot for easy identification. Otherwise, when you fit Permaflex UV lenses, you'll be providing your patients with the time-tested Permaflex Natural 74 attributes: high water content (74%) that permits superior O_2 transmission for optimum corneal health and increased wearing comfort; superior optics with excellent visual acuity. And, with superior durability and handling, all Permaflex lenses are easy to fit and comfortable to wear, right from the start.

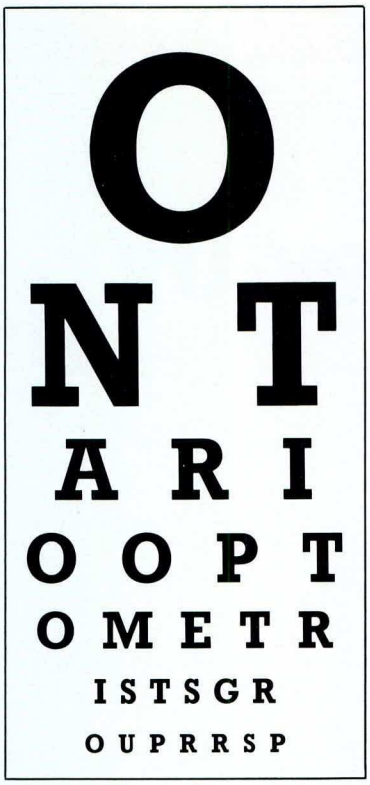
New Permaflex® UV Hydrophilic Contact Lenses

The newest reason to fit Permaflex Lenses

References
1. Data on file, CooperVision, Inc.
2. Sliney D and Wolbarsht M: Safety with Lasers and Other Optical Sources: A Comprehensive Handbook. New York, Plenum Press, 1980, p. 107.
3. Pitts DG: Threat of ultraviolet radiation to the eye – how to protect against it. *J Am Optom Assoc 52(12):* 949-957, 1981.
4. Sliney DH: Physical factors in cataractogenesis – ambient ultraviolet radiation and temperature. *Invest Ophthal Vis Sci*, submitted for publication.

To learn more about the negative effects of UV radiation on the eye, write to us for further information.

CooperVision® 100 McPherson Street
Markham, Ontario L3R 3V6, Canada



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Sure, you can get an RRSP at your bank. But the Ontario Optometrists Group RRSP is a diversified investment and a stake in your retirement security.

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VISION CARE NEWS/ACTUALITÉ OCULO-VISUELLE

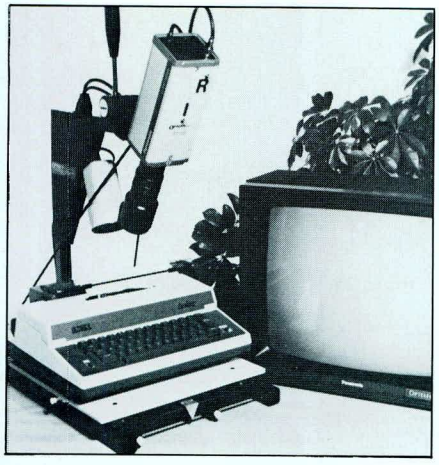
IOOL Appoints New Executive Director

Effective January 1, 1987, the International Optometric and Optical League has a new Executive Director.

Mrs. Lynette M. Braithwaite, B.A., LL.B., M.B.A., 30 years old, was formerly a solicitor in the Supreme Court of New South Wales, Australia, a position she held for four years before moving to England in 1984 to pursue her M.B.A. degree at one of the UK's leading business schools, the Cranfield School of Management.

Headquarted in London, England, the IOOL is an international optometric organization whose goal is to upgrade education and standards of practice for the profession of Optometry worldwide.

Mrs. Braithwaite replaces Don Schaefer, whose three-year mandate as Executive Director expired in December.



Low Vision Reading Aids Can Be Used With Typewriters

A new, swivel head option that permits their own high resolution reading aids to be used with portable typewriters has been introduced by Optelec USA Inc., of Harvard, MA.

The special swivel head option, available on the company's FDR LV reading aids, focusses on the carriage of small electric or manual portable typewriters, displaying an image electronically enhanced and magnified 45 times on a Panasonic monitor.

