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**Special Article: Optometry: Its Heritage and its Future. By
Irvin M. Borish**

**Faculty Profile: Debra McConnaha
The Impact of Low Vision Patient Care**

**Review Article: Accommodative Facility Testing as an Indicator
of Accommodative and Binocular Dysfunctions**

In This Issue

Leading off this issue is an article by optometric giant Irvin Borish. It details some of the history of optometry based on his experiences, recollections, and readings as well as some of his recommendations for the profession's future. It, of course, has the intrinsic interest and value that all history possesses, but Borish also spins a cautionary tale. It should be required reading for every optometrist!

Profiled in this issue is Debra McConnaha, who is noted for the low vision care and instruction she provides. She writes about the importance of low vision care and illustrates its impact with some case reports.

The British journal *Ophthalmic and Physiological Optics* recently published a valuable article on the usefulness of accommodative facility testing. That article is reviewed and some additional analysis of the data from that paper is presented.

Lastly, Arthur Bradley shares some of the insights he has gained serving on the FDA Ophthalmic Devices Panel. Recently they discussed a new surgical device for controlling intraocular pressure and ways to study the risk of corneal ulcers from extended wear contact lenses.



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Cover: *Dr. Irvin M. Borish, whose article on the heritage and future of optometry starts on page 23.*

Special Article: *Optometry: Its Heritage and its Future*, by Irvin M. Borish, O.D., D.O.S., L.L.D., D.Sc., D.H.L.

Editor's Note: This paper was presented by Dr. Borish at the Indiana Optometric Association Fall Seminar in October of 2000. The journal board recognized the great significance of his talk, and Dr. Borish was kind enough to let us publish it here. Irv Borish is well known by optometrists everywhere for his many contributions to optometry. Borish was born in Philadelphia in 1913 to Lithuanian immigrant parents. The Great Depression made the choice of career difficult for him. After college, an uncle who was an optometrist drew him to Chicago, where Borish received his O.D. degree from the Northern Illinois College of Optometry in 1934. Following his graduation, he served the Northern Illinois College of Optometry as a professor and administrator. In 1944, he entered private practice in Kokomo, Indiana. Borish worked with the Indiana Optometric Association committee that was instrumental in starting the optometry school at Indiana University. Then while in practice in Kokomo, he served as a part-time faculty member at the optometry school in Bloomington, driving the 180 mile round trip on a weekly basis. In 1972, he retired from private practice, turning the practice over to four younger associates, and took a full-time position on the faculty at IU. Borish retired from IU in 1982. He then was Benedict Professor of Optometry at the University of Houston for several years. The Borish Center for Ophthalmic Research, begun in 1994 at the Indiana University School of Optometry, has received several financial bequests from Borish and his wife Bea. The University of Houston established the Irvin M. Borish Chair in Optometric Practice and the Irvin M. Borish Reading Room in its library. Dr. Borish is well known for the extensive lecturing he has done throughout the United States and many countries, and for the famous textbook *Clinical Refraction*. He has received numerous awards and recognitions, including several honorary degrees, the American Optometric Association Apollo Award (1968), the American Optometric Association Distinguished Service Award (1989), and election to the Optometry Hall of Fame (1998). In 1999, readers of the *Review of Optometry* chose him as "the most influential optometrist of our time."

I. INTRODUCTION

As I anticipated this event, I realized that I have been involved as an optometrist for over 66 years of the life of the profession. When I started the study of optometry, the first law licensing optometrists had been passed only thirty years before.

Despite the maxim by De Rochefouchauld that "old men love to give good precepts to console themselves for being no longer able to give bad examples," I will ask you to make some concession to the influence which experience may exert upon my opinions. To repeat Santayana's oft-cited dictum "he who ignores history may be doomed to repeat it." If we believe that the past had few surprises for us, we may find a surprise-free past a prologue to a future full of surprises. When I entered practice in Indiana, the Secretary of the state optometry board was John Davey, a lawyer as well as an optometrist, who had written the optometry statute. On one occasion he mentioned to me that a provision in the Indiana law required an optometrist to secure a county license and forbid holding more than one county license. The objective was to prevent chains from practicing optometry. "Occasionally someone violated the law and opened a branch office in adjacent counties," he noted, "but we never took such to task. The law is unconstitutional but as long as it was on the books, it deters all but a very few from trying branch offices. I hope no one ever tries to enforce it in court because they will lose and the floodgates will be opened." John died and new appointees to the state board some years later, ignorant of the reasoning when the law was established, did try to enforce it and did lose the case and commercial chains entered Indiana.

II. PAST OF REFRACTION

A. Ancient History

What appear to be magnifying lenses existed in ancient cultures. Spectacle makers guilds appeared in Germany by the middle of the 15th century, and it was the invention of printing in about 1440 that gave wearing of spectacles its greatest impetus. The term optician arose in Germany in

the early 1600s. The first book on the prescription of lenses, essentially the first optometry book, was written in the early 1600s. The use of the term optometry wouldn't arise, however, until the late nineteenth century.

B. Medical Opposition

The first sizable medical treatise on disease and disorders of the eye was by Richard Banister in 1622, who recognized glaucoma but made no reference to lenses. Joseph Beer (1753-1821) was the first to describe the symptoms of glaucoma, but was better known for his opposition to the wearing of spectacles.

Ophthalmology as a specialty began to take form in about the mid 1800s, and established itself finally by about the 1890s. Following the Civil War, it accepted the use of convex lenses for "old sight," but strongly opposed the use of such lenses for eyestrain. Sichel of France originated medical prejudice against the wear of convex lenses for hyperopia, an attitude followed for many years by most ophthalmologists.

Thomas Hall Shastid, a prominent ophthalmologist of his time, cites from personal experience the medical thinking of the post-Civil war period as related to spectacle wear. He cites that Ferdinand von Arlt (1812-1887) called upon the medical profession to fit spectacles and eyeglasses themselves instead of leaving so important a matter to opticians. This was disregarded for a very long time. Shastid recalls how uncorrected eyestrain handicapped him in his youth, and how he was without relief until finally fitted with glasses by a jeweler-optician. His own father, a physician, shared the medical sentiment of the 1880s and swore that the glasses would ruin his son's eyes. So strongly was this sentiment promulgated that many of us in practice years later still often encountered patients who queried us uncertainly as to whether the wearing of glasses would ruin or weaken their eyes.

Sixty or seventy years later, Shastid, still embittered about medical thinking of the time, expressed his feelings: "The M.D.s generally would not recognize even the existence of such a thing as eyestrain. For eyestrain headache, they gave morphin, antipyrin, antifebrin, and the like. Sometimes, in this way, they produced drug habitués. If there was any worse quackery than this of the regular medical profession, I do not know what it was. Yet they called 'quacks' all of us who fitted glasses to the eyes of the young.

"There were certain traveling 'spec-peddlers' who went from house to house fitting glasses and unskillful though they were, relieving many of the simpler cases of eyestrain headache, sick stomach, and nervous disorders. Such men, speaking generally, excited extreme contempt and bitterness on the part of the 'regular' profession, feelings which grew the more the 'spec-peddlers' beat these scientific M.D.s at the treatment of eyestrain and its numerous results....

