A manual for the training of optometric assistants

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A manual for the training of optometric assistants

Abstract
A manual for the training of optometric assistants

Degree Type
Thesis

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A MANUAL FOR THE TRAINING
OF OPTOMETRIC ASSISTANTS

by

Terrence Town Clark

A Paper Submitted in Partial Fulfillment
Of the Requirements of the Degree of Doctor of Optometry

Spring 1978
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Acknowledgements

Several people deserve consideration for their help in this project. Drs. Scott Pike, Norman Reiss and John Boyer sponsored the project at Pacific University. Several wives of my classmates read sections of the paper and provided helpful suggestions to improve the information provided. Mesdames Mary Bailes, Sheri Keene, Sandi Jorgenson and Pat Stacy made critical suggestions and significant contributions. Mrs. Audrey Winters and Mrs. Mary Bailes worked particularly hard typing early drafts of the paper.

Finally and most important, I would like to thank and offer deepest appreciation to the editor and major typist, my wife, Rosemarie. Her suggestions, criticisms and discussion were crucial to the project.
Foreword

This manual has been prepared to assist the optometrist with the training of his office assistants. It makes a number of basic assumptions regarding both the optometrist and his assistant and the nature of their relationship.

First, it presupposes that the new assistant has no previous experience in an optometric office; nor is she a graduate of one of the recently-developed community college training programs for optometric assistants. Her inexperience is her main deficit. It assumes that her greatest assets are her strong potential for growth in the field and her desire to develop this potential.

Naturally, it is assumed that the new assistant has significant interest in a service occupation and a corresponding ability to get along with the public.

The assumptions regarding the optometrist are even greater. First, it is assumed that the optometrist wishes to cultivate in his assistant the ability to handle significant responsibilities with limited ongoing direction from him. Such skills on the part of the assistant will free the optometrist from time spent in continually giving instructions and will enable him to concentrate his time and skills on the most important aspects of his work.
Second, it assumes that the optometrist is capable of regarding himself not as a general commanding dutiful soldiers, but as the director and leader of a skilled professional-para-professional team. The sense of teamwork--of optometrist and assistants working together to provide the highest standards of patient care--is integral to the concepts of the project. It presumes that people are motivated by participation and by recognition.

Third, it presupposes that the optometrist, having assisted his office personnel in developing new skills, will allow them to use and sharpen these talents by delegating to them commensurate new responsibilities. It would be pointless and degrading to encourage an employee to cultivate new professional skills and then to deny her any opportunity to use them.

Finally, it assumes that the optometrist will reward the assistant with recognition for her professional advances and with appropriate financial remuneration as she becomes more and more an asset to his practice.
Recognition

The text of this project uses the pronouns "she" and "her" referring to optometric assistants and the pronouns "he" and "his" in reference to the optometrist. This distinction has been made solely for clarity and brevity and is not meant to overlook the presence of male assistants or to deny the existence of the many excellent female optometrists.

Neither is it intended to perpetuate the unfortunate use of terms such as "the girls" when referring to optometric assistants or other female office personnel.

The use of "he" for optometrist and "she" for assistant is simply a vehicle of convenience since most optometrists are male and most assistants are female.


Introduction

The most difficult aspect of a new job for an employee is learning what he is to do and how to do it. Hiring a new person is also difficult for the employer, who must train the new employee in his duties and help him to develop skill in doing them.

Learning and teaching optometric skills is especially difficult. The optometrist cannot afford the time in a busy practice to teach various technical skills, nor can he assign to anyone else the important responsibility of teaching optometric skills. To complicate matters, the busier the office, the more important it is to have trained personnel at hand. For the learner, optometric materials may seem difficult to master without considerable help and guidance.

The material presented in this project is designed to facilitate the assistant's adjustment to optometric work. The material describes what is done and how to accomplish various skills in an optometric office. Material so prepared is meant to free the optometrist from sacrificing hours out of his practice to present background information. The material is also organized to prepare the assistant for the performance of various technical skills.
The project is prepared in three major sections: 1) Public Relations and Communication Skills; 2) General Information about Optometry; and 3) Ancillary Testing. Dealing with the public and communicating effectively are covered in the first section. The section on General Information describes the optometric profession, its goals, and its relationship to the other health professions. A glossary of terms is also included. Specific optometric skills are presented in the Ancillary Testing section. Nine procedures are detailed and described: 1) Case History; 2) Entrance Skills; 3) Color Vision Testing; 4) Stereoscopic Testing; 5) Keratometry; 6) Recording; 7) Tonometry; 8) Visual Fields Testing; and, 9) Lensometry. Where appropriate, examples of optometric findings are given. Following each testing procedure, objectives are listed for the assistant and for the optometrist. It is not the intention of this project to imply that an optometric assistant should be able to quickly learn and execute all of the outlined procedures; rather, they are presented here as a guide and an encouragement toward growth in the field of optometric assistantship.
The Public Relations Image of the Office
and Communication Skills

The present day scientifically trained health care professional often finds too little time for the amenities of his less well-trained predecessor. To conduct a practice that allows for the frequent or periodic examinations crucial to preventive medicine, and to continue his own education so as to offer the highest standard of professional care, can put such demands on the time of the practitioner as to cause the decline of the warm personal relationship that the patient wants, needs and expects. The assistant is in the vanguard of those who can improve the image of the office. She is normally the patient's first and last contact with the office and the patient's first and final impressions of the doctor and his office are derived from this contact. Thus, she is in a unique position to facilitate good office-patient relations.

Remembering that the patient is the reason for the existence of the optometric practice, and not just an entity to be shuffled into available slots in the appointment book, will help the assistant to strive for good relationships with the patients. Each patient is a human being--with feelings, emotions, prejudices, and needs--and deserves to be treated as an individual and not as a case, no matter how busy the office staff.
Receiving the Patient

Each patient—or other visitor to the office—should be made to feel welcome. The assistant is in an excellent position to do so. She can create an atmosphere that is inviting and cordial, putting the patient at ease and seeing to his comfort. A warm smile and cheery greeting, calling the patient by name, are the initial steps. Should the assistant be on the telephone or in conversation when the patient arrives, a smile and nod acknowledges the patient's presence without interrupting the conversation in progress.

A brief inquiry regarding the family, hobby or interests of the patient, if this information is known, reflects genuine concern for the patient. It has the double advantage of making the patient feel like a special person and of aiding the assistant in cultivating an interest in others. What begins as a device for conversational ice-breaking can develop into an enriching interest in other people. A few appropriate notes regarding the patient's family or interests might be jotted just inside the patient record to jog her memory. For example, the assistant might ask how the patient's child performed in the piano recital mentioned at the last visit. One might be cautioned, however, against the open-ended greeting "How are you?" which is occasionally followed by an outpouring of comments on the patient's ills and unhappinesses.
Patients should be assisted with the removal of overcoats and should be shown where to place coats, overshoes and umbrellas. An appropriate place for this type of outerwear should be made available in the reception area. The advantages are threefold: 1) the patient will be more comfortable dressed for the indoor temperatures and will be freed from transporting extra bundles back to the examining room; 2) the outdoor clothing will be out of the way of the doctor, the staff and other patients; and 3) in the case of wet clothing, it can be hung up to drip, away from patients, the furniture and carpets, or magazines and other printed material.

Creating a Cordial Atmosphere

It must be said at this point that the assistant's warmth and cordiality cannot singlehandedly overcome the disadvantages of an unattractive or uninviting office area. The reception areas should be appealingly and tastefully appointed. A small, dark or dingy office area is in itself uninviting. Care should be taken to the selection of furniture and accessories that they are durable, attractive, easy to care for, and complementary. The choice of color scheme and decor is important in establishing an atmosphere that is relaxing without sacrificing professional stature. Tidiness is a must. Temperature and lighting should be adjusted for patient comfort. Noise levels should be kept at a minimum. If the budget allows, an internal music system provides quiet music and masks street noises and other auditory intrusions.
Should the optometrist be running behind schedule, the assistant can often forestall patient irritation simply by appraising patients of the delay and honestly explaining the reasons for it. Also, the assistant can compliment patients who arrive on time for their punctuality. A word of appreciation may lead to continued timely arrivals.

Assisting Patients With Special Needs

Some patients have special needs which require special handling. Invalids or persons confined to wheel chairs need particular attention and assistance. If at all possible, appointments should be arranged at times most convenient and least embarrassing for the patient. If he is very sensitive about his condition, the handicapped patient may prefer to be seated immediately in the refraction area. Some handicapped persons, however, are very sensitive to an overly solicitous or condescending attitude. The surest guide to the patient's needs is to choose a private moment and ask him directly if there is anything the office can do to help him. It is to be hoped that a new practice will take into consideration the special needs of the handicapped and plan for ramps rather than stairs, extra wide doorways to accommodate wheelchairs and lavatories that are usable by these patients.

Children, also, can be patients with special needs. A separate play area--or at least adequate play and reading materials for different age groups--should be supplied for young patients and the visiting children of adult patients. A local librarian
or primary school teacher might be consulted for advice. Children can be very concerned about visiting a "doctor's office", associating it with painful shots, discomforting dental work or tiring physical examinations. For this reason, many optometrists and their assistants prefer colored uniforms or street clothing to distinguish them from the white-jacketed personnel found in these other offices. Some health care professionals recommend bringing young children along on a parent's or older sibling's office visit. They can sit in the refraction chair, look through the phoropter and see the specialized equipment before experiencing its use. This introductory step can alleviate some of the apprehension that a child might reasonably feel for unfamiliar surroundings.

Receiving Other Visitors

The optometric practice has many visitors who are not patients. The optometrist should set office policy regarding seeing these people. Many optometrists, while they want the opportunity to see and talk with equipment sales people and lab representatives, insist that these people be seen by appointment only. Other optometrists establish an open afternoon or morning once a week during which they will receive visitors without formal appointments. Each of these representatives should be shown the same cordiality that is shown to patients. The assistant should advise the optometrist of the name of the caller, the company he represents and the purpose of his call. Then, if the optometrist finds extra time in his schedule and
chooses to see a visitor without an appointment when it is contrary to office policy, he should make note to the assistant that unusual circumstances prevail. Otherwise, she will quite rightfully question whether she is correct in asking visitors to make appointments.

Telephone Callers

It is equally important that telephone callers receive a warm greeting. The discriminating telephone caller is unlikely to choose the practice where the telephone is answered after numerous rings by an obviously flustered or irritable assistant. If other opportunities for professional care are available, they are sure to be utilized.