Featuring a zoom camera, the FDR LV reading aids can also be switched from positive to negative display modes.

Price for the full unit, including a 19'' monitor, is $2,134.00 ($US).

Information: Optelec USA Inc.
David Rosette,
Marketing
325 Ayer Road
Harvard, MA
01451, USA
Tel. (617) 772-3395

In a Wink "Refreshing" Drops from Ciba Vision Care

This past summer, Ciba Vision Care introduced a new addition to its ''In A Wink'' family of lens care products, In A Wink Refreshing Drops.

Designed as cleansing and lubricating eye drops for patients who experience dry eyes as a result of wearing contact lenses, In A Wink Refreshing Drops are formulated with Ciba E.A., which contains no thimerosal or chlorhexidine, significantly reducing the chances of a solution-related reaction by the wearer.

The drops are available in 05ml sample sizes, as well as in a 15ml retail size.

For further information, or an introductory sample, contact one of Ciba Vision Care's customer service numbers, or (416) 821-4774.

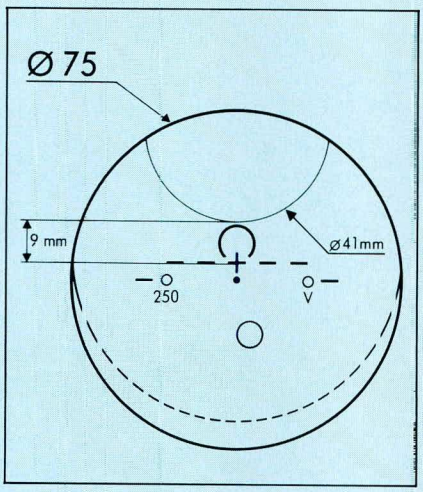
Essilor Introduces Varilux "Occupational" Progressive Lens

Essilor has announced ''good news'' for all presbyopes whose profession requires clear near vision above the head, citing lab technicians, pharmacists, electricians, pilots, painters and mechanics as potential beneficiaries of the product.

The Varilux ''Occupational'' is a new progressive lens with a 41mm near vision segment in its upper part which, according to Essilor, ''gives a wide field of vision and a position, 9mm above fitting cross (which) does not interfere with distance vision.''

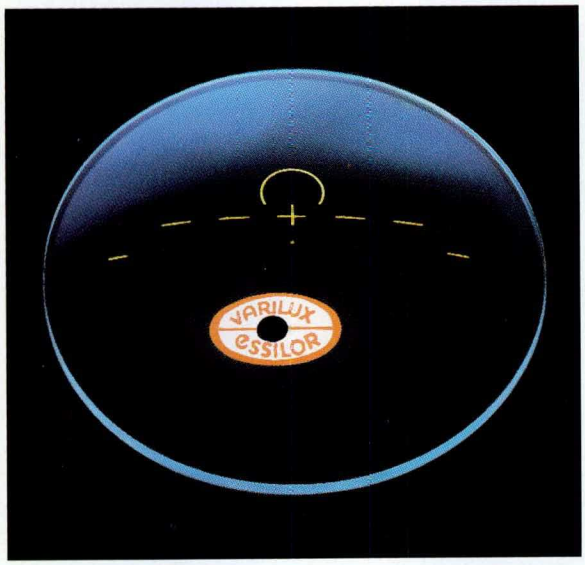
Characteristics of the lens are as follows:

Varilux 075 Equithin
+3.00 to −3.00; cyl. −4.00 maximum
combined power − on −: −3.00



Information: Essilor
295 DesLauriers
St-Laurent, Quebec
H4N 1W2
Tel. (514) 337-2943

Progression	+1.50	+1.75	+2.00	+2.25	+2.50
Addition	+1.00	+1.25	+1.50	+1.75	+2.00



THE BEST LENS

BECAUSE

For overall visual comfort to the presbyope, no lens can beat Varilux.