"Hardly anything that now I can recall served so much to weaken the standing and influence of physicians in any community than this absurd, ridiculous, hard-headed, stubborn ... opposition to the fitting of glasses ..."1

C. Pressure to Reverse Ophthalmology's Stand

George M. Gould, Editor of the journal *American Medicine*, began to crusade against this indifference in the first decade of the 1900s. He pioneered for the "new" ophthalmology which recognized more than disease and surgery, and opposed strongly the development of non-medical refraction. He noted "Poor refraction work on the part of oculists is the greatest cause of skepticism. Those who do accurate refraction know perfectly well that, broadly speaking, the ophthalmologists of the world have done their refraction work badly."2

Despite his efforts, he generally was not taken seriously. Into the late 1800s, much of ophthalmology not only continued to ignore refractive corrections but to oppose them. Ophthalmology's interest then was essentially in disease and surgery, and their training had little relationship to that which was cardinal to refractive expertise. Gould was eventually convinced that much as he deplored the growth of optometry, he could not escape the conclusion that nonmedical refraction came about because of the failure of the majority of ophthalmologists to meet public need. Nor could he escape the admission that the type of nonmedical refraction available at the time was as good as, if not better than, his own profession was able to provide. Donders himself credited the nonmedical refractionists for their work in correcting hyperopia.

Thus, history appears to indicate that we exist as a profession primarily because ophthalmology left a vacuum.

III. OPTOMETRIC INVOLVEMENT

A. Early Optical Establishments

In early America, the lack of optical establishments in an expanding country led to continuation of the peddlers, now disappearing in Europe, who had largely anteceded optical shops. The scheme for testing was a haphazard trying of spherical lenses until a satisfactory lens was found. Prescriptions for both eyes were generally alike. Some optical firms were established, such as that of John McAllister in Philadelphia, considered America's first optical firm, and which continued to operate until well into the twentieth century. It fitted Thomas Jefferson and Andrew Jackson with reading glasses. It was the first in this country to make lenses to correct astigmatism and also began the manufacture of frames of gold and silver. Just as early surgery developed from barber shops, because they had a sharp cutting instrument, much of early American optometry was associated with jewelry stores because the frames which held the lenses were initially made of gold and silver. Optical importers were located with jewelry importers and the first periodical publications on optical devices occurred in jewelry magazines. For example, the original Jewelers Circular Weekly eventually became the present Review of Optometry.

By the time ophthalmology introduced its ill-prepared participation into refraction, optometry was well on its way. Ophthalmology, considering optometry a rival and competitor, strongly opposed its development.

B. Distinction of Optometry from the Practice of Medicine

When the first optometry laws were being passed, the bitter opposition by ophthalmology included the charge made to each legislature that optometry was attempting to encroach upon the practice of medicine without a medical license. Optometry's answer was that "a lens is not a pill," and the distinction between optometry and medicine was emphasized by laws which forbade optometry from using pharmaceutical agents.

C. Characteristics of Optometry When I Began

When I began my optometric career, I entered a field struggling for acceptance and recognition despite the fact that modern civilization could scarcely have progressed without some of the essential services provided for a number of past centuries by optometrists. While individual optometrists established private professional practices, many graduates in the field were still recruited by jewelry stores or optical dispensing chains. The term "optometrist" had come into usage only about fifty years before. To much of the public, optometrists were automatically confused with dispensing opticians. And to many individuals, the term "optometrist" merely designated a fairly skilled craft. To others, the term "optometry" was totally alien. When, as a student, I met my wife, I had to explain to her what it was that I was studying. Even to this day, the total reference to refractive care and its cost is usually directed to the materials, the frame and lenses, neglecting the examination and other related services.

Optometry was unrecognized by government or social and charitable agencies of any sort. In World War II, optometrists could not be used professionally and be commissioned as officers. Every aspect was strongly opposed by organized ophthalmology. Most health columnists, public sources of health care information, and teachers advising students of health care in schools cautioned their readers and listeners away from optometrists. Optical dispensers, who filled ophthalmologists' prescriptions, repeatedly advertised in the newspapers strongly and openly advised the public to resort to an ophthalmologist and secure a "medical eye examination." Reader's Digest shortly thereafter published a most derogatory and widely read article practically designating optometry as a dangerous cult. Major office buildings in downtown Chicago which were occupied by health professionals refused to rent space to optometrists. It was obvious that if optometry were to continue and succeed as a professional endeavor, much had to be done to refurbish its image.

D. Evaluation of the Status of Optometry

The accepted social position of a profession bears distinct relationships to the role which society understands its members play in the social order. It refers to a group of individuals recapturing a sense of vocation and pursuing a learned art as a common calling in a spirit of public service - no less a public service because it is a means of livelihood. If it becomes a livelihood first, and only incidentally a public service, it becomes merely a calling. It is true that certain members of certain professions are accorded status because they attain economic prominence, but it is also true that they are often accorded economic prominence because they are concomitantly accepted as major contributors towards the increased welfare of the society which accords the status.

Many factors help determine the particular place a vocation is accorded. Probably in the forefront is the service which it renders to society. The more critical its services are to the fulfillment of health and comfort, to peace of mind and security, to the social need for interaction and personal relationship, the higher the position such a vocation is likely to assume.

Other characteristics particularize the professional and form an image in the public mind. Among them are personal attributes of its members, such as the extent of its vocabulary, the rhetoric used, intellectual interests, and similar values indicative of educational and cultural involvement beyond the norm. These certain aspects help establish a peer group for evaluation among social estimates. However, foremost is the realization that the vocation commands a broad body of specialized knowledge that is sufficiently defined and delineated so that it readily and universally can be identified by the public.

E. Upgrading the Profession: Educational Base

That basic requirement for proper recognition - the vocation's command of a defined and delineated broad body of specialized knowledge readily and universally identifiable by the public - is not, however, in itself enough. It must also be accompanied by the implication that command of that body of knowledge cannot be achieved without a formal program of education at a high level. In actual fact, the status of the vocation bears a reasonably direct correlation to the length and level of the educational process.

Until the 1900s, the status of medical education had also, to some extent, been in disarray. Consistency of licensure was dubious, and much of medical education consisted of unregulated apprenticeships in physician's offices. The notorious Flexner Report, early in the twentieth century, exposed the huge gaps and irregularities in medical education. It created such a public consternation that a council on medical education to evaluate and accredit medical educational facilities was established, regulations for licensure eligibility were developed, and the present alignment of plausible schools and colleges began. Optometry had taken somewhat the first steps toward similar measures since the licensing laws passed in each state designated the requirements for licensure examination. However, each law included so-called "grandfather clauses" which automatically licensed "by exemption" all individuals whose vocation had embraced refraction and/or spectacles. Consequently, at the time of my graduation, a fairly large number of optometrists were in practice with either little, or at best cursory, formal educational background. Available formal optometric education comprised eight organized institutions in the United States and one in Canada, of which three were affiliated with universities. The length of courses varied, as did the degrees granted. The admission requirements and the curricula were also widely disparate, and the physical resources, faculty qualifications, and clinical and laboratory facilities were mostly rudimentary.

In view of the furor raised about medical education by the Flexner Report, it appeared obvious that an important step towards developing optometry's public image rested in refurbishing its educational base. Thus, shortly thereafter, Eugene Freeman, later the Dean of the Chicago College of Optometry, and I, while we were both colleagues on the faculty of the Northern Illinois College of Optometry, wrote the initial manual of accreditation setting the minimum educational operational standards for schools and colleges of optometry. Concurrently, we were able to persuade the American Optometric Association to re-establish a council on education as an accrediting body, and to have Charles Sheard, who had instituted the first full-time optometry program in an American university at The Ohio State University, to accept the chairmanship of the council. At about the same time, we formed the Association of Schools and Colleges of Optometry, bringing the various institutions together to work for common advantage. This led over the subsequent years to numerous conferences and committee meetings resulting in consistent advancement of the standards throughout the years.