Different practices use different greetings; however, common sense dictates that the assistant immediately identify the office. "Dr. Jones' office" may be preceded by "Good morning" or followed by "May I help you?" or "Miss Jones speaking". Most writers on the subject of telephone etiquette suggest that the caller strive to keep a pleasant, well-modulated voice. Some suggest the technique of smiling when answering the telephone as a sure method of presenting a warm vocal reception.

If at all possible, the telephone should be answered as soon as it rings. If circumstances require that it ring several times before being answered, the assistant should insert a brief apology to the caller for keeping him waiting.
Often the caller will identify himself immediately. If he does not, the assistant must tactfully draw out his identity. Giving one's own name often prompts the caller to respond with his name.

If it is not possible to grant a patient's request, the assistant should explain why this is so. Neglecting this explanation may suggest to the caller that the decision was based on caprice, and that his needs are of little consequence to the office staff.

Should the assistant not understand what the caller is saying, she must avoid the common reaction of showing irritation. Interrupting the caller with a snappish "What did you say?" or "What do you mean?" is not only non-productive, but also rude. Misunderstandings occur between people, not solely within a speaker or within a listener. The assistant should tactfully encourage the patient to elaborate. Sometimes, gently probing questions will elicit the desired symptoms of a "problem".

It should be unnecessary to add that arguing or losing one's temper serves no purpose.

When placing a call, the assistant should have before her the patient file, appointment book or other pertinent information so that questions from the other party can be answered without hesitation. When calling, she should identify herself and her purpose immediately.

All calls--incoming and outgoing--should be courteously terminated. When closing a conversation that has related to
the making of an appointment, it is helpful to repeat the significant information, such as "We'll see Tom at 10:15 the morning of Tuesday, the tenth."

Certain types of telephone calls can present particular problems to the assistant, particularly if she is new to the office or tends to exhibit an unforceful personality. It may be helpful to her--and to the optometrists's working relationship with her--to provide her with a guide to responses to difficult questions. Although the office staff actively works to prevent communication gaps, it simply is not possible to eradicate all of them. Helping the assistant cope with them is the most responsible alternative.

Communication Skills

Much of the public relations aspect of the assistant's relationship with patients, visitors and telephone callers calls heavily on the skills of communication. Even the best-trained and most courteous optometric assistant will be limited in her performance unless she has developed communication skills. Effective communication is not just an asset, it is essential to her position. She often spends as much time with patients and other visitors as the optometrist, and, whether or not she is aware of it, she will be continually communicating with them. It is important, therefore, that the assistant knows how she is communicating so that she can control what she is communicating, and so that she can better understand others.
Misunderstandings usually occur between people, when the message in the speaker's mind is not received intact by the listener. There are cues that help the listener and/or speaker to clarify the information being communicated. Inflection, intonation, facial expression, posture and even silence are such cues. The attentive assistant will make use of these non-verbal cues to better understand the patient.

For example, a patient might ask the assistant a number of probing questions about glaucoma while she is waiting for the doctor. If her demeanor is unusually nervous or anxious, this may signal to the assistant that the patient may fear that she or someone she knows has glaucoma. The assistant should advise the doctor so that he can see that all of the patient's questions and concerns are aired before she leaves the office.

The knowledge of effective communication will facilitate not only staff-patient relations but will also pay dividends among the staff itself. Effective communication can reduce non-productive time, eliminate many misunderstandings and promote harmony among the staff. The net result is to improve the quality of patient care.
The literature of interpersonal communication has swollen in recent years with studies which attempt to analyze the nature of communication. Reduced to basic elements, communication involves a source (the speaker), a receiver (the listener) and the message which is being transmitted. If the process were actually so simple, there would be little opportunity for the misunderstandings that so frequently occur between people. Clearly, the art of communication is more complicated. The speaker brings to the communication his set of personal experiences, values and social needs, all of which color the message he transmits. So does the listener. And each person brings his own degree of skill as expressing himself. It becomes easier to see how understanding can go astray.

For example, a patient who requires lenses in order to see might telephone the office in great anxiety, stating that he has an emergency and must see the doctor immediately. The assistant, hearing the anxiety in the patient's voice, might form a mental picture of the patient experiencing severe problems. She might tell the patient to come to the office immediately, that the doctor will see him the moment the patient arrives. When the patient arrives and his "emergency" is a screw missing from his frame, which does not require the doctor's attention, the assistant might feel irritated that the patient claimed to have an emergency. However, from the patient's viewpoint, if he cannot wear his glasses without the screw, he has an emergency.
Instruction in General Knowledge of Optometry

Appendix
Instruction in General Knowledge of Optometry

When an optometrist hires a new assistant, he must assume that her knowledge of optometry is limited. To better understand office services and to explain these services to patients, the assistant should be given some preliminary information about optometry in general. Only by being armed with this knowledge can she hope to communicate effectively with the optometrist and his patients.

The new assistant needs to be provided certain specific information. Seven major topics are considered: 1) the optometrist's education and background; 2) the scope and limitations of optometry; 3) the scope of the particular optometric office; 4) the relationship of optometry to the other health professions; 5) the terminology of optometry; 6) the responsibilities of the assistant; and, 7) the handling of emergencies.

Optometric Education and Background

Basically, the optometrist's major degree and education is the optometry doctorate (O.D.). The O.D. degree is obtained through four years of post-graduate study and clinical work. Prior to studying optometry, the optometrist takes basic science courses in undergraduate college, including mathematics, biology, chemistry, physics, zoology and psychology. Most students go on to finish their Bachelor's degree before entering optometry school. This is due, in part, to the fact that the Bachelor's or undergraduate degree must be completed before the O.D. degree can be awarded.
The B.A. or B.S. degree is usually, but not necessarily, in one of the sciences since many science courses are pre-requisites to Optometry school admission. Any Bachelor's degree is acceptable, with no real preference given to any one major, as long as the course requirements for entry are met.

While in Optometry school, the student's studies are very comprehensive. Optics is studied in great detail. Both applied and theoretical optics of light and the principles of lenses and other light-affecting materials is studied. Physiological optics, the optics of the human eye, is thoroughly studied through the most modern research and literature available. Biochemistry, advanced human physiology, and neurology, are all studied to provide in-depth understanding of the functions of the body in general and the visual system in particular. Microbiology, ocular pathology and central nervous system disease are examined in order to know and recognize all the diseases of the eye and visual system. All possible visual dysfunctions are scrutinized by studying normal and abnormal visual function, psychology, perception, strabismus, and amblyopia. The exhaustive study of remediation and evaluation of visual dysfunction is accomplished through extensive coursework in spectacle correction, contact lenses, microscopic and telescopic aids, visual training, pharmacology, and, of course, through actual clinical experience. Clinical experience is provided throughout the final two years of optometric study.
Scope of Optometry

The purpose of optometric education is obviously to be able to understand the human visual system. This includes problems of the eye, its component parts, and the relevant structures of the central nervous system. Further education aims to treat most of the problems of the visual system. Micro-biological disorders are not currently within the scope of most optometrists. The basic education is provided to allow for possible future use of therapeutic pharmaceuticals, pending appropriate legislation. Surgery is not now, nor ever intended to be, a part of optometric practice. Optometry does utilize all possible treatments of the visual system which do not involve the application of therapeutic pharmaceuticals and/or surgery.

Within the optometric practice there are several fields of sub-specialty. Nearly all optometrists use special instruments to check the health of their patients' eyes and to diagnose the presence or absence of pathology. Some optometrists use pharmaceuticals to assist in this work. Most optometrists also are well versed in the use of spectacles to treat visual problems.

The sub-specialty of contact lenses is concerned with the treatment of visual and optical problems through the use of contact lenses.

Low vision is a specialty concerned with the therapy of those who cannot obtain normal or standard acuity and vision by ordinary methods. Special microscopes, telescopes, magnifiers and televisions are used in low vision.

Strabismus and amblyopia is a specialty area treated by the optometrist through the use of both lenses and visual training.
These patients have either a deviation of one eye, so the two eyes do not move and coordinate together, or an unexplained loss of visual acuity of one eye. Special muscle and perceptual exercises and techniques are used to help correct these conditions.

General spectacle corrections, contacts lenses, low vision aids and vision training are all means of remediation of the varied and complex problems of vision. The optometric exam is designed to diagnose problems and to indicate the appropriate treatments from the various specialties. The optometric exam is also designed to diagnose, but not necessarily to treat, all possible pathological conditions of the eye.

A particular optometric practice, naturally, may be involved in one or more of these specialty areas of the practice of optometry.

Optometry and Other Health Professions

Eventually the sometimes sensitive issue concerning the relationship of optometry to the rest of the health professional community will arise. This may well come about when a patient asks, "Is an optometrist a real doctor?" Obviously, the optometrist is a real doctor. Just as obviously, it is best to advise the new assistant of the ramifications and complexity of the issue immediately on her arrival. The best short explanation of the O.D.-M.D. difference may be as follows.

The optometric doctor diagnoses all problems of the eye and its related structures. He treats those problems which do not necessitate surgery or therapeutic pharmaceuticals. Those ocular problems requiring therapeutic pharmaceuticals or surgery
are referred to an M.D. specializing in ocular problems, who
is known as an ophthalmologist. Those systemic problems or
pathologies which are non-ocular in cause or major effect
are referred to the physician or doctor of the appropriate
specialty.

The sensitivity in this issue arises from the fact that
both ophthalmologists and optometrists are dealing with the
eye. There is therefore considerable opportunity for pro-
fessional differences in preferred treatment. Most important,
although seldom openly admitted, there can be direct economic
competition between the ophthalmologist and the optometrist.
Unfortunately, competition sometimes degenerates into acrimony.
In point of fact, the optometrist and the ophthalmologist
each has his area of maximal expertise and value. The optom-
estrist is generally the better trained in optics and psychol-
ogy and is therefore better at lens application and training
procedures. The ophthalmologist is the better trained to treat
disorders requiring pharmaceuticals. Only he has the training
necessary for surgery.