- *Varilux has a right and left lens that are power modulated differently to favour binocularity in peripheral vision.*
- *Varilux is fully aspheric to ensure orthoscopy in static and dynamic vision: straight lines remain straight and the wearer's eye can wander freely without disturbing "side effects".*
- *Varilux's design provides patients with more functional intermediate and reading vision.*
- *Varilux has the highest record of patient satisfaction and is backed by the greatest experience. More than 40 clinical studies at leading Canadian and American universities confirm it.*

NATURAL VISION RECREATED,
MILLIONS OF SATISFIED WEARERS AGREE!

PATENTS EXPIRE ONLY IN 1990, NOTHING COMES CLOSE YET!

VARILUX

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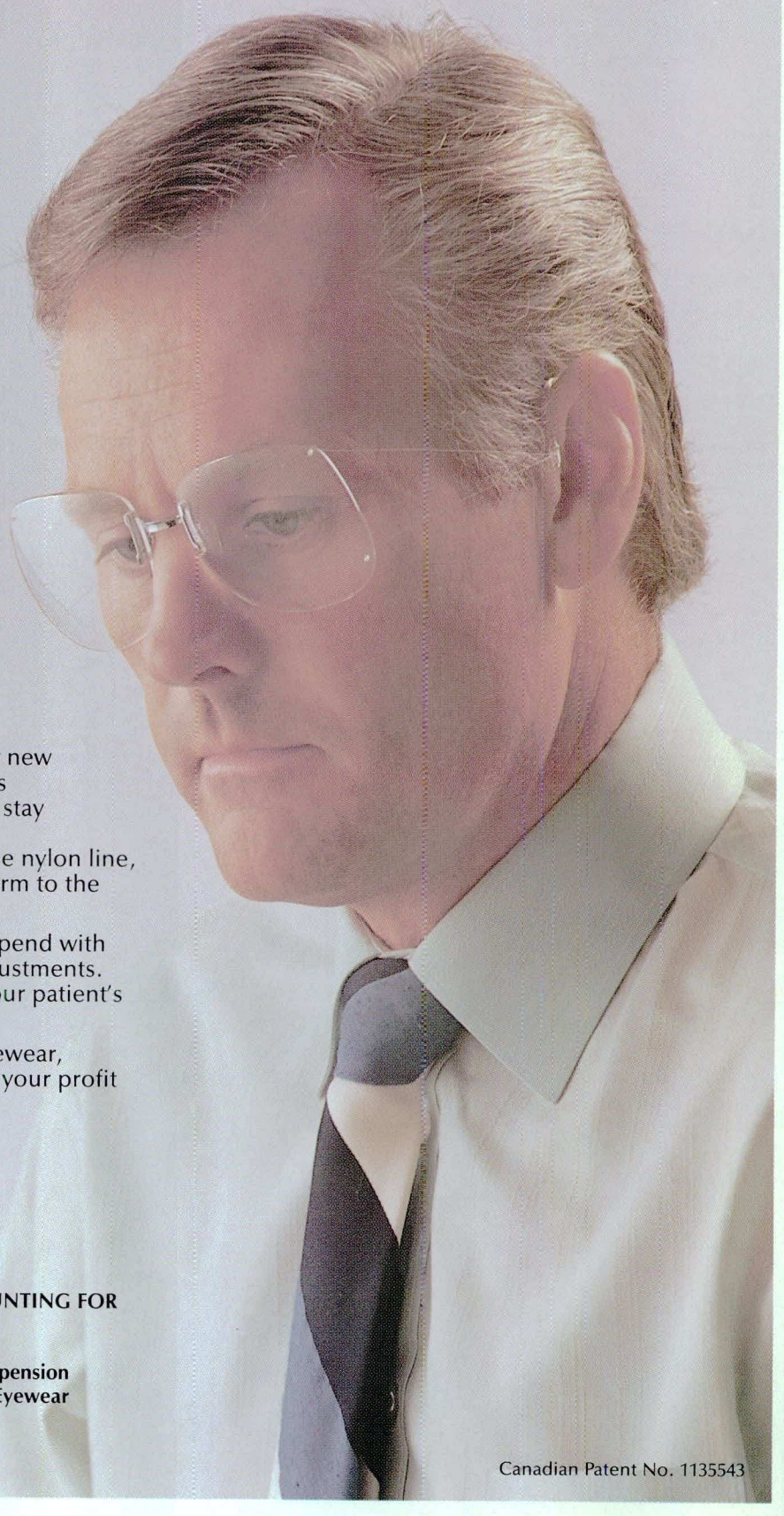
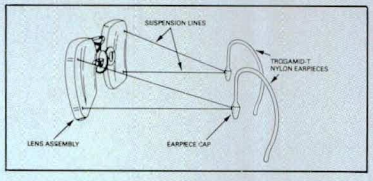


What's missing are ordinary glasses that slip and slide, that pinch at the nose and the ears and hurt on the side of the head.