F. Other Impacts

1. Increased Number of Ophthalmologists

During World War II, the United States government appropriated large sums for the expansion of health care educational institutions. Many of the present physical facilities in optometry are a result of that action. A major objective was to increase the number of primary medical practitioners to supplant those conscripted into military service and to anticipate the expected increases in general population. However, much of this appropriation was diverted by medicine to increase the number of residencies in specialties. One result was to very quickly almost double the

number of ophthalmologists.

2. Shifts in Ophthalmology Operations

During those same years, technical innovations changed most cataract surgery from a potentially traumatic, time oriented and hospital necessary surgical process to a relatively simple office ambulatory procedure, while the invention of implants also eliminated the complex optical corrections required post-surgically. As time passed, approximately 75 to 80% of cataract surgery was being performed by from 25 to 30% of the ophthalmologists. The remaining eye diseases and injuries proved markedly insufficient to engage the balance of the ophthalmologists, most of whom then moved en masse into refraction and fitting glasses, the basic mainstay of optometric practice. For a while, the introduction and initial promulgation of contact lenses by optometrists helped alleviate some of the problem, but this, too, was eventually adopted by ophthalmology.

3. Ophthalmological Promotion Against Optometry

Again an open confrontation was raised by ophthalmology against optometry, this time in the area of promotion to the public. Ophthalmological offices handed patients circulars which instructed them that refraction was originally an ophthalmological procedure and since ophthalmologists could also handle all the ocular situations which might be present both within and beyond the scope of optometry, it made sense to see an ophthalmologist who could do the whole job, in the first place. Billboards were put up using prominent personalities such as Bob Hope to advise the public to see an ophthalmologist initially. Despite the advances made and in progress, optometry was confronted with a powerful and threatening competition for the role of the primary eyecare provider.

G. Optometry's Recourse

1. LaGuardia Airport Meeting

In 1967, Alden N. ("Norm") Haffner, President of the School of Optometry at the State University of New York, called me on the telephone, to discuss the situation. He suggested that several progressive thinkers in the field be invited to a special parley. Subsequently, eight of us spent three full days within the LaGuardia Airport Hotel in New York in discussion. Several conclusions became paramount:

(a) To avoid conflict with ophthalmology, the profession was originally forbidden the use of drugs. The acceptance of this restriction had not prevented continued irritation between the two professions and had even been used by ophthalmology to attempt to convince the public of basic optometric inadequacy, despite the fact that optometry had developed skills and services by perfecting specialized techniques, many of which became such standard procedures that they were subsequently adopted by ophthalmology. Among the major health delivery professions, our role as non-drug using and serving a delineated role was paralleled mainly by clinical psychology. Clinical psychology occupied a relationship to psychiatry parallel to that of optometry to ophthalmology, and accordingly had all the same problems of competition and full public acceptance which optometry had.

(b) The length of the educational programs since the first institution of the optometry laws had increased several times over, by about a year for each decade, but the legalized functions of its graduates had remained relatively the same.

(c) It appeared time to more closely correspond the legalized functions to the increased range of education. The image of the optometrist was vastly influenced by the public's perception that "real doctors" were involved with "medicines and drugs." In another vein, the use of pharmaceuticals could be of great potential advantage in increasing the collegiality, communication, and cooperation of the general practitioner of medicine, dentistry, et al. with optometrists.

(d) In this connection, the major promotion and advertising of health care to the public was being taken over by the giant drug companies, who were essentially either ignorant of optometry's role in care (except for contact lens wetting and care products), or found it expedient to promote ophthalmology as wider users of their products.

(e) We anticipated that health care delivery would move steadily towards insurance payments and third party involvement, and that, in its traditionally restricted status, optometry could not readily compete for the role of primary provider against ophthalmology. The argument to the circulars distributed in ophthalmological offices about "the whole job" was a potent one. Why should an insurance company pay a fee to an optometrist who might have to refer a patient to an ophthalmologist to whom the company would then pay an additional fee if that ophthalmologist could

also cover whatever the optometrist would do?

2. Optometric / Ophthalmological Referral

However, even without the matter of third party involvement, optometric referral to ophthalmology often contained its own significant problem. As the optometrist was morally and ethically obligated to refer any case of suspected pathology to an ophthalmologist, most optometrists established specific cooperating relationships with ophthalmologists in their area so that the ophthalmologist carefully returned both the patient and a copy of the findings to the referring optometrist. Many optometrists, salved by the careful and ethical return of their patient and a copy of the findings, failed to realize the ultimate results of the referral. This was brought home to me by a personal incident in my own practice.

During the early days of contact lenses, I was possibly the first practitioner in my area to expand my contact lens practice. Many of my colleagues were not involved, and referred such of their patients who insisted on contact lenses to me. On one occasion one of them in a nearby town sent a young woman to me for that purpose. In those days dealing with impermeable polymethylmethacrylate lenses, it often took a number of visits to both build up wearing time and reshape the contact lens curvatures to secure the maximum tear interchange to the cornea. Thus, it took a number of visits over a number of weeks to finally reach full time satisfactory wear. Therefore, I got to know the mother, who had accompanied her daughter at each visit, as well as the patient. When we had reached the stage where the lenses were being worn full time comfortably, I informed the daughter that my work was finished, that I would send the doctor who had referred her a full report and a copy of the record, and that she was to consult him in the future for any problem and he would decide whether she needed to see me.

Some months later, I entered one of our examination rooms to examine a new patient and found the mother seated in the examination chair. "Is something wrong with (daughter's name, which I have since forgotten)?": I asked. "Oh, no, " she replied, "I'm here for myself." "Do you want contact lenses?" I asked. "No," she replied, "I'm here for glasses."

The return of the patient involved in specific referral is relatively insignificant. Many patients interpret the referral as an upward shift in competence. If the ophthalmologist also refracts, there is distinct possibility that in the future, the patient might point his family or friends directly to the ophthalmological office for even future refractions. As optometrists began to realize this, the concept of optometrically involved referral centers developed. The success of many of these indicated that optometrists would be better served by referring to the third level of ophthalmological specialists who were not interested in refraction.

H. Breaking the Drug Barrier

For all these reasons, we came to the conclusion that it was time to break the drug barrier, and to expand the scope of optometric practice. The most justifiable and logical approach was the use of diagnostic drugs since it seemed incredible that anyone could logically oppose increasing the ability of optometrists, who still saw the majority of eye patients, to secure a better view of the fundus.

We decided that if ophthalmology questioned our decision to the American Optometric Association (AOA), the AOA should take the position that this was in no wise a measure endorsed by the AOA, but represented only a small fringe group of irregular fanatics whom they had no control over. In the meantime, we would start to alter the curricula in our schools to include more pharmacology and its related essentials.

We knew that our proposal would create a problem for the Board of the AOA. A number of years before, the AOA had officially passed a resolution which defined refraction as the practice of optometry. The ophthalmological section of the American Medical Association (AMA) at its next meeting in Atlantic City, obviously chagrined at the competition resulting from its own neglect, adopted a notorious resolution who forbade any member of the section from even acknowledging referrals from, consulting with, lecturing to, teaching, or otherwise conferring with an optometrist. Despite many efforts by the AOA, including withdrawing its own resolution, the status persisted for several decades with obviously dire public relations for optometry. Among other things, it helped delay the formation of the school at Indiana University, since the head of its ophthalmology department was also the Secretary of the Section on Ophthalmology. It was only finally rescinded by pressure from the AMA itself in response to a warning from an individual optometrist, incidentally not even a member of the AOA, who threatened to sue the AMA for restraint of trade. We knew that the

AOA Board would immediately recall this and in fear of renewing a similar violent reaction would have little heart to engage in another confrontation.