Responsibilities of the Assistant

The assistant should clearly understand that in an optometric
practice the first and primary responsibility is to the patient.
The consequences sometimes place the assistant in difficult or
unpleasant situations. There will be busy days when patients come in without an appointment to have glasses fixed, or to complain, or to make billing arrangements. Even though she might be very busy at the time, the assistant must put aside her work to take care of the visitors first. There is no other way for the patient to understand that he is important. This does not mean that all office procedures must be abandoned to fulfill every patient request. If someone has come in for a frame repair or other service without an appointment, it may be necessary to advise him that he will have a very long wait and it might be best to come in another time with an appointment.

If the patient or other visitor needs to see the assistant and she can leave the work she is doing, she should. Exactly which duties can be interrupted to attend to an unscheduled visit should be made explicit in a policy manual. When the assistant cannot leave her work, she should say so, telling the patient when she will be able to devote her full attention to him. In order to best serve all visitors to the office, it is necessary for the assistant to acknowledge everyone who comes in and to attempt to provide some service to each one. She must decide what can be done to satisfy their needs and when the necessary service can be provided. As earlier noted, the breakdown of those conditions which need to be handled only by the doctor, those which can be attended to by either the assistant or doctor, those which require the assistant only, and those which necessitate appointments, has to be specified in a policy manual written by the optometrist to suit his particular practice.
The policy manual will detail the responsibilities of the assistant to the optometrist himself, as well as to visitors to the office. For example, he may want her to type all letters exactly as written, or he may want her to edit them. The optometrist will also need to itemize services which she can and cannot do for him, and explain why. Those things which the assistant may not explain or discuss with a patient will be detailed. Even though the assistant may know the appropriate explanation, it is the optometrist who is licensed and who must therefore be responsible for all optometric judgements, even to the point of explaining a condition. As stated, the optometrist will elucidate through a written office policy manual those duties which an assistant can do for herself, those services which she can perform for the optometrist, the specific things which she can say to a patient and all that she may not do.

Handling Emergencies

In addition to her other responsibilities, the assistant will at times have to deal with emergencies. There can be in-office non-ocular emergencies. A patient in for an exam might faint, calling for the fairly simple immediate treatment of laying the patient down with his head lower than the rest of his body. Cardio-pulmonary resuscitation (CPR) might need to be administered to a heart attack victim. A list of such possible non-optometric emergencies can be drawn up if the office personnel deem necessary. In any case, since the optometrist will provide only first aid in such cases, preparations should be made by the assistant to summon appropriate help. Telephone numbers of the nearest ambulance, hospital, fire department
station, police station and at least one physician should be put onto every telephone in the office.

Ocular emergencies which are presented to the optometrist can occur either in the office, in the vicinity, or elsewhere. Those emergencies occurring in the office will nearly always be handled by the optometrist himself. For such emergencies, a telephone number for an ophthalmologist should be posted on all telephones. Many in-office ocular emergencies are likely to be discovered by the optometrist himself, and would, of course, be handled by him.

There are also many instances where the assistant will have to decide if an ocular emergency really exists. The patient will present a symptomology either over the telephone or in person from which the assistant must decide whether an emergency exists. Should an emergency exist, the proper procedure, laid out ahead of time in the policy manual, will be followed. This would normally consist of having the patient be seen by the doctor ahead of schedule or by referring him directly to an ophthalmologist. A suggested list of potential ocular emergencies worthy of immediate attention is as follows:

1. Any sudden (within minutes or a few day) loss of visual acuity or loss of discrimination of detail in objects.
2. A rapid onset of a persistent blurring of vision.
3. Any suddenly noticed blindness.
4. Any known or suspected introduction of a foreign object into the eye or its vicinity.
5. A scratchy or irritated feeling in the eye, which feels like there might be something in it.

6. A blow to the eye or head.

7. The sudden appearance of cloudiness in the cornea or eye or profuse exudate (matter flowing from the eye).

8. Any blow to the eye or vicinity of a contact lens wearer which might have caused injury to his eyes because of wearing contacts.

9. Whenever there is doubt, the assistant should check it out or ask the optometrist to handle the problem.

Good office procedures are of paramount importance in helping the assistant to distinguish when an emergency exists and in allowing her to know how the emergency is to be handled.

Terms of Optometry

In addition to the foregoing general information concerning the optometrist's background, the scope of optometry and its position within the health professions, it is important that the assistant acquires the terminology of optometry. To that end, a list of some terms and their definitions is provided in the Appendix associated with this section of the paper. Some of these terms are found in the O.E.P. Papers, the Visual Science Dictionary or Dorland's Medical Dictionary.
Terms

1. Accommodation—the ability of the (chrystalline) lens inside the eye to increase its power to see and focus objects closer than about 15 feet. The process is obviously reversible.

2. Angle—designates the amount of space between the root of the iris and the cornea near the limbus. The drainage system for the aqueous humor is located here.

3. Anisocoria—unequal pupil sizes of the two eyes.

4. Anisometropia—unequal refractive error of the two eyes.

5. Aqueous humor—the liquid which fills the interior and anterior third of the eye.

6. Anterior—a term used in anatomy to indicate forward position.

7. Astigmatia—fault in an optical system in which light from a point is not focused into a point, but rather distorted into a line.

8. Binocular—having to do with both eyes.

9. Blepharitis—an inflammation of the eyelid, usually the margin.

10. Cataract—an opacity of the lens in the eye.

11. Chalazion—an inflammation characterized by a hard, somewhat reddish nodule found usually on the inside of the eyelid.
12. Choroid—the vascular layer just behind the retina, and just inside the sclera.

13. Chorioretinitis—an inflammation of choroid and retina.

14. Ciliary muscle—the muscle inside the eye that changes the shape of the lens during accommodation.

15. Conjunctiva—a thin, vascular tissue covering the eye (bulbar c.) and the inside of the lids (palpebral c.).

16. Contrast—the perception of the difference in light level of two visual stimuli.

17. Cornea—the clear, avascular, most anterior part of the eye. It is the first and most powerful refracting part of the eye.

18. Cylinder lens—a lens used to correct astigmatism.

19. Diabetes—a condition wherein carbohydrates are not metabolized. Lesions and changes in the fundus are often found (and the disease is thereby diagnosable).


22. Duction—the movement or test of movement of either or both eyes; usually the ability of the eyes to move in response to prisms.
23. Ectropion--the (lower) lid falls away from the eye, rather than maintaining contact with it.

24. Entropian--the lid turns into the eye.

25. Extrinsic--outside.(i.e., the extrinsic ocular muscles are attached to the outside of the globe).

26. Fornix--the fold in the conjunctiva where the palpebral and bulbar conjunctivae meet.

27. Fovea--the small part of the retina most sensitive to small detail.

28. Fundus oculi--referred to simply as the fundus, it is the back, inside part of the eye (which is a fluid-filled hollow organ).

29. Glaucoma--an abnormally high intraocular pressure (IOP) of one of two major types that can cause blindness if untreated. Type 1: closed angle or acute glaucoma, which is an IOP increase caused by an obstruction of the angle and drainage system of the aqueous humor. Type 2: open angle glaucoma, which is the most common type wherein there is no obstruction of the angle. The causes are varied.

30. Hordeolum--also known as a sty, a kind of pimple or infection in the lid margins, associated usually with eyelash.

31. Hyperopia--an eye in which the power of the optical system is not strong enough to focus
light on the retina. If it were possible, the light would focus instead behind the retina.

32. Interpupillary distance (p.d.)--the distance between the two eyes. Most often, this is between the corneal light reflex of each eye.

33. Intraocular pressure (I.O.P.)--the fluid pressure inside the eye, measured by a tonometer.

34. Iris--the colored part of the eye between the lens and cornea (it contains a central hole, the pupil).

35. Keratoconus--a condition of unknown cause where the central part of the cornea bulges forward, getting thinner over time--to the point of rupture if left untreated.

36. Limbus--the juncture between the cornea and sclera.

37. Meibomion gland--a gland within the eyelid. It is the site of a chalazion.

38. Mire--the image of a target seen when the examiner looks through an instrument.


40. Myopia--nearsighted; the eye focuses light in front of the retina.
41. O.D.--right eye.
42. O.S.--left eye.
43. O.U.--both eyes.
44. Optic nerve--the nerve that leaves the back of each eye, taking visual information to the brain.
45. Palpbrae--the eyelids.
46. Phoria--a theoretical position of rest, or posture, that the eyes tend to move to or from when they do not have to work together.
47. Presbyopia--literally "old sight", characterized by the loss of accommodation with age. By age 45-50, the loss is normally complete.
48. Ptosis--a drooping upper eyelid, partial or complete.
49. Pupil--the hole in the center of the iris that allows light to reach the back of the eye and the retina.
50. Retina--the nerve layer and light receptive layer of the fundus and the innermost part of the fundus.
51. Refractive error--the amount, commonly expressed in diopters, by which the eye's optical system errs in focusing light exactly on the retina.
52. Renal disease--kidney disease. One of the causes of vascular disorders seen in the retina.
53. Sclera--the tough, white, largely avascular outer covering of the eye.

54. Sphere--prescriptable lens that focuses light to a point.

55. Strabismus--a lack of binocular fixation; the two eyes do not coordinate together and foveally fixate the same object.

56. Suppression--the inability to perceive an object with one eye when both eyes are stimulated by that object.

57. Vascular--pertaining to the blood vessels of the eye.

58. Vision--the act of seeing, including (but much more inclusive) than simple visual acuity. Ocular coordination, perception, ocular movements, movement detection and contrast detection are all part of vision.

59. Visual acuity--the ability to discriminate fine detail.

60. Vitreous humor--the gelatinous fluid-filled substance behind the lens and in front of the retina of the eye.
Instruction in Ancillary Testing

Utilizing the general information in optometry, combined with effective communication and teaching skills, the optometrist and his assistant can begin instruction in some of the office's testing procedures. The choice of material presented here is arbitrary and not all-inclusive. Only those procedures involved in general ancillary testing are covered. The individual optometrist will, of course, add and delete various procedures at will.

Nine procedures that can be done by assistants have been chosen for presentation here. Several factors were considered in deciding which procedures to include. The procedure cannot be one that is limited by law or license to the professional. Any professional judgements involved must not be a part of the procedure itself. The procedures chosen have to be useful and meaningful, and there must be an advantage in having the assistant rather than the optometrist do them. The advantage is that the assistant can save the optometrist time and relieve him from the pressure of many responsibilities. The optometrist is allowed to do other procedures more thoroughly. The assistant can often spend more time and therefore do a better job than if the optometrist tried to rush through a number of testing procedures unaided. By working directly with patients, the assistant can obtain a better feeling for the work the optometrist does. Many assistants
will also find ancillary testing more challenging and rewarding than other phases of office work. Through establishing well-chosen procedures for the assistant, one can create better work for the assistant, provide more thorough evaluation of the patient, and relieve some of the pressure on the optometrist.