Suspension Eyewear® is a completely new technology in eyewear. These glasses weigh less than ordinary glasses and stay in place better because they're held securely by sturdy, yet nearly invisible nylon line, and Trogamid-T earpieces that conform to the contours of the ears.

What else is missing? The time you spend with ordinary glasses making periodic adjustments. Once Suspension Eyewear is fit to your patient's satisfaction, it stays fit.

If you're not carrying Suspension Eyewear, something is definitely missing from your profit picture.



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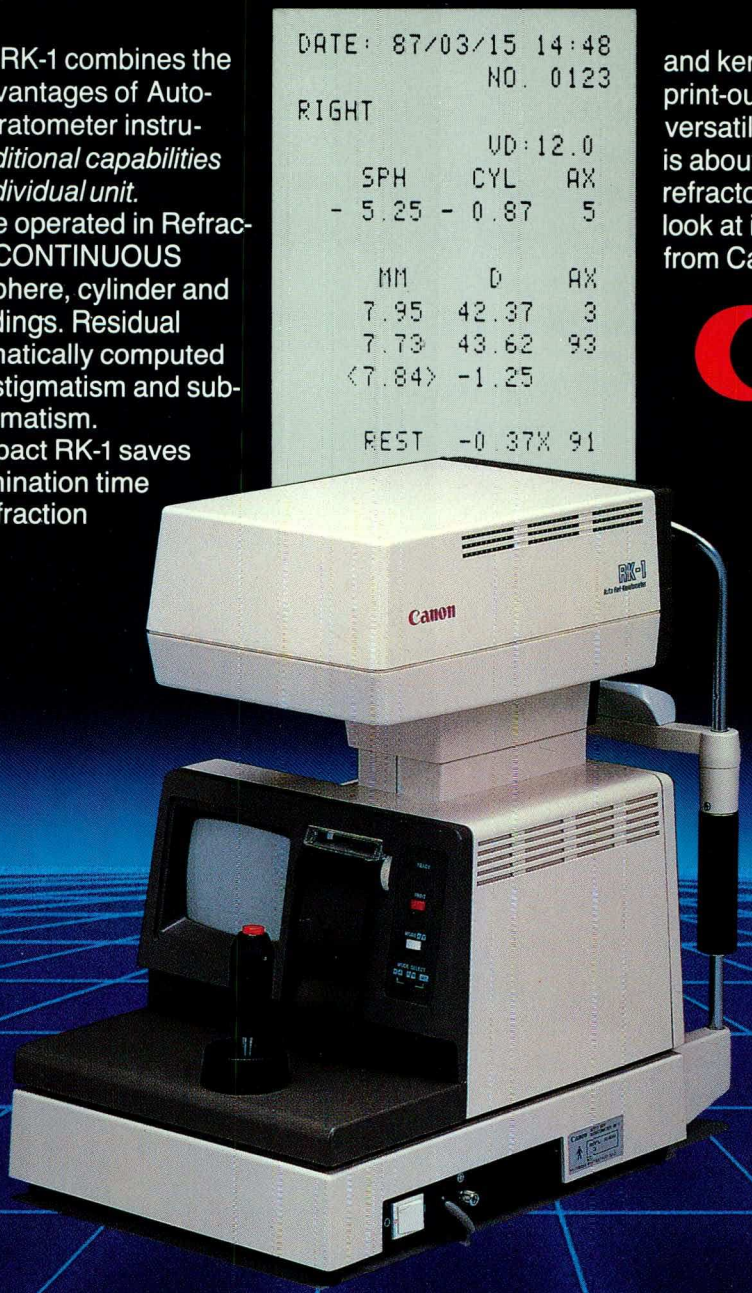
Introducing the incredible Canon RK-1.