Some opposition came from some optometrists who interpreted this movement as possibly diverting attention away from the uniquely optometric concepts of the enhancement of vision. Many optometrists also opposed a deviation from the drugless legacy which had originally helped establish optometry as a distinct profession. Revision of the premises upon which our profession had developed concerned many optometrists who had come to see our "drugless" heritage as our characteristic of professional individuality.

Sometime after the LaGuardia meeting, Norm Haffner was a principal speaker at the New England Council of Optometrists meeting in Boston, and recited the events at LaGuardia and the reasons for taking the stand I just described. Mort Silverman, an ex-President of the Rhode Island Optometric Association, was in his audience, took the message to heart, and returned home to approach some of his close friends in the Rhode Island legislature. Before we really got started on the plan for our curricula, and while still debating the issues at conferences, the change was begun by the practitioners in the legislature of Rhode Island, followed by West Virginia. (Indiana optometry statute of 1935 established diagnosis by "any means," thus allowing pharmaceutical authority.)

IV. AT PRESENT

Through those years, we consistently struggled with the other social elements which comprised the total professional image. We continued to be particularly effective politically. Ophthalmologists usually congregated in larger communities with available surgical facilities, while optometrists tended to gravitate to communities of smaller population. This demographic distribution enabled optometrists to be actively associated with the majority of legislators representing their districts.

The challenge to secure appropriate social status had undeniably been a factor in the motivation of the professions's leaders. The essential driving force stimulating the optometrist is probably closely identifiable with the nagging forces which motivate any minority group. We are a small and tightly knit group, a minority profession, and like all minorities we are highly sensitive to allusions and inferences. All minorities become well organized, and are aggressive, assertive, and defensive. This becomes practically a necessity since appeasement usually gains little but surface acceptance. It becomes necessary to strive mightily and labor more forcibly just to reach equivalence. But it is this very contentiousness which has proved the agency for our progress. It has been said that when times are good for optometrists, they are bad for optometry; and when times are bad for optometrists, they are good for optometry.

A. Present Educational Status

The numbers of years making up our educational programs has increased by an average of one year each decade of our existence until a curriculum fairly uniform to comparable professions was reached. Today we exhibit fairly standard entrance and pre-professional requirements, a common doctoral degree, and extension of academic accreditation by the respective regional university accreditation agencies as well as accreditation by the professional council. At the present time, there are no longer any proprietary educational institutions. Eighteen schools are accredited in the United States, Canada, and Puerto Rico, thirteen of which are affiliated with universities. Numerous alumni with graduate degrees from optometric schools hold significant research appointments in major medical and scientific institutions and serve as board members or investigators for the National Institutes of Health.

B. General Situation

Optometry is recognized by all public health agencies and optometrists are commissioned by all branches of the military services, including an optometric appointment in the federal Veterans Administration. Almost all optometry schools carry on externship programs in Veterans Administration hospitals, and optometrists hold increasing numbers of staff positions in many other public hospitals and clinics. Insurance and third party health care agencies cite optometric organizations and include optometry in their programs. Most health care columnists no longer ignore or exclude optometry or its recommendations. Optometric practitioners and faculty members serve as consultants and members of governmental and social boards and commissions. Optometry also set an example in the establishment of continuing education as a qualification for relicensure.

C. Concurrent Developments

1. Shift in Optometric Emphasis

The expansion of the scope of optometry has not only affected practice, but also our curriculum and continuing education. A decided shift in time and emphasis has taken place from geometrical and physiological optics towards pharmacology and disease. A major problem is that the increase in scope demands additional examination procedures. If the refractive portion of the examination is maintained at the level heretofore associated with optometric care, adding these extra tests requires more time per each examination. Either the number of examinations must be reduced, or the cost per examination increased. Neither is economically and competitively feasible for most practitioners. The result has been a reduction in the time allotted to and the practitioner's concern for the refractive portions of the examination. Many of the skills which heretofore placed the optometrist in the forefront of refractive service seem rarely considered today.

Let me emphasize that I mention this not as an expression of opposition to the increased scope of practice. Obviously, it has served to answer a number of the original considerations which motivated the conferees at LaGuardia. But at the same time, a dangerous trend appears to be developing. The vision was that the scope of optometry would be increased in the form of an expanding circle, extending beyond but maintaining its original core of refractive expertise. What we see happening is rather a lateral shift of scope from refractive expertise, towards the area of diagnosis and treatment of disease. Our profession appears to be in danger of repeating the sad history of ophthalmology by leaving the same vacuum for someone else to fill that ophthalmology left for optometry.

The economic resultant actually cautions strongly against this. In a study compiled by Irving Bennett a few years ago, the distribution of values within the total ophthalmic market were distributed as follows:

Total market, ignoring sunglasses: \$19 million
Examination of the eyes: 10.5% (\$2 million)
Disease and injury: 5.2% (\$1 million)
Surgery and implants: 18.4% (\$3.5 million)
Spectacles, etc.: 65.8% (\$12.5 million)

The actual figures may vary some nowadays, but the ratio is probably not too much different.

These figures reveal why, as was noted earlier, many ophthalmologists who were not sufficiently occupied with cataract surgery turned to refraction. A still consistent drive to claim refraction as originally ophthalmological persists.

2. Surgical Refraction

Surgical treatment of refractive anomalies has arisen to supplant the surgical vacancy. The present day laser techniques offer more precision than the initial forms of surgical refraction. A significant question is the long term effects which time will uncover. The limitations are the inapplicability of the technique for the still growing child whose ocular structures remain in flux, and the presbyope who still may need corrections for nearpoint. The growth of surgical refraction appears to be increasing as its promotion to the public also increases by ophthalmologists offering it.

V. CONSIDERATIONS FOR THE FUTURE

It appears obvious that it is essential that optometry not lose its sharp cutting edge advantage in the field of refraction. This probably means a need for broad changes in the mode of practice to accompany the changed scope. The following considerations may help to guide these broad changes:

A. Third Party Systems / Group Practices

The typical practice management courses in our schools are directed towards the single professional practitioner in a one person office. It is becoming apparent that such practices are at a great disadvantage in competing for third party contracts, in affording the most effective types of equipment, and in employing ancillary personnel for test delegation. The viable role of optometry in the third party health care delivery system must still be properly defined, clarified, and firmly established. The present scene reveals that physicians are meeting the competition of HMOs by organizing group practices under their own administration. It would appear that optometrists also should consider doing likewise or joining multidisciplinary groups which afford them appropriate involvement of ownership and/or administration.

B. Delegation to Ancillary Personnel

Optometrists, in the main, continue to be their own technicians. They continue to collect data which any trained technician could collect just as well. Delineating the time of examination appropriately so as to include the newer tests of the increased scope without relinquishing the traditional tests upon which our established expertise was based requires that those tests which are purely quantitative (i.e., whose results are purely a numerical figure) be delegated to trained ancillary personnel so that the optometrists can concentrate their time upon those tests which are qualitatively interpreted (i.e., depend upon the examiner's trained judgement). For example, physicians can delegate the blood pressure test or measurement of weight or pulse rate to nurses, but reserve the stethoscopic evaluation of the chest to themselves. Optometric education must begin to incorporate such ancillaries in their training clinics to familiarize their graduates with such cooperation, as medical schools do with their nurses and technicians for their interns. The expense of such ancillary personnel is best borne by a multiple individual practice, since the cost of each ancillary is divided among several practitioners.

A second advantage beyond efficiency of and caliber of practice is that added employees of a practice serve to increase promotion of that practice. During the later years of my practice, a new ophthalmologist opened a practice nearby. He immediately employed eight people in his office - receptionist, nurses, technicians, dispenser, etc. One of the people he employed was a woman who had been my patient for a long time. I began to hear subsequently from some of my patients with whom she was friendly that she was putting out great effort to persuade them to shift to her new employer. It brought home to me that an ophthalmological office with eight employees had a great promotional advantage over the typical optometric office with usually only a receptionist employed.