The procedures to be covered are listed as follows: 1) taking the case history; 2) doing entrance skills; 3) testing for color vision; 4) screening for stereoscopic vision; 5) keratometry; 6) recording examination findings; 7) tonometry; 8) taking visual fields; and 9) lensometry.
Case History

The case history consists of the patient's general and visual health history, as elicited from the patient. Important information concerning the patient's needs and desires can be gleaned only from the case history. The health picture presented by the history helps alert the optometrist to possible areas to which he should direct particular attention. The history can also provide clues and explanations to the optometrist's findings and the patient's difficulties. Because of the very important and unique information provided in the case history, care should be taken to assure its completeness.

One method of procuring a complete case history is to prepare it in questionnaire form. In this way, the patient can save the office staff time by filling it out himself. After the patient has filled out the history form, the assistant or the optometrist can then interview him to reaffirm major points, pursue necessary items in depth and check for possible oversights. The patient is therefore provided two opportunities to provide a complete and correct history. This repetition assures that neither the patient nor those caring for him will omit pertinent information. A sample questionnaire is provided to fully illustrate.

Before dealing with the questionnaire itself, there are some general points to consider in taking any case history. The single most important bit of information is to discover and detail
the patient's chief complaint. Whether the chief complaint is headache, pain in the eyes or some other symptom, it is best to write it down in the patient's own words. This holds whether the patient fills out a history form himself or not. Anytime a symptom is verbally reported, it should be further investigated to determine the time of onset and any associations with particular tasks. Beyond the value of the information gathered, this demonstrates a real interest in the patient and what he has to say.

While she must be responsive to a patient's verbal report, the assistant must be careful in answering questions. Many general questions can be answered by the assistant, but technical questions should not be. When discussing medications, for example, the assistant can reassure the patient that the optometrist needs to know about medications because many of them affect the visual system. Should the assistant be asked about any possible effects caused by medications, she should defer to the doctor. It is sufficient to answer all such technical questions by saying the doctor can give the best and most professional answer, and to encourage the patient to discuss his questions with the optometrist. As she escorts the patient in to see the doctor, and by way of encouraging him, the assistant might advise the optometrist that the patient does have a question to discuss with him.

The specific form of the case history will be suited to the needs of each individual practice. The major points can best be illustrated by the sample prepared here. All patient
replies are set up to be yes/no or short answer responses.
Space is left beside each item to provide for follow-up
questioning and recording by the assistant and the optometrist.
In the following sample, the questions and comments in italics
are samples of the follow-up questions the assistant might
use.

Case History

Determination of chief problem: Are you having any difficulties
that caused you to see us today?

1. Do you have any of the following visual problems:
   a. Double vision? Yes No
      *(If yes, when does it start and how long has it
         been noticed?)*
   b. Do you get headaches? Yes No
      *(If yes, what time of the day, how often, where
         in your head or neck—temples, over the eyes, etc.—
         do they seem to be located, what seems to relieve them?)*
   c. Do you ever experience blurring of vision? Yes No
      *(If yes, at near or at far? After reading?)*
   d. Are your eyes tired or strained after a short
      period of near work? Yes No
      *(If yes, is this true all the time or periodically?)*
   e. Do you see spots before your eyes? Yes No
      *(If yes, how long ago did you notice them? Are
         they like flashes of light?)*
   f. Are you very sensitive to sunlight? Yes No
      *(Would you want sunglasses? For work? For
         driving? For what activities?)*
g. Have you ever suffered a loss of vision?
   Yes No

h. Have you ever had any eye injuries or diseases?
   Yes No

   (If yes, what were the injuries, when did they take place? Are they now cured? What were the diseases, how and when were they treated? Have you ever had any eye infections? How often?)

   (A statement from the patient regarding his visual efficiency and problem should be asked as a summation to possible visual problems.)

2. Do you wear glasses?
   Yes No

   (For near work only? For far work only? How long have you worn them?)

3. If you wear glasses, are they satisfactory?
   Yes No

   (If not, why? Are things blurry up close or far away? Did they work well when you first got them?)

4. If you wear glasses, do they fit well and do you like the style?
   Yes No

   (If not, why not, where do they bother you? If the style is poor, would you like larger, smaller or a different colored frame?)

5. Do you wear contacts?
   Yes No

   (If not, would you like to?)

6. Have you ever worn contacts and discontinued them?
   Yes No

   (If yes, why? Uncomfortable? Lost? No desire to continue?)

7. When was your last visual exam?

   (From whom, in case we need to get some information about your visual condition?)
8. When was your last dental exam? Is your dental health good?

(What specific dental problems have you had? There can be ocular involvement from dental problems.)

9. When was your last physical or medical exam? Is your general health good?

(What is the name of your practitioner, in case a problem develops?)

10. Have you ever had any major diseases? Hypertension, heart trouble, tuberculosis, kidney problems, etc?

(What were the diseases? Are you under care for them now? What medication do you take for them?)

11. Do you—or anyone in your family—have diabetes?

(Who, what is their relationship to you? How severe is it, how long ago diagnosed, and how is it treated?)

12. Have you ever been in a hospital? Yes No

(For what? For how long?)

13. For women, do you or have you ever had (female) difficulties with menstruation, pregnancy or menopause? Yes No

(When and what was the problem? Do you notice any visual problems associated with any of the above?)

14. For children, why and when was the first visual exam?

(What were the results of previous exams? How well does the child do in school? Ask child if he has any difficulties with reading, seeing the blackboard, etc. Ask parent if the child's maturation seems to have been normal.)

15. For all adults, what are your hobbies? What is your occupation? What do you do for recreation?

(For each of the above, ask at what distance is vision normally centered. For each, are there any special visual needs or eye protection needs that the patient is aware of?)
16. If the patient has a prescription, ask if he has a spare and suggest that he might benefit from a spare in case one is lost or destroyed.

17. Advise patient that the optometrist may wish to cover some of these points in depth.
Goals for the assistant:

1. To know what a case history is and why it is important.

2. To be able to administer the case history using the optometrist's case history form.

Requirements for the optometrist:

1. To provide the assistant with the case history form and answer any questions she may have.

2. To coach and assist the assistant with her first attempts at taking a case history.
Entrance Skills

Entrance skills consist of measuring the patient's visual acuity, measuring his interpupillary distance, and observing the quality of his ocular movements, known as pursuits and saccades. A given optometrist will choose to have his assistant do any one or all of these skills based on several factors. One factor is, of course, the assistant's interest in doing them. Another consideration is the level of activity in the practice. If the work load is not high, the optometrist may do one or all of the entrance skills himself. By the same token, if the practice is very busy, these skills may all be delegated to the assistant. In some instances, however, the optometrist might feel it his professional responsibility to do one or all of these procedures himself.

Measuring Visual Acuity

Visual acuity is a measure of the sharpness of vision. It is one of the aspects of vision more noticeable to the patient. If he cannot see detail, such as printed material, the patient will be very aware of it. Good acuity does not, however, mean good visual function. The two eyes may not function well together or they may be slow in processing information or they may exhibit other problems. The converse is also true. One can have sub-standard acuity and have a well-functioning visual system otherwise. Naturally, if any part of the visual process is impaired, there will be difficulties, so there is a need for good visual acuity.
The visual acuity, or V.A., is usually measured as a fraction. Standard or "normal" acuity is popularly known as 20/20 vision. The 20 in the numerator refers specifically to the size of the letter, which is standardized based on a 20-foot testing distance. The 20 of the denominator refers to the distance to which the standard letter of the numerator could be removed and still be distinguished by a standard observer. More precisely, the fraction is an expression of minimum detail in arc minutes discriminable by the patient. The 20/20 measure means he can discern detail as small as one arc minute.

To illustrate further, one might consider a hypothetical patient who sees only 20/40. Assuming the test distance is actually or effectively 20 feet, the figure 20/40 means that this person can see detail at no more than 20 feet which a more normally sighted person could see at 40 feet. The 20/40 person, in effect, has to have things twice as large to make them out at the same distance as a person with normal acuity.

In actually taking the patient's visual acuity measure, the patient will be seated comfortably. The projector, if used, will have been preset by the optometrist. The optometrist focuses the projector, calibrates the letters and sets the screen-to-projector distance to meet his standards. These things are done to assure accurate and repeatable measurements and tampering with these details should therefore be avoided by the assistant. If a painted chart is used, it will also meet certain standards in terms of distance and quality of print.
After seating the patient and making him comfortable, there are a few precautions the assistant should observe. The patient should be carefully instructed to keep both eyes open, even when one eye is covered by the assistant. No squinting, head turning, movement toward the chart or any such extraneous action, which is an attempt to make out more letters, should be attempted. All such idiosyncratic devices employed by a patient should be recorded. When a patient calls out letters in something other than a relaxed, simple manner, the assistant should ask him to repeat the process.

It is important to observe the patient and to prevent squinting and other such behaviors in order to obtain a true acuity measure. When a patient uses extraneous behaviors he may induce better (or even worse) acuity than he might have in normal, everyday circumstances.

Once the patient is seated, the assistant should say: "Call out the letters of the lowest line you can make out." This is done first with both eyes open and while the patient is wearing any prescription lens that he might have.

On most charts there will be a number beside the line the patient has just recited. This number is the denominator of the visual acuity fraction. If the patient called out most of the letters in the 15 line correctly, his acuity is 20/15. In this case, 20/15 O.U. would be recorded, signifying both eyes are used. Whatever line he reads, the patient should be asked to guess at a few of the letters in the next lower line, until it is certain
he has reached his limit. Often, patients can do better than
the point where they choose to begin.

After the O.U. measure with prescription lens is made, monocular measures while wearing prescription lenses need to be made. The left eye is occluded and the process is repeated, taking care to reach the lowest possible line. This will be recorded as the right eye or O.D. acuity measure. The acuity measure is repeated once more, only this time the right eye is occluded and the results are recorded as the O.S. measure.

The whole process is repeated, this time with any prescription lens previously worn removed. In this way, the patient's unaided acuity is measured. Again, and in order, the O.U., O.D. and O.S. measures are made and recorded exactly as with the prescription lenses on. This time the three measures are simply given the heading of "unaided acuity".