We'd like you to look at it two ways.

The new Canon RK-1 combines the best features and advantages of Auto-refractor and Autokeratometer instruments, providing *additional capabilities not found in either individual unit.*

The RK-1 may be operated in Refraction, Keratometry or CONTINUOUS modes to measure sphere, cylinder and axis as well as K readings. Residual Astigmatism is automatically computed by measuring total astigmatism and subtracting corneal astigmatism.

The single, compact RK-1 saves space, reduces examination time and provides both refraction and keratometry readings on a single print-out. Best of all, the cost to add this versatile new instrument to your practice is about the same as many popular auto-refractors alone. So no matter how you look at it, it's another sound investment from Canon.



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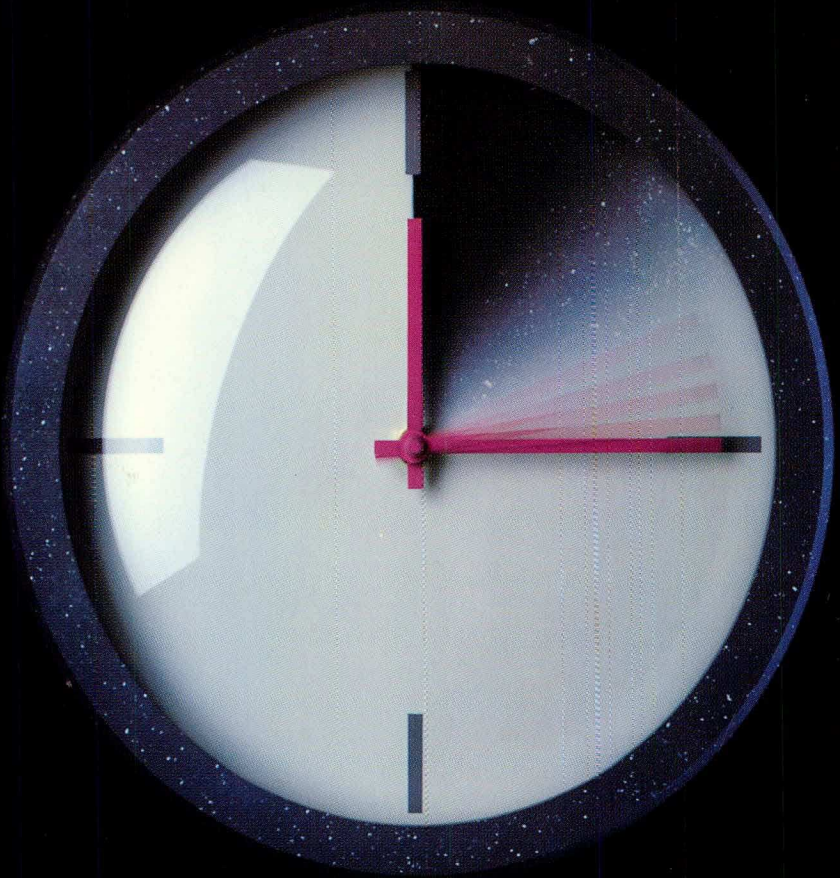
L5T 1P7
(416) 678-2730

Canon RK-1

ULTRAZYME
Protein remover tablets



ONE STEP CONVENIENCE

☐ EFFECTIVE PROTEIN REMOVAL
ULTRAZYME is a unique naturally derived enzyme (Subtilisin-A) that effectively removes protein deposits from all soft contact lenses including high water and extended wear.

☐ ULTRAZYME IS SAFE
ULTRAZYME has a large molecular structure with unique non-binding properties. This formulation is non-irritating, providing safe, comfortable lens wear, even when lenses are soaked overnight.

☐ ULTRAZYME IS CONVENIENT
ULTRAZYME is a one-tablet system which simplifies the lens care regimen. A single tablet used weekly for 15 minutes will remove protein deposits from two lenses.

☐ A SIMPLE COMBINATION
Unique ULTRAZYME and Oxysept 1* work together synergistically. The result of this combination is improved protein removal and disinfection.

*ULTRAZYME can be used with all hydrogen peroxide systems with the exception of AOsept.

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