C. Automation

Automated instrumentation, especially those with specific functions, serves better to keep the examination processes at a high and speedy level, thus assisting with the time elements of an examination. Because they are usually quite expensive, they are more readily included and utilized in a group practice.

D. More Effective Testing Techniques

Many optometrists become confirmed in the specific techniques which they learned in school and continue to use them throughout their careers. In certain instances, techniques have been developed which not only provide more accurate data in less time than those so learned, but also cue the examiner as to necessity of testing for other aspects, thereby saving significant amounts of time in the examination. For example, binocular subjective refraction readily indicates whether suppression, vertical imbalances, and fusional difficulties exist without leaving the subjective routine of refraction.

E. Surgical Refraction

The question of surgical refraction as an alternative to spectacles or contact lenses must be faced and its role as part of the full scope of optometric practice delineated. Some optometrists have developed a solution for the process of surgical refraction by allying with the clinical agencies which provide the service and functioning as ancillaries for pre- and post-surgical coverage. If we recognize that the precise surgical process essential to the results is not in itself dependent upon human surgical skill, but upon computerized measurements, calculations and procedures which are within the scope of scientific optometry, the question of utilization by optometry in the future may be considered.

VI. CONCLUDING COMMENTS

We should be quite pleased with the expansion of scope of optometry witnessed in recent decades, but we must be very careful to not leave a vacuum in the leadership role in refractive care. Please join with me in working for the long term vitality of optometry and its important role in health care.

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Faculty Profile: *Debra L. McConnaha, O.D.* by *David A. Goss.*

Low vision patients visiting the Indiana University optometry clinics are in the very capable hands of Debra McConnaha. McConnaha was born in Würzburg, Germany, while her father was serving in the United States Army. As a small child she moved to Lebanon, Indiana. She lived there until moving to the South side of Indianapolis as a teenager.

When McConnaha attended Indiana University as an undergraduate, she had no thought of becoming an optometrist. She completed a B.A. degree in biology in 1976, and went to work as a research associate in biochemistry and biophysics at the Medical Center in Indianapolis. Then she worked as a quality control chemist at Ford Motor Company in Indianapolis checking and monitoring solutions and oils. When the auto industry was depressed in the late 1970s, she was laid off at Ford. She thought that would be a good time to go back to school. She decided that she wanted a career that was patient care oriented. Lebanon optometrist Richard Hall, to whom she had been going for vision care since a child, influenced her to go into optometry.

Dr. McConnaha graduated from the Indiana University School of Optometry in 1984. She first became interested in low vision as a second year optometry student when her grandmother started suffering from vision problems due to macular degeneration. In 1984-85, she completed a residency in Low Vision and Rehabilitative Optometry at Southern California College of Optometry and the Los Angeles Veterans Administration Outpatient Clinic, with additional interdisciplinary training in geriatrics at the Sepulveda Veterans Administration Medical Center. For three years after her residency, she was a Clinical Instructor in primary care and low vision at the Southern California College of Optometry in Fullerton. She also practiced part-time for a year and a half for Wayne W. Hoeft, O.D., and Associates, in Hollywood, California, providing low vision and primary care services.

In 1988, Dr. McConnaha returned to Indiana, taking a full-time position as Clinical Assistant Professor and Chief of Low Vision Services at Indiana University School of Optometry. She took over the low vision service at the Indianapolis Eye Care Center and established a low vision clinic at the Community Eye Care Center in Bloomington. Since that time she has supervised numerous interns in the low vision clinics at those locations. From 1988 to 1997, McConnaha taught the School of Optometry's courses in low vision, rehabilitative optometry, geriatrics, and gerontology. She developed the concept and the initial syllabus for the geriatrics course and worked successfully to have it included in the curriculum. In January of 1998, she reduced her position at the School of Optometry to 60% time. At present she also practices at Dixon Eye Care Center in Greenwood, Indiana, where she provides primary care, contact lens, and low vision care. McConnaha is active in a number of optometric and low vision organizations, including the American Optometric Association Low Vision Section, (charter member), Indiana Visually Impaired Services Alliance, and Indiana Low Vision and Rehabilitation Society (Vice President).

Dr. McConnaha enjoys low vision work for several reasons. Many people write to express their gratitude for being able to return to a job or an activity that had been placed in jeopardy due to their vision problems. The many thank you notes she receives from patients and their family members are very rewarding. Family members often write to thank her for explaining the vision conditions of their loved ones and why they see the way they do. McConnaha likes the optical and patient management challenges of helping people do what they want to do because every patient is different. While magnification is the staple of low vision practice, success in low vision care often requires other approaches, such as controlling glare or teaching eccentric viewing, and it always requires good doctor-patient rapport. McConnaha also enjoys the interaction with the teachers, physicians, and other rehabilitation professionals necessary in low vision care. When she is away from work, she goes ballroom dancing with her husband Kirk, does gardening and landscaping at her home, serves as a Board member at her church, and spends time with her 14 year-old daughter Katie.

Featured Review:

The Impact of Low Vision Patient Care, by Debra McConnaha, O.D.

Widespread awareness of the importance of low vision care and rehabilitative optometry has been slow in coming. On October 19, 1999, the National Eye Institute launched the Low Vision Education Program as part of the National Eye Health Education Program. This program is designed to educate professionals and consumers about low vision and available services. It is noteworthy that the Indiana University School of Optometry started its own program of patient care and student education in low vision 25 years earlier.

In December, 1976, IU's Illinois Street Clinic opened in downtown Indianapolis with funding from the Indiana State Office of Vocational Rehabilitation to provide low vision services. That agency recognized that providing vision rehabilitation services to clients would improve their employability ("quality of life" was not yet a familiar term), and the School of Optometry had an opportunity to provide education in the specialty areas of low vision rehabilitation to fourth year interns.



Dr. McConnaha

Over the ensuing years, changes in location, funding, referral sources, and patient demographics have occurred. The Low Vision Service currently operates out of both the Indianapolis Eye Care Center and the Community Eye Care Center in Bloomington. Although the state is still a significant source of patients, well over half of the patients are referred by area ophthalmologists and optometrists. Many patients are seniors with no vocational goals but a need to maintain independence and quality of life.

The mission of the School to educate students in all aspects of optometric care still results in fourth year interns learning not only the technical and optical facets of rehabilitative optometry, but also the physical, financial, and emotional impact of vision impairment on the individual. Patients with low vision have differing needs and goals for daily living. Patient management in low vision must take those individual factors into account. Interns rotating through the Low Vision Service learn how to think beyond visual acuity and medical condition to the way the patient functions outside the exam room.

Low vision rehabilitation sometimes has been referred to as "slow vision" because of the extensive time involved in a thorough evaluation of the patient's visual status, goals, and response to optical devices. This type of care also requires an ability to manage the psychological upheavals the patient and their families may be undergoing. However, the potential rewards are great for all parties concerned.

The three most common goals for visually impaired individuals are reading, driving, and controlling glare. For young patients, meeting these goals allows them to gain independence and "live their own lives." For older patients, losing the ability to drive is yet another loss in what is frequently a series of losses, and an inability to read may force them to give up managing their own finances. Controlling glare not only increases visual comfort, but also improves safety and mobility.

Every doctor can cite examples of how providing an accurate pair of spectacles or properly diagnosing an optometric condition or a medical condition enhanced a patient's quality of life, or even saved their vision. In low vision rehabilitation, such stories occur daily, as shown by the following three examples (names have been changed for patient confidentiality):



Bioptic driving requires expert fitting of the system and extensive training in its use.