The optometrist may want a measure of acuities taken at near, as well as at far. A reduced Snellen card, which the optometrist can easily demonstrate to the assistant, is held sixteen inches away from the patient's eyes. This distance should be precise, but to measure it every time would be cumbersome. With a little practice, the assistant will learn to estimate sixteen inches accurately.

The near acuity is measured exactly as is distance acuity measure. The original prescription lens can be left off to first measure unaided near acuity--O.U., O.D. and O.S.. Finally, the prescription lens is replaced, and if it is a bifocal lens, the aided near acuity--O.U., O.D. and O.S.--is taken through the
bifocal or reading lens. As a final note, acuity should be measured under standard room illumination of seven foot candles. This is usually achieved by making a mark on the rheostat for the room lighting which delivers the proper amount of light.

**Interpupillary Distance Measure (P.D.)**

The interpupillary distance (P.D.) is the distance between a patient's eyes. More exactly the P.D. is the distance between the optical center of the eyes. The P.D. is needed because it should match the distance between the optical centers of the lenses in a spectacle prescription. If the P.D. is not matched to the spectacle prescription properly, the lenses can induce harmful optical effects.

To measure interpupillary distance, a penlight and a P.D. rule (a 15-20 centimeter rule with millimeter markings) are needed. First, the assistant must turn on the penlight and find the corneal light reflex (CLR). A spot of white light will be seen in or near the pupil when the light is directed at the patient's eyes--this is the light reflex. The light reflex is easily demonstrated by the optometrist by shining the light on a piece of window glass. Before proceeding, the CLR should be seen in both of the patient's eyes simultaneously. The penlight is held in the examiner's left hand, directly under the examiner's left eye. The P.D. rule is held across the patient's nose with the top edge of the rule just under the pupils. The patient is told to look at the light. The end or 0 mark is lined up with the CLR in the patient's right eye (examiner's left side). Simultaneously, the assistant reads the number on the rule below the
CLR in the patient's left eye. This number will be something near 60 millimeters in most adults. This first reading is the near P.D. or P.D. with the eye approximating a reading position.

After making the near P.D. reading, the assistant simply moves the penlight from her left eye to her right eye (with the left hand.) Again the patient looks at the light. The examiner does not realign the CLR of the patient's right eye with the zero end of the P.D. rule. She simply reads the number of the rule underneath the CLR of the patient's left eye. This reading is the distance P.D., usually two or three millimeters larger than then near P.D.. The P.D. is usually recorded as a fraction with the distance P.D. as numerator and the near P.D. as denominator; (i.e., 63/60). To best see how it is done, the assistant should watch the optometrist take the P.D. on a volunteer. Then the assistant can measure the same person and see if her results are accurate.

An alternate method is to measure from the far right side of the pupil (or iris) of the patient's right eye to the right side of the pupil (or iris) in the left eye. This is somewhat faster as it does not require the use of the penlight. It is not as accurate and is not the method of choice. If the optometrist wants to use it, he will demonstrate this method.

Motilities: Pursuits & Saccades

Evaluation of patients' ocular motilities is diagnostic of some conditions and is therefore not commonly done by assistants. It will therefore not be treated in depth. Whether assistants do evaluate motilities, however, they may record the results
observed by the optometrist. For this and for better understanding of optometric function, it would be well for the assistant to understand motilities and the method for recording them.

Ocular motilities consist of pursuits and saccades. Pursuits are tracking movements—the eye follows an object as it moves. The optometrist slowly moves an object in rotational and straight line patterns and watches for perturbations or limitations of movement.

Saccades are much faster eye movements than pursuits. They are the movements employed when looking rapidly from one object to another. The examiner looks to see that the objects are fixated accurately in one movement and to see that fixation can be maintained. Saccades are observed in different fields of gaze and from near to far and far to near. The recording method for pursuits and saccades are individualized, therefore the optometrist will demonstrate his particular method.

A special kind of pursuit is called the near point of convergence (NPC). This occurs when an object is followed by both eyes along the midline up to the nose. When the object gets too close, both eyes will no longer be able to track the object. This is the near point or maximal point of convergence. The NPC is recorded as the distance from the nose where the two eyes first lose the object. This is the NPC "break". A "recovery" is also recorded, which is the distance from the nose where the two eyes first pick up the object again as it is moved slowly away from the nose. Break and recovery are recorded as
a fraction similar to the P.D. measure. The numerator is the break. Thus, 3"/5" means break occurred three inches from the nose, and recovery was attained at five inches from the nose.

There are other entrance skills besides the pursuits, the saccade, and NPC. The confrontation test is a check to see whether peripheral vision is intact. It is done by asking the patient when he can see a peripherally placed object while looking straight ahead. Instructions in any other entrance skills that the optometrist might use will be provided by him.
Goals for the assistant:

1. To know what visual acuity is and how to measure and record it.

2. To know what the P.D. is, what it is used for, and how to measure and record it.

3. To know what motilities are, how to observe them and how to record them.

Requirements for the optometrist:

1. To demonstrate the use of his projector or chart in measuring visual acuities, and to show how visual acuity is measured.

2. To take a P.D., showing the assistant how it is done, and how to find the corneal light reflex.

3. To show the assistant how he wants entrance skills test results recorded and to show how he does them.
Color Vision Testing

General Information

The rate of color vision defects is greater among males than females. About eight percent of males have color vision defects, compared to one-half percent for females. All congenital or "at birth" color defects are inheritable as a sex linked trait. That is, a mother can pass it to her son without showing the defect herself.

Color vision defects can also be brought on by disease. Only the optometrist can take the responsibility of deciding whether an individual's defect is inherited or disease-related. Should the assistant be asked about the cause of a patient's color anomaly, she should defer to the optometrist.

There are different types and degrees of color deficiencies; nearly all deal with red-green difficulties. Persons with an insensitivity to red are referred to as protans; those insensitive to green are called deutans. The rarer blue-insensitive persons are called tritans. The classification and diagnosis of type and degree of color defect, is of course, the optometrist's responsibility. It is, however, useful for the assistant to know that protans and deutans both confuse red and greens in different combinations.
It is important to note here that the language and words are very carefully chosen when dealing with color vision. Problems in color vision are properly called defects or anomalies or color confusions. Color blindness is a poor term—there probably are no patients who are totally blind only to color. People with defective color vision receive and are sensitive to colored light, but cannot discriminate different colors one from another as well as the non color-defective person. It is important to realize that the patient can see well but has difficulty in telling some colors apart.

It is important for the patient to realize the significance of his defect and the proper language to describe it. The patient should know that he is not blind. The optometrist will clarify what his confusions are and specify the jobs and situations likely to cause him difficulty so that he can deal with them.

Testing for Color Vision

The testing of color vision is not in itself difficult, although it does require special equipment and necessitates certain precautions. Most tests are in the form of a screening device, designed to determine the presence and general category of color defects. Each specific type of test and each manufacturer's product requires special equipment and special procedures.

One of the common tests consists of color plates bound in notebook form. All such types of printed material use special inks and patterns to detect color defects. In order for these tests to be effective, they must be conducted under proper
lighting. The apparent color of each ink is dependent on the light source. If a printed test is given under a shaded, dim tungsten (common) light bulb, most people will have difficulty with or actually fail these color vision tests. Thus, depending on the light source used, anyone can be made to pass or fail this sort of color vision test. A light which does not transmit yellow as much as tungsten light is needed, and suitable lamps are available. The Criticolor light made by General Electric Company is one such possibility. On some days the best light available is outside—under a blue, cloudless sky. If the manufacturer designs his test to be used under other light sources, it will be stated. Regardless of the specific test given, it is important that it be given under the proper light source or the results will be invalid.

One way to demonstrate the importance of the light source is to look closely at a yellow paint chip and then to look into an ophthalmoscopic light. Remembering what the paint chip looked like before staring at the light, one will probably notice that, after seeing the light, the chip appears very pale, if not white. While this is not exactly the same effect that different sources have on a given reflecting surface, it does show that color vision is not an absolute function.

Instruction

The printed color vision tests are nearly always pseudo-isochromatic plates. These are plates of colored dots made with specially controlled pigment combinations. The plates are
designed to present a figure on a colored or neutral background when shown under proper lighting. A color defective person will see either no figure or one different from that which is expected. All that the assistant need do is show the plates under the correct light source in the order prescribed by the manufacturer. She should know the expected response, and record any errors either on a specially prepared response sheet or on the case record. The method of recording will be determined by the optometrist. Some optometrists may want to give additional tests if any errors are discovered on the first test to confirm and categorize the color defect.

Another type of test is the D-15 test and the similar Munsell 100 Hue test. Instead of using color plates, these tests use caps with a bit of colored substance on one side. On the inside of each cap is a number. The caps are given to the patient with the colored side up, and the patient is told to arrange the caps in order by color, starting with a fixed-position cap. After the patient has finished, the caps are turned over and the sequence of the numbers recorded. A form provided by the manufacturer is available to record the results of these tests.

There are other color vision tests, but the plates or colored caps are the most common and the easiest to administer. One other major type is the anomaloscope. This instrument manipulates the color of the light source, and one-half of the viewing tube is compared to the other. They are usually very expensive and are not normally found in private optometric
offices. The anomaloscope, however, probably provides the best method of determining the severity of a given patient's color defect.
Goals for the assistant:

1. To understand the importance of proper lighting.
2. To know the appropriate light source for a given color vision test.
3. To know color defects and the sort of problems a color defective person has.
4. To know what tests are available for color vision screening.
5. To be able to administer the color vision tests used in the office where she works.

Requirements for the optometrist:

1. To demonstrate the use of the particular color vision tests in his office.
2. To provide the proper light source for his color vision tests.
3. To assist and observe the assistant's first color vision tests.
Stereoscopic Testing

Stereoscopic vision, or stereopsis, is the ability to see depth through the use of both eyes. Stereopsis is a cortical function. That is, the brain "computes" or integrates visual information to perceive three-dimensionality out of information received from both eyes. Each eye receives its own view of the world. Each eye has an essentially flat light receptive layer, the retina. The flat retinas are only sensitive to two dimensions. The eyes therefore, convert the three dimensions of space into two dimensions. The brain reconstructs three dimensions by integrating and comparing the slightly different information received by each eye under binocular conditions. The brain also extracts three dimensional information from one eye alone.