Patient 1. Brian was born with achromatopsia and myopia. When first seen in the Low Vision Service, he was a rebellious college student with poor compliance on rigid gas permeable contact lens wear and follow-up. He was extremely bright, and due to determination and parental support, he was doing well in school with no optical devices and only over-the-counter sunglasses. Over the next couple of years, he was convinced of the necessity for proper contact lens wear regimens and follow-up, and we found a

combination of filters that allowed him to function with relative comfort in different lighting conditions without making him look "different" (cosmetic appearance is frequently important). He refused to use any magnifiers, but finally realized that the use of a VisualTek closed circuit television (CCTV) system allowed him to keep up on reading and writing assignments more easily.

After graduation, Brian was hired in the Human Resources department of a large corporation. They provided him with a CCTV at work and he continued to use his VisualTek at home. He also took up scuba diving as a hobby. He returned to the clinic asking if there was a way to reduce glare underwater - night diving was not a problem.

Since his favorite filter was a PLS 550, a dark red filter similar to the X-Chrome lens used for color defectives, we ordered a pair of X-Chrome contact lenses. They worked beautifully for glare control, so that he wore them during daytime hours for all activities. He commented that they enabled him to see stoplights, brake lights, etc., more easily.

Brian had long ago resigned himself to never being allowed to drive. However, his acuity, response to magnification, and ability to detect lights were so improved by the new lenses that we fit him with a bioptically mounted telescope and entered him in the Indiana Bureau of Motor Vehicles bioptic driving program. He almost crushed my ribs hugging me the day he received his driver's license. Brian is now a Director of Human Resources, married, a published author of a horror novel, still scuba dives regularly, and happily drives wherever he wants to go.

The challenges posed by managing a patient with acquired vision loss can be quite different. For one thing, there is the natural response of comparing how the vision is with optical or electronic devices with how it used to be with standard spectacles. In addition, these patients are frequently dealing with many other physical, financial, or emotional changes in their lives. Sometimes these patients respond very well to multiple and sophisticated devices which require extensive training, such as bioptically mounted telescopes, microscopic doublets, pocket magnifiers, CCTVs, and indoor and outdoor glare control filters. In other cases, all that is possible on the first evaluation is a careful explanation to the patient and family of the functional effects of the vision condition, a simple lighted pocket magnifier for checking mail and reading price tags, a pair of outdoor glare control filters, and referral for an in-home visit from an occupational therapist or rehabilitation teacher.

Patient 2. At the age of 37, Karen was devastated by sudden vision loss in both eyes from subfoveal hemorrhages secondary to ocular histoplasmosis. A single mother employed in the customer service industry, legal blindness left her unable to function at work, reliant on her twelve year old son for many household functions, and severely clinically depressed. She was referred to the Low Vision Service by her retinal specialist for assistance in reading, cooking, seeing bus signs, controlling glare, and hopefully returning to work.



Visually impaired adults and children use electric magnification and contrast reversal to read.

Karen responded beautifully to magnification, bursting into tears when she was able to read newspaper print with high plus prism half eye readers. We prescribed the readers along with a hand-held telescope for distance spotting, a small lighted pocket magnifier for shopping, and wrap-around filters for glare control outdoors. She also responded well to electronic magnification.

Due to her difficulty with household chores and her desire to return to work, we referred her to the Department of Aging and Rehabilitation's Office for Services to the Blind and Visually Impaired for evaluation and training. After undergoing daily living skills as well as extensive education in the use of a CCTV and adaptive computer equipment, she returned to work.

Over the past five years, Karen has experienced some additional decrease in her vision. However, she now returns with the expectation that we will be able to assist her by changing her assistive devices and is generally upbeat about her life. She now uses a high add bifocal, two different filters depending upon lighting, her telescope, and of course her CCTV and adaptive computer equipment (upgraded, of course, as needed). She also uses a Beecher 7x spectacle telescopic system to watch her son, a star football player, on the field.

For a senior with age-related macular degeneration, low vision rehabilitation can mean the difference between staying in his or her own home and moving into assisted living or a family member's home. The major problems encountered in these cases are shopping, reading mail, handling finances, cooking, laundry, and cleaning. There are also frequently transportation issues as

many of these individuals are not good candidates for bioptic driving.

Patient 3. Jenny was an 87 year old widow who was referred to us by her optometrist after she told him that her family was considering moving her to a nursing home due to their concern about her ability to function safely. Her daughter brought her in and explained that someone from the family stopped in every day to check on her. Since everyone in her extended family either worked or was too young to drive, they took turns coming in the evenings to read her mail to her and prepare her dinner. They also did her grocery shopping, picked up her prescriptions at the pharmacy, and took her to the doctor and church.

Jenny appreciated her family's concern, but wanted to be more independent and was adamant about staying in her own home. She was willing to try anything in order to do so. Fortunately, she responded very well to low vision devices, preferring a small lighted pocker magnifier for reading her mail, price tags, and stove dials. She decided that she was not comfortable with the electronic magnification options as they were "too much like a computer," and so chose a 4x microscopic doublet for reading. She also appreciated the contrast enhancement of a light amber filter.

Many of Jenny's goals could be met by non-optical methods and daily living skill training. After discussion with her daughter, she chose to have an in-home evaluation by a rehabilitation teacher and she also had an orientation and mobility assessment. We also discussed the availability of large print utility bills, free directory assistance from the phone company, transportation services for the elderly and disabled, and the use of handicapped parking placards by family members transporting her.

Ultimately, Jenny was able to stay in her home and function independently for several years. Her family contacted her daily by phone and took her shopping weekly. She used transportation services on a regular basis but also enjoyed outings with family members more now that she wasn't dropped at the door while they parked the car, but rather they used the handicapped spaces and walked with her. Even after she had a stroke and was forced to move into an extended care facility, she continued to use her microscopic doublet successfully.

The need for low vision services is increasing because the older population is increasing in numbers and because people today look for ways to improve quality of life rather than accepting severe restriction of daily activities due to vision loss. Due to the increasing need for these services, more research is being done in developing options for low vision patients. Of course, just as in all parts of our lives, the use of technology is increasing in low vision services. As demand has increased, variety and availability have increased and costs are starting to come down.



Simple lighted magnifiers enable patients to perform many daily living tasks, such as reading medication bottles.

New technology ranges widely, from autofocus telescopes to head-mounted videomagnification systems to computer voice recognition software. While these new devices can make significant changes in a patient's visual function and quality of life, they are additions to our "low vision toolbox," not replacements. There will always be a need for thorough visual function assessment, careful trial frame refraction, and evaluation of "low tech," traditional low vision devices in order to provide the optimum care to visually impaired patients.

The examples given in this paper show that real successes are possible in low vision. Patients may be able to resume or start activities or jobs that would not have been possible without low vision rehabilitation. Low vision care can be very beneficial and exciting for the patient and very gratifying and rewarding for the doctor.

Review of Article of Interest: *Accommodative Facility Testing as an Indicator of Accommodative and Binocular Dysfunctions.* Review by David A. Goss, O.D., Ph.D.

García A, Cacho P, Lara F, Megías R. The relation between accommodative facility and general binocular dysfunction. *Ophthal Physiol Opt* 2000; 20(2): 98-104.

The purpose of this study was to evaluate the relation of accommodative facility rates with accommodative and non-strabismic binocular vision dysfunctions. The authors hypothesized that "a patient with an accommodative problem would have problems with monocular accommodative facility whereas if a patient fails the binocular test, a binocular problem should be deduced." If their hypothesis is supported by the data, then accommodative facility testing can be helpful in detecting accommodative and binocular problems.