The whole process of three-dimensional perception is complex, and is as subject to dysfunction as any other biological process. Stereoscopic testing or screening is designed to ascertain whether the three-dimensional processing of vision is normal. The Keystone Company has developed a special instrument, a stereoscope, and a series of stereoscopic cards which evaluate stereo (three dimensional) vision. The visual skills test made by Keystone is a set of stereoscopic cards prepared as a screening device which can be presented to the patient by the assistant.
The Keystone Company supplies a complete set of instructions with each set of screening cards. The assistant should follow the manufacturer's instructions. A simplified set of instructions is provided here, for convenience (See Griffin, page 69.)

General Instructions

The patient is seated before the stereoscope and the cards are placed in the stereoscope at the far point setting. Each card is presented in order, without asking leading questions, by saying "What do you see?" The assistant then proceeds with specific instructions. If a patient sees only half of a card, this fact is recorded by the assistant.

Specific Tests

Test 1. Card DB-10A.

This is often referred to as the "dog and pig" test. The assistant asks "Where is the dog in relation to the pig?" and records the patient's response.

Test 2. Card DB-8C.

This is a test for vertical phoria. A line should pass through or near a red symbol. The assistant asks the patient which symbol the line passes through and records the response.


This is a test for lateral phoria. A yellow arrow should point to a number. The assistant should record the number reported by the patient when he is asked to which number the arrow points.
Test 4. Card DB-4K.

Red, white and blue balls are arranged vertically. The assistant asks "How many balls do you see?" and records the patient's response.

Test 5. Card DB-3D.

A three-dimensional view of a railroad bridge is seen. Within the scene are signboards which contain five white diamonds on a black background. Each of the ten numbered signboards has one dot in one of the diamonds. The assistant should ask the following questions and record the patient responses.

(1) "Does the bridge appear to be flat like a picture or does it seem to have real-life depth?"

(2) "Look at the signboard with the number 1. Within the signboard number 1 there are five diamonds. One of the five diamonds has a dot in it; which diamond has a dot: the top, bottom, left or right diamond?" (The center diamond never has the dot.)

(3) The assistant will continue asking where the dot is in each of the succeeding diamonds. If the patient's response is "I don't know", the assistant asks him to guess.

(4) If the patient is a child, the assistant will ask him to point his finger in the direction of the diamond with the dot.

(5) The assistant records by circling the number of the last signboard in which the position (relative to the center diamond) of the dot is correctly identified.
Test 6. Card DB-2D.

This test is essentially the same as test 5 in appearance, assistant performance and recording.

Test 7. Card DB-6D.

Twelve rows of symbols are seen within a rectangle. The assistant asks "Do any of the figures in the first row appear closer or farther away from you than the others?" One figure in each row should be seen as closer than the others in that row. The response is recorded for each of the 12 rows.

For the next test, and for all succeeding tests, the card holder is moved to the near or 2.50 setting on the stereoscope.

Test 8. Card DB-9B.

Like test number three, a yellow arrow points to a number. The assistant asks the patient to which number the yellow arrow appears to be pointing, and records the patient's response.

Test 9. Card DB-5K.

Like test number four, this test has red, white and blue balls arranged vertically. The assistant records the patient's response to the question, "How many balls do you see?"

Test 10. Card DB-16.

A sequentially numbered ring of circles is printed on the card. The patient should see a pattern of either lines, dots or gray. Three unnumbered circles are placed in the center
**KEYSTONE VISUAL SKILLS PROFILE**

For Use with Keystone Ophthalmic Telebinocular

<table>
<thead>
<tr>
<th>Test</th>
<th>Left Only</th>
<th>Right Only</th>
<th>Underconvergence Low Usable Vision</th>
<th>EXPECTED</th>
<th>Overconvergence High Usable Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1 (DB-10A)</td>
<td>Nocked Vision (Far Point)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Test 2 (DB-8C)</td>
<td>Vertical Pursuit (Far Point)</td>
<td></td>
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<td></td>
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<tr>
<td>Test 3 (DB-9)</td>
<td>Lateral Pursuit (Far Point)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Test 4 (DB-1K)</td>
<td>Pursuit (Far Point)</td>
<td></td>
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</tr>
<tr>
<td>Test 5 (DB-1D)</td>
<td>Color Perception (Near Point)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Test 6 (DB-2B)</td>
<td>Unlens Vision, Right Eye (Near Point)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Test 7 (DB-6B)</td>
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<tr>
<td>Test 8 (DB-13A)</td>
<td>Color Perception (Far Point)</td>
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<tr>
<td>Test 9 (DB-14A)</td>
<td>Color Perception (Far Point)</td>
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<tr>
<td>Test 10 (DB-9B)</td>
<td>Lateral Pursuit (Near Point)</td>
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</tr>
<tr>
<td>Test 11 (DB-5K)</td>
<td>Fovea Only (Near Point)</td>
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<td></td>
</tr>
<tr>
<td>Test 12 (DB-15)</td>
<td>Unlens Vision, Both Eyes (Near Point)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Test 13 (DB-16)</td>
<td>Unlens Vision, Right Eye (Near Point)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 14 (DB-17)</td>
<td>Unlens Vision, Left Eye (Near Point)</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**NOTES:**
of the ring on one half of the card. The assistant can point to and identify for the patient the pattern in each of the three centered circles. The assistant should then ask the patient to identify the pattern inside circle one. The identification of each circle's pattern is continued until the patient loses accuracy. The number of the last correctly identified circle is recorded.

Recording of the stereoscope testing is most easily done on a recording form supplied by the Keystone Company. The form is simply a reproduction of the salient features of each card printed to represent possible patient responses. The assistant need only circle the response or correct response on each test. A copy of such a form is included here.
Goals for the assistant:

1. To know what three dimensional vision is.
2. To know why stereoscopic screening is done.
3. To be able to perform stereoscopic screening with Keystone cards.

Requirements for the optometrist:

1. To show each card to the assistant to explain its use.
2. To perform the test for the assistant to observe.
3. To observe and assist the aide in the procedure until the assistant feels competent.
Keratometry

Appendix
**Keratometry**

Generically, a Keratometer is an instrument which measures the shape or radius of curvature of the front surface of the cornea. A light of a known size is reflected from the cornea, as though it were a mirror. The radius of curvature is obtained through the optical design of the instrument, which directly measures the size of the reflected images, known as mires. The information from the Keratometer is used in contact lens work, in determining astigmatism, and in evaluating corneal health. Because of the Keratometer's use in determining astigmatism, most instruments are calibrated in diopters of power, rather than in millimeters of radius of curvature. This is only a matter of convenience, for radius is always the aspect being measured. The Keratometer is specifically an instrument made by Bausch and Lomb Company, but all similar instruments work on the same principle.

In order to obtain accurate, reliable readings from the Keratometer, specific procedures must be followed. Before the patient is seen, the instrument should be focused. This is accomplished by lowering the occluding eye shield at the top of the head rest in front of the Keratometer. The eyepiece is turned out, and the cross is observed through the eyepiece. The eyepiece is then slowly turned in (clockwise) until the cross first becomes clear. This process may not always be necessary. The
The optometrist may have the eyepiece focused and calibrated to his own needs and if so he will state that he does not want the Keratometer focused.

Once the instrument is ready for use, the patient can be seated before the Keratometer. The chin rest and forehead rest should be cleaned in the patient's presence with an alcohol swab. The instrument stand should then be brought to the proper height and locked in place. The assistant should have the patient place his chin on the chin rest and his forehead against the forehead rest. The forehead must be kept against the forehead rest or the mires may not be focusable. The assistant should inform the patient that he may blink normally, but that he is not to talk or move his head or eyes in any way. The patient should be instructed to look down the barrel of the instrument at the reflection of his eye until the reading is made.

With the barrel of the Keratometer before his right eye, the patient's left eye is occluded. The assistant moves the Keratometer barrel left and right, up and down, until the reflected images can be seen approximately centered on the cornea. (See drawings in appendix of this section) The initial alignment is done by looking outside the instrument and directly observing the change in the corneal reflection as the instrument is moved. If this is not done prior to viewing through the instrument, great difficulty will be experienced in finding the mires. After the gross adjustments have been completed, the assistant looks into the instrument. If the mires are not seen, the
assistant looks again outside the instrument and repositions until the mires are seen reflecting off the cornea through the instrument.

When the instrument is properly aligned, the assistant will see the mires as three circles, each having plus and minus signs associated with it. One circle will be in the lower right part of the field of view, one in the lower left and one in the upper right. The lower right circle is used to ascertain focus—it will be doubled unless proper focus is attained. The lower left circle and upper right circle are the measuring circles. When the horizontal measuring drum is turned, the lower left circle will move; when the vertical measuring drum is rotated, the upper right circle will move.

Using small movements, the assistant centers the cross left and right into the lower right ring, and centers it vertically in the same circle. After the cross is approximately centered, the locking knob on the Keratometer is tightened and the mires are focused with the focusing knob. The measurements are now ready to be made. While continually focusing with one hand, the left or horizontal measuring drum control knob is turned until the horizontal tops of the plus signs between the lower left and right circles just meet, or would meet, if they are not aligned. Then the barrel is rotated until the plus signs are in alignment. (See drawings.) The horizontal drum is then turned in until the plus marks are perfectly superimposed. The drum should not be rocked back and forth; otherwise, accuracy is lost. When the horizontal measurement is finished, the
vertical drum is turned until the minus sign at the top of the upper right circle superimposes on the minus sign of the lower right circle. The values are recorded from the power drums. The left eye is then measured in the same manner.

In recording the values, a number in diopters relating to the curvature of the cornea is followed by a meridian, which indicates whether the measurement corresponds to the horizontal or to the vertical measure. Each eye has two measures, one for each meridian ninety degrees (90°) apart. Since the two meridians measured by the Keratometer are always 90 degrees apart, only one meridian needs to be labelled. For example: O.D. 42.00 and 42.50 @112°. This signifies that the right eye (O.D.) was measured, and a curvature corresponding to 42.50 D (or 7.94mm) in the 112th meridian and 42.00 D (or 8.00mm) in the 22nd meridian (112°-90°=22°) was found.

In recording the results from Keratometry the optometrist might wish to ascribe a grading system to the quality of the mires for diagnostic purposes. A four-numbered system is one that can be employed, and one which is employed in other systems. The numbers 1 through 4 are assigned, based on the regularity and continuity of the mires. The assignment of each number is based on established criteria, as listed.

Number 1. Poor quality, distorted mires; parts of the mires missing due to corneal aberrations, indicating possible corneal pathology.
Number 2. Distorted or irregular mires but the continuity of the mires is maintained.

Number 3. Slight irregularities in the mires, all parts of which can be made clear and visible; no pathology apparent.

Number 4. Very sharp and distinct mires, indicative of very healthy corneas.

The number 1, or a special number such as 0, may be used by some practitioners to indicate the special condition of keratoconus.

Because of the diagnostic value of keratometry, some, if not most, practitioners will prefer to do keratometry themselves. This is to insure the best care for the patient. Since the assistant will be called upon to pursue varying extents of the keratometric procedure, it has been covered in its entirety. In this way, the assistant can perform keratometry to the extent desired by the individual optometrist. Through familiarity with the entire procedure, the assistant will be better able to understand and record the optometrist's findings, enabling him to provide quicker, more efficient care to all patients.

To review, possible findings might be as follows:

O.D. 42.00 and 43.00 @ 90° #2 mire
O.S. 41.50 and 42.25 @ 105° #2 mire
Goals for the assistant:

1. To set up the instrument and prepare the patient for a reading.
2. To focus and properly position the mires.
3. To make a measurement.
4. To be able to record and understand the significance of the four-point mire grading system.

Requirements for the optometrist:

1. To demonstrate the head and chin rest adjustments.
2. To demonstrate the location of the axis.
3. To demonstrate the way to lock the instrument into position.
4. To demonstrate the height adjustment, focusing knob, eyepiece focusing and horizontal and vertical measuring drums.
5. To demonstrate how to find the reflected images through the instrument and how to align the mires when astigmatism is present.
Figure 1-12. The Bausch and Lomb keratometer.
Keratometer Mires

Axial Determination

Keratometer Mires

Astigmatic Eye
Recording Skills

Introduction

Recording findings for the optometrist is an important duty and it can be very satisfying. The optometrist's complete attention can be focused on the patient and the testing procedures when his assistant records test results. Greater continuity in the testing procedures can be maintained when a second person records. Testing time is reduced, lowering fatigue in the patient, the optometrist and all office personnel. Records are usually neater and more complete when the assistant does the recording. With the assistant recording, better records can be kept, the testing procedure flows more smoothly, and the patient ultimately receives better care.

The task of recording may itself seem a menial chore. However, because of the better care the patient receives, recording is not trivial. The findings have to be understood in order to be recorded properly. The special vocabulary of optometry must be learned to do the job well. Through recording, the assistant can better understand and explain the available services when patients make inquiries. The challenges in learning to record, the usefulness of recording, and the contact with patients which recording provides all prevent this skill from being a mindless or menial task.
Recording will be treated in two sections—visual function and ocular health. Visual function is concerned partly with determining the refractive status or optical accuracy of the two eyes. The ability of the two eyes to focus at near, to move accurately and with facility, and to coordinate are also tested under visual function. Special or aberrant visual functions are also tested.

Under ocular health, the patient's external and internal ocular health is examined. External health is evaluated for infections, foreign bodies, or defects in the lids, lashes, tears, tear drainage system, conjunctiva, cornea, iris and lens. Internally, the health of the lens is again checked, as is the cornea, the retina, retinal blood vessels, and optic nerve. The internal ocular pressure is also evaluated, to complete the ocular health exam.

Recording Visual Function

The visual function aspect of the optometric exam is an evaluation of the skill and integrity of the visual system. The visual system is divided into various aspects and tested individually. The components of the system are evaluated as a whole to determine whether the individual's vision is functioning optimally. If the system is not working well, the same tests help to determine remediation.

The first major component which the optometrist evaluates is the eyes' ability to properly focus light on the retina. This entails the making of objective and subjective measures of optical function and clarity. Objective measures are simply
those which require no response or interpretation from the patient, while subjective measures do require patient participation. Keratometry and retinoscopy are objective measures of the optical system. Keratometry measures the cornea and retinoscopy measures the optical system as a whole. The subjective complex offers the lens system that seems sharpest to the patient.

The second major system is the convergence system. Convergence, or more properly, vergence, is the ability of the two eyes to turn in and out together. The measurements are made with prisms, which deviate light to one side without changing the focus of that light. As the light is turned with the prism, the optometrist determines where the patient's eyes are positioned, and how much his eyes turn, according to the type of specific test which is given.

The accommodative system is the third item subject to scrutiny. There is a lens just behind the iris which is able to change its shape and thereby change its power. The eye is set to focus at infinity. In order to focus on objects which are closer than about 20 feet (six meters), this lens must increase its power by changing its shape. The process of the lens changing shape is known as accommodation, and is accomplished through the activity of the ciliary muscle, which surrounds the lens.

Some of the tests done by the optometrist are designed to determine whether the two major systems of accommodation and convergence are well-coordinated individually and together. This
is necessary because the two eyes have to focus (accommodation) at the point in space at which the eyes are converged. If the eyes do not converge properly and in accordance with the amount of accommodation present, or vice versa, there will be visual difficulties. Reading can be disturbed and blurriness or double vision may result. These phenomena can be brought on by lack of coordination of the convergence and accommodative systems. As a final note, there are other factors involved in the visual system. Stereopsis is a major system which is treated separately under stereoscopic testing. Perception and cortical function in general are extremely important, but are matters of interpretation and special testing. These are therefore left entirely to the optometrist.

Testing and Recording Procedure

The 21-point exam developed by the Optometric Extension Program, because of its widespread use, is used as the framework for describing the recording procedure. Each test is presented by name and number. A short description of each test is provided, with an example of the type of finding the assistant will record. By knowing what each test is, she can accurately identify them and record them in the proper place on the form. Some test numbers are not detailed and others are subdivided. This is due to modification of the 21-point sequence over the years, and to the fact that some test numbers correspond to tests covered under other headings. Unless otherwise stated, the tests are done behind the phoropter.
While the 21 points follow in a specific order, such ordering is not mandatory and the individual optometrist may modify it. Also, while all 21 points are usually included, a complete exam does not necessarily follow this sequence. Depending on the patient, the optometrist may delete or modify certain tests, and he may use other tests as well. If a test is not done, the assistant can write N/A (for not applicable) adjacent to that test number. It is advisable to indicate in some fashion that the test was not given, so that it is clear that the recorder simply did not neglect to record the score. If a patient gives no response to a test, NR or X can be recorded. If the optometrist feels that a patient's response is not reliable, NRL can be recorded.

The Exam Sequence

Number 1. Ophthalmoscopy. This is covered under the visual health section.

Number 2. Keratometry. This is detailed in the separate section on Keratometry.

Number 3. Habitual phoria at 20 feet (6 meters).

Example: 2 XO

The phoria test is designed to determine the resting position of the eyes when directed to a specified distance, in this case, 20 feet.

In the testing procedure, prisms are used to cause diplopia; then one prism is used to bring the two images into vertical alignment. The test is complete when the number of prism diopters necessary to create alignment has been determined. Eso-phoria is
the turning inward of the eyes at rest. Exo-phoria is the
turning outward of the eyes at rest. The abbreviation "SO" is
used for esophoria; the abbreviation "XO" is used for exophoria.
It is absolutely necessary to label the test results as SO or
XO or they will have no meaning.

This test of the vergence system is done through the patient's
habitual spectacles or contacts, if any are worn.

Number 13A. Habitual phoria at 16 inches (40cm).

Example: 5 XO

Like the previous test, this test is used to determine
the rest position of the eye when directed to a specific dis-
tance. In this case, however, the distance is 16 inches,
instead of 20 feet.

Again, prisms are used to cause diplopia; then one prism
is used to bring the two images into vertical alignment. The
number of prism diopters necessary to create alignment is
determined with esophoria indicative of the eyes' rest position
being turned in and exophoria indicating the eyes turn out.

The vergence system usually assumes a different resting
posture at near than it does at far.

Number 4. Static retinoscopy.

Example: O.D. +4.00 -1.00 X5
    O.S. -1.00 -.50 X15

This test is an objective determination of the optical error,
if any, of the eye. The recorded figures correspond to the power
and type of lens used to correct the error.
The optometrist uses a special instrument, the retinoscope, which reflects light from the back of the eye. He puts lenses in front of the eye, according to the character of the light as viewed through the retinoscope. He determines the lens combination which best focuses light on the retina.

It is very important to record the numbers in the right sequence and using the correct sign. In the example O.D. +4.00 -1.00 X5, the O.D. refers to the right eye. The +4.00 refers to the sphere lens that is used. The -1.00 refers to the amount of cylinder used. The X5 refers to the axis of the cylinder. The θ sign may be used before the 5 in the cylinder to indicate that the 5 is a single digit (X5 or θ5). Sometimes there is no cylinder. In this case, "sph" for sphere is used after the first number to indicate that there is no cylinder (i.e., O.D. +4.00 sph).

The cylinder, by convention, always has a minus sign, and it must always be written. The sphere may be either plus or minus and the sign must be included. When cylinder is present, and axis number must also be recorded.

Number 5A. **Dynamic** retinoscopy at 20 inches (50cm).  
**or, High Neutral**

Example:  O.D. +5.00 -1.00 X5  
O.S. plano - .50 X15

Alternate:  O.D. +5.00 w/cyl  
O.S. plano w/cyl

This test is designed to help objectively determine the functioning quality of accommodation. The procedure is the same
as that used in test number four; however, this test is presented at a distance of 20 inches instead of 20 feet used previously.

The test is often called the high neutral test of accommodation. The findings are usually higher in plus, compared to test four. The findings indicate the least activity at near of accommodation. Because of the nature of the test, the sphere numbers of test number five will be higher in plus than those of test number four. Since test number five is not a test of optical integrity per se, the cylinder amount is not usually different from that of test number four. The recorded number is often sphere only with "w/cyl" after it to show that the cylinder of number four is maintained in place on the number five test.

Number 5B. Dynamic retinoscopy at 20 inches (50cm).
or, Low neutral

Example: O.D. +4.25 w/cyl
         O.S. - .75 w/cyl

The test is essentially the same as number 5A and is recorded in the same way and with the same considerations. The only difference between the tests of high and low neutral is that low neutral uses more minus lenses than the high neutral. This is because low neutral is an estimation of maximum accommodative activity at near. Test 5B is not commonly done, but the optometrist may be inclined to use it with children.
Number 6.  Retinoscopy at 40 inches (1 meter).