Subjects and Methods

They tested 48 subjects with ± 2.00 D lens flippers. The subjects were optometry clinic patients. The subjects ranged in age from 10 to 30 years (mean, 21.8 years), and included both males and females. All subjects had normal ocular and systemic health, and at least 6/6 monocular corrected visual acuities. None of the subjects wore contact lenses.

Subjects were classified into one of four categories: (1) accommodative dysfunction, (2) binocular dysfunction, (3) both accommodative and binocular dysfunction, and (4) no accommodative or binocular diagnosis (normal group). Accommodative diagnoses included accommodative insufficiency and accommodative excess. Binocular diagnoses were mostly convergence excess and convergence insufficiency, and there was one with divergence excess. Diagnoses were based on a standard battery of accommodation and vergence tests.

Accommodative facility was tested with the Bernell acuity suppression slide 40 cm from the spectacle plane. Polarizing glasses allowed monitoring for suppression. Subjects were instructed to say "now" when the middle line on the Bernell slide was clear and single and all letters on all three lines were seen. The examiner flipped the lenses at each "now" response. Testing started on the plus side of the $+2.00$ D flippers, and continued for one minute. The number of cycles per minute (cpm) was counted and recorded. In the few instances when subjects reported constant blur, suppression, or diplopia, a rate of 0 cpm was recorded. Testing was done first with the right eye,

	<i>Right Eye</i>	<i>Left Eye</i>	<i>Binocular</i>
Accommodative dysfunction (n=13)	5.7 \pm 3.0	5.6 \pm 2.9	7.5 \pm 3.2
Binocular Dysfunction (n=11)	12.6 \pm 4.2	12.7 \pm 3.6	5.2 \pm 3.8
Accommodative and Binocular Dysfunction (n=12)	8.9 \pm 5.0	8.3 \pm 4.6	7.1 \pm 4.1
Normal Accommodation and Binocularity (n=12)	13.4 \pm 2.2	13.0 \pm 2.3	13.1 \pm 2.5

then with the left eye, and binocularly last. Right eye and left eye results were very similar, so only the right eye and binocular data were analyzed.

Based on norms from Zellers et al.,¹ monocular rates were failing if they were 6 cpm or less, and suspect if they were better than 6 cpm and less than 11 cpm. Binocular rates were classified as fails if they were 3 cpm or less, and suspect if they were above 3 cpm but less than 8 cpm.

Table 1. Mean \pm standard deviation accommodative facility flipper rates in cycles per minute for each of the study groups.

Results

The mean flipper rates for the four groups are given in Table 1. Each of the dysfunction groups differed significantly (at the 0.05 level) from the normal group on the binocular flippers. On the monocular (right eye) flipper rates, the means for the accommodative dysfunction group and the

combined accommodative and binocular dysfunction group were significantly different from the mean for the normal group. The binocular dysfunction group right eye rate did not differ from the right eye rate for the normal group.

	<i>Pass</i>	<i>Fail or Suspect</i>
Accommodative dysfunction		0 13
Binocular Dysfunction	8	3
Accommodative and Binocular dysfunction	4	8
Normal Accommodation and Binocularity	11	1

Table 2. Number of subjects in the pass category (11 cpm or better) and in the fail or suspect categories on the monocular (right eye) lens flippers.

Table 2 shows that the monocular flipper rate was excellent in detecting accommodative dysfunction and quite good in detecting combined accommodative and binocular dysfunction, but not effective in detecting binocular dysfunction. Table 3 shows that binocular accommodative facility was good in detecting binocular dysfunction, but not effective in finding accommodative dysfunction.

	<i>Pass</i>	<i>Fail or Suspect</i>
Accommodative dysfunction	8	5
Binocular Dysfunction	4	7
Accommodative and Binocular dysfunction	6	6
Normal Accommodation and Binocularity	12	0

Table 3. Number of subjects in the pass category (8 cpm or better) and in the fail or suspect categories on the binocular lens flippers.

Authors' Conclusions

The authors concluded that the study data "supported a relation between reduced accommodative facility and a general binocular dysfunction (accommodative or binocular) which demonstrates the importance of the accommodative facility test in diagnosing an accommodative or binocular anomaly." They noted that other parts of the accommodative and binocular work-up are needed for a definitive diagnosis.

<p>$Sensitivity = TP / (TP + FN)$ $Specificity = TN / (TN + FP)$ where: TP = true positives (number of subjects who did not pass accommodative facility and who were diagnosed with an accommodative and/or binocular dysfunction) FP = false positives (number of subjects who did not pass accommodative facility but who were in the normal accommodation and binocularity group) TN = true negatives (number of subjects who passed accommodative facility and who were in the normal accommodation and binocularity group) FN = false negatives (number of subjects who passed accommodative facility but who were diagnosed with an accommodative and/or binocular dysfunction)</p>

Table 4. Formulas for sensitivity and specificity.

Comments - Are the Zellers et al. Norms Appropriate?

This paper used the Zellers et al.¹ norms for passing (at least 11 cpm on the monocular flippers and at least 8 cpm on the binocular flippers). The authors did not attempt to assess whether a different cut-off would be better in distinguishing between normal and dysfunction cases. To do so, we can apply the concepts of sensitivity and specificity from epidemiology. Sensitivity is the proportion of dysfunction cases which are correctly identified by failing the test. Sensitivity is calculated by dividing the number of true positives by the sum of the true

positives and false negatives (Table 4). Specificity is the proportion of normal cases which are correctly identified by passing the test. Specificity is calculated by dividing the number of true negatives by the sum of true negatives and false positives.

Using a value of less than 11 on the monocular flippers (same as the cut-off for fail or suspect in the Zellers et al. norms), the sensitivity for identifying accommodative and/or binocular dysfunction is 66.7% and the specificity for identifying normals is 91.7% (Table 5). No other cut-off level increases the sensitivity and specificity.

With a cut-off of 8 cpm for passing the binocular flippers (same as Zellers et al.), the

<i>Test Failure (cpm)</i>	<i>Sensitivity</i>	<i>Specificity</i>
Less than 11 on monocular flippers	66.7	91.7
Less than 8 on binocular flippers	50.00	100.00
Less than 10 on binocular flippers	69.4	100.00
Monocular-binocular difference greater than 4	33.3	100.00
Monocular less than 11 OR Binocular less than 10 OR monocular-binocular difference greater than 4	91.7	91.7

sensitivity is 50% and the specificity is 100% (Table 5). Sensitivity is maximized to 69.4% and specificity is still 100% by shifting the cut-off to 10 on the binocular flippers.

The mean flipper rates for the binocular dysfunction group were much lower on the binocular flippers than on the monocular flippers, so perhaps finding the difference between monocular and binocular rates may be helpful in detecting binocular dysfunction. To my

Table 5. Sensitivity and specificity using various failure criteria.

knowledge, no norms have ever been given for the difference between monocular and binocular facility rates. In this study, 8 of 11 binocular dysfunction cases had a difference between monocular and binocular rates greater than 4 cpm, but none of the normals did. The difference between monocular and binocular rates was usually less than 4 in the accommodative dysfunction cases, so the sensitivity for all dysfunction cases was only 33.3% (Table 5).

The accommodative dysfunction cases had low monocular and/or binocular rates, but usually a normal monocular-binocular difference. The binocular dysfunction cases usually had a low binocular rate and/or a high monocular-binocular difference, but a normal monocular rate. We can ask whether using a failure criterion employing all three aspects - monocular, binocular, and monocular-binocular difference - would optimize sensitivity and specificity. In fact, that turns out to be correct. With a failure criterion of monocular less than 11 cpm, OR binocular less than 10 cpm, OR monocular-binocular difference greater than 4 cpm, the sensitivity is 91.7% and specificity is 91.7%! These are quite high levels for any test.