Example:  O.D. +3.00 sph
          O.S. +2.00 sph

Test number 6 is the same as number 5; however, the test
distance is twice that of number 5. Many other distances are
possible, but 40 inches is the distance most commonly used.

The recording and requirements are the same as for tests
4 and 5.

Number 7.  Subjective complex.

Example:  O.D. -2.00 sph
          O.S. -2.00 - .50 X180

The number 7 test is the subjective counterpart to test
number 4. The design allows the patient some input, so that
the optometrist knows what lens seems to make objects sharpest
and clearest to the patient. The recording requirements are
the same as those used in test number 4.

a.  Red-green test.

Example:  O.D. -2.00
          O.S. -2.00

This is a test for sphere power using a chart which
is half red and half green. The optometrist manipulates
lenses which have the effect of making either the red or
the green half of the chart clearer. After the optometrist
makes further lens changes, the patient will switch and
see as clearer that half of the chart which was formerly
less clear. This portion of the test is complete when
this change has been achieved.
b. Clock dial test.

Example: O.D. -0.50 X180
          O.S. -0.75 X180

This is a gross test for astigmatism. Only the amount of cylinder is determined. The endpoint is reached when, after the application of cylinder lenses, the patient sees as blackest those lines which are 90 degrees from the lines originally seen as blackest. This test, if done, may or may not be recorded.

c. Jackson Cross Cylinder (JCC)

Example: O.D. plano
          O.S. -.50 X180

This test serves to refine the determination of cylinder amount and axis. As with the clock dial test, only cylinder and axis need to be recorded. The cross cylinder is a special lens which, by its alignment, tells the optometrist whether more or less cylinder power is needed, and which way to turn the axis. The theory and explanation of its use is complex and is discussed at length in Rubin. The optometrist can easily demonstrate its use if he chooses.

d. Equalization test.

Example: O.D. -2.00
          O.S. -2.00

This is a test to help determine if there is a difference in sphere power needed for each eye. There are several methods, and the optometrist will explain the one he uses. The sphere power of each eye is recorded separately to indicate the amount of correction each eye requires.
f. 7A or Best Visual Acuity (BVA)

Example: O.D. -2.00 sph
0.S. -2.00 -.50 X180

This is the final value of the test number 7 complex and is the one aspect that is always recorded for every patient receiving a full exam. The lens system determined here is the lens that allows the patient to best see the smallest possible detail.

There are different ways of arriving at this final value, all of which are designed to determine the lens combination that provides best acuity. Since vision entails far more than acuity, this is not always the lens of prescription. However, because of the importance of acuity, and because of the accuracy with which this value is obtained and verified within the exam, this value is frequently that of the prescribable lens. It is therefore important to be certain that the correct value is recorded here.

Number 8. Induced phoria through #7 or #7A.

Example: 2 XO

This test is the same as test number three, only it is done through the lens system derived in the number seven complex. The purpose is to see whether the resting position of the eyes (phoria) at a distance is changed by the lens system.

Tests 9, 10, 11, 16 and 17 are all similar and are referred to as a group as "the ductions". In general, these are tests of
the vergence system—the ability of the eyes to turn in and out. These tests use prisms and turn them to deviate light so that the eyes must turn to maintain clear, single vision. The direction of the prism base determines the direction in which the eyes turn. When the base is out, the eyes go in. A special prism called the Risley prism is used and is calibrated to quantify the amount of turn in terms of a unit known as the prism diopter or \( A \). Since each specificduction test specifies the direction of turn, and as the numbers of these tests can only be in prism diopters, there is no need to label each number—it can stand alone.

Tests 9, 10 and 11 are done at 20 feet. Tests 16 and 17 are done at the 16-inch distance.

**Number 9. Base out to blur.**

Example: 10

This test is concerned with the amount of base out prism administered until the patient sees 20/20 letters blur. Some patients will not recognize or report this blur in which case an X or NR is recorded.

**Number 10. Base out break and recovery.**

Example: 18/12

This is a continuation of test number 9, and measures the point at which doubleness is first noted by the patient. This doubleness is the break and is the first value recorded. The prism strength is then reduced until single vision is recovered.
This recovery is the second value of the 10 complex or the denominator when break and recovery are written as a fraction. (The fractional value has no meaning).

Sometimes the 10 recovery will actually be on the base-in side instead of the base-out. In this case, the value is recorded as a minus number. Hence, 10/-2 means break was 10 base out and recovery was 2 base in.

Number 11. Base in break and recovery.

Example: 9/5

This is the conclusion of the duction test at far. It measures the amount of base-in prism or turning out of the eyes. No blur at far should be noted by any patient with base-in prism; there is therefore no counterpart to test number 9.

As with base out prism, the base in prism figures in test number 11 may be minus (usually only the recovery) if the "turning out" is actually measured with base out prism. That is, recovery may not occur until the zero point is reached or exceeded.

Number 12. Vertical phoria.

Example: 2 BUOS Vertical Duction  ODS 4/2  ODI 2/0
Alternate: 0 Vertical Duction  ODS 3/1  ODI 3/1

Test number 12 is actually a complex which includes the vertical phoria at far and vertical duction at far.

The vertical phoria is similar to test number 8, or lateral phoria. Double vision is created with prism. Instead of bringing
the two targets into vertical alignment, one prism is turned until the two targets are in horizontal alignment. This then tells if one eye's position of rest is vertically displaced with respect to the other. It usually is not and is recorded as 0, when it is zero. When one eye is vertically displaced, the base direction and the eye over which it is taken is recorded. Thus, 2 BUOS means a displacement of 2° base-up on the left eye was found.

Vertical duction is similar to the lateral duction of tests number 10 and 11. Instead of turning the prism base in and out before the eyes, the prism bases are turned up and down. By convention, the up and down turn is always recorded as the right eye turning up with respect to the left (ODS) and the right eye turning down with respect to the left (ODI). No matter how the measurement is made, the optometrist will report it as ODS and ODI, and the assistant will record it in this manner. Thus, 3/1 ODS means that at 3° right eye up, diplopia is created, and single vision restored at 1° right eye up. And 3/1 ODI means diplopia at 3° right eye down and singleness at 1° down.

Vertical ductions are always small because the eyes are limited in their ability to turn up and down independently of each other.

Tests 13B through 21 are all done at the near distance of 16 inches (40cm). The distance need not be recorded unless the optometrist specifically notes that he is using a different test distance.
Number 13B. Induced phoria at near.

Example: 6 X0 Min plus 20/20 +1.00

This test is similar to all phoria tests. The resting posture (laterally) of the two eyes at near through the lens determined by the number 7 complex is measured. The result is usually X0.

Older people often need extra lens power to see 20/20 at near. The amount is recorded next to 13B as the minimum plus to 20/20. As in the example above, it is recorded next to the finding.

Number 14A. Dissociated cross cylinder at near.

Example: O.D. +2.00 - .50 X90
O.S. +2.25 - .50 X90

This is a complex test which measures accommodative activity in response to an indefinite target (black lines) held at the near distance of 16 inches (40cm). The accommodative level is measured monocularly. An important aspect of the test is the cross-cylinder. This special cylinder is used to control the conditions of the test, but has nothing to do with determination of cylinder amount in a prescription, as in the JCC test of the number 7 complex. The patient will see one set of lines in a grid as blacker than the perpendicular lines. With a change in lens power, the patient will see the other set as darker. This point of recognition of change will almost always require a sphere lens power which has more plus than the lens determined in the number 7 complex. It is usually more plus by about +1.50 or so.
Since this is not a cylinder test, it is adequate to record only the sphere power and the notation "w/cyl" if cylinder was found during the number 7 complex. The test is designed to manipulate only sphere power. The full explanation and detail of this test is found in Borish.

Number 14B. Binocular cross cylinder.

Example: 0.D. +1.50 sph
0.S. +1.75 sph

This test is exactly the same, with the same meaning as number 14A, except it is done binocularly instead of monocularly. Again, the lens power as reported by the optometrist is recorded. Usually this figure will be about .50D less in plus power than the 14A. Again, the notation "w/cyl" is used if necessary.

Number 15A. Induced phoria through 14A.

Example: 6 XO

This is a lateral phoria like test 3, 8 and 13B and is recorded in the same manner; however, it is taken through the lens determined in 14A.

Number 15B. Induced phoria through 14B.

Example: 6 XO

This phoria is taken through the 14B lens and indicates the resting position of the eyes through that lens.

NOTE: The 15A results are usually recorded with the 14A results and the 15B results are recorded with 14B.
Number 16A. Base out to blur.

Example: 10

This test is the same as test number 9, only it is done at near instead of at far. The eyes are caused to turn in with prism until 20/20 letters blur, at which point the amount of prism is recorded.

Number 16B. Base out break/recovery.

Example: 20/15

This is the same as test number 10, only it is done at near instead of at far. The eyes are turned in with prism until diplopia is reached, and letters appear to break into two groups. The process is reversed, and the break and recovery points are recorded.

Sometimes the 16A and 16B test results are written together. In such a case, the figure 10/20/15 would mean blur was reached at 10\(^{\Delta}\) BO, diplopia was found at 20\(^{\Delta}\) BO and single-ness was regained at 15\(^{\Delta}\) BO. As with all ductions, these numbers may be minus values if they "cross over" the zero point.

Number 17A. Base in blur.

Example: 12

Test 17A has no counterpart at far, but is similar to tests 9 and 16A as a detected blur of 20/20 letters when base in (instead of base out) prism is applied.
Number 17B. Base in break/recovery.

Example: 24/15

This test is a base in break/recovery test. Base in is applied until diplopia is achieved. Recovery is obtained as the base in amount is reduced. The value 24/15 means then, that 24°BI gives diplopia, and 15°BI returns singleness.

Sometimes on tests 16 and 17 the patient will notice the letters seem to move in and get smaller and move out and get larger. This is recorded, if the patient reports it, by writing SILO (Smaller In, Larger Out) beside the prism amounts. This phenomenon has perceptual significance.

Number 18. Vertical phoria.

Example: © Vertical duction 3/1 ODS 3/1 ODI

Test number 18 is exactly like test number 12, only the former is done at near instead of at far.

Number 19. Minus to blur.

or, Positive relative accommodation

Example: O.D. _____ O.S. _____ 0.U. -6.00

This is a test of maximum possible accommodative