Comments - Use of Flippers to Screen for Accommodative and Binocular Dysfunction

These high sensitivity and specificity levels suggest that lens flippers can make a good screening test for accommodative and binocular disorders. In this issue of the journal, Borish² points out how important it is for optometry to maintain its traditional strengths. Testing for accommodative problems and non-strabismic binocular vision problems has for many years been a strength of optometry. To help maintain the traditional strengths, Borish advocates the use of highly effective tests and increased use of technicians in testing. The results of this sensitivity and specificity analysis suggests lens rock accommodative facility to be a very effective test. It probably also is a test that could be routinely delegated to a skilled technician. The results suggest a failure criterion of less than 11 cpm on monocular +2.00 D flippers, or less than 10 cpm on the binocular +2.00 D flippers, or a monocular-binocular difference greater than 4 cpm. If the patient fails this test or other appropriate routine binocular vision tests, then a complete battery of accommodation and vergence tests could be performed to make a diagnosis.

General Comments on Lens Rock Testing

The subjects in this study were 10 to 30 years of age. The relationship of accommodative facility and ocular symptoms has been demonstrated for school-age children,^{3,4} but one study of 45 adults between the ages of 30 and 42 years did not find a significant difference in facility rates between symptomatic and asymptomatic groups.⁵ Clinicians have observed that young children often have difficulty with accommodative facility testing because of its subjective nature. So the age range of 10 to 30 used in this study may be close to the optimal age range for use of accommodative facility testing. Kedzia et al.⁶ described an apparatus designed for use with young children, and presented some preliminary data on 7 to 10-year olds.

Average flipper rates reported in the literature in different studies have varied quite a bit because different testing methods were used.⁷ Accommodative facility rates increase as letter size

increases, lens power decreases, or test distance decreases.⁸ Therefore, the failure criterion levels suggested by this analysis apply only to the test procedures used in this study.

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Report from Washington. *by Arthur Bradley, Ph.D.*

The November 8, 2000 FDA Ophthalmic Devices Panel included four optometry representatives (myself, Dr. Mark Bullimore from The Ohio State University, Dr. Clifford Scott from New England College of Optometry, and Dr. Jan Jurkus from Illinois College of Optometry). The panel examined the safety and efficacy of a new surgical device for lowering intraocular pressure (IOP), and we advised the FDA on how best to develop a study protocol to identify if new extended wear contact lenses pose unacceptably high risks of corneal ulcers.

The morning session examined the efficacy and safety of a new porcine collagen insert designed by Starr Surgical to lower IOP in patients who are not responding to medications. The device, which is inserted deep into the limbal region of the sclera, acts as a space filler that eventually (after about 9 months) dissolves.

The device is implanted in a small section of sclera just superficial to Schlemm's canal. A small section of Schlemm's canal is exposed in a three-step surgery. First, a superficial rectangular flap of sclera is made that remains attached in the limbal region, the exposed sclera is removed down to the depth of the clearly visible Schlemm's canal. After the lining of Schlemm's canal is removed, the collagen insert is sutured into the space, and the superficial flap repositioned and sutured.

The combination of deep non-penetrating sclerectomy and the collagen insert are specifically designed to avoid two problems that currently face open angle glaucoma patients not responding to IOP medications. Deep non-penetrating sclerectomy has been used before, but post surgical fibrosis eventually fills the space created by the sclerectomy and blocks increased drainage into the sub-conjunctival space. The theory behind the collagen insert is that it acts as a porous space-filler and during the post-surgical period during which fibrosis would have filled the space, there is no space to be filled. Once the collagen has been absorbed, the process of fibrosis is over leaving a direct out-flow for aqueous through a thin superficial layer of sclera.

Currently, a penetrating trabeculectomy is the most common surgical technique to lower IOP in these patients. However, in addition to the concerns associated with penetrating the globe, these surgeries also require medication with antimetabolites to prevent fibrosis. Also, because the globe has been completely penetrated, there is a danger of hypotony after the surgery if the flap closure is not secured tightly.

After some discussion, the Starr Surgical Collagen Insert device ("AquaFlow Collagen Drainage Device") was found to be largely safe and effective and was approved, with some conditions, to be marketed in the USA. Most of the surgical experience with this device has been in Switzerland, where, in the hands of very experienced surgical ophthalmologists, it has proven to be effective and safe. At one year post-surgery, about 70% of the patients had IOPs lowered to less than 21 mm Hg without medications, this percentage was higher than 90% if it included patients who were using medications post-surgery. The average number of medications used pre-surgery was 2.2, and this dropped to 0.2 post-surgery.

In spite of the proven effectiveness, there was some concern about the difficulty of this deep sclerectomy surgical procedure which cuts deep into the sclera (as deep as Schlemm's canal) but does not penetrate. The Starr Surgical consultant argued that even if the sclera is penetrated, this is not catastrophic in that the deep sclerectomy becomes basically the same surgery as penetrating trabeculectomy (the current standard).

In the afternoon, the panel was asked by the FDA to help devise a workable method for determining if a new 30-day extended-wear contact lens produced an unacceptably high level of corneal ulcers. Although this task seems pretty straight forward, the low incidence of such ulcers makes the task

very difficult. The FDA dilemma was presented by one of their newest employees, Gene Hilmantel, O.D., IU class of 1981.

There are two basic issues facing the FDA. First, they must identify the point at which the risk of corneal ulcers becomes unacceptable high. Is this 1%, 4/10,000, etc.? Data from the 1980's (a very expensive prospective study by Poggio et al., 1989, *New Eng J Med*, vol. 321, pp. 779-783) found that 4 in 10,000 daily wear CL patients developed corneal ulcers. This rate increased to 20/10,000 in extended wear patients changing lenses weekly. In a different non-prospective study which examined patients who developed ulcers, they found that the risk of ulceration was about 15 times greater in extended wear patients who kept the lenses in for longer than 15 days. Using the two studies together, this suggests that the incidence rate in extended wear of longer than 15 days is about 60/10,000 or higher. This rate was considered too high and approval for extended wear was limited to one week.

A longitudinal analysis performed by the FDA showed that, with an annual incidence rate of 60/10,000, a patient wearing such lenses for 20 years, has a 12% chance of developing a corneal ulcer (one in eight!). Since one-week extended wear has been approved, and the risk associated with this is 20/10,000 per year, the panel cautiously suggested that this risk level not be exceeded with any new 30-day lenses. However, it was argued that if a 20/10,000 risk is acceptable for one week extended wear, a higher risk should be acceptable for 30-day extended wear since there is more benefit associated with 30-day extended wear (less cost since only one pair per month, and more convenience).

The second issue is a practical one. Given that the incidence of corneal ulceration is so low, it is only possible to ascertain incidence accurately by sampling a very large number of patients. The FDA estimates that to ascertain with a high degree of certainty whether 30-day extended wear lenses pose a significantly higher risk than one-week extended wear lenses 22,000 patients must be studied. This study would be both time-consuming and expensive, and may serve to prevent any such product from coming to market if it was a prerequisite for bringing such a product to market. The FDA is looking, therefore, for a means of assessing ulceration risk that is feasible and will not prevent companies from developing such products.

Because of the concern that a prospective study, which is the only direct way to assess incidence, would be prohibitively expensive, the FDA is considering a post-market case-control study design. This approach examines patients who present with ulcers to determine the association between ulcers and extended wear lenses. It provides a measure of the relative risk associated with 30-day extended wear compared to daily wear or weekly wear regimes. It will not provide an estimate of the incidence of ulcers in patients who use extended wear lenses.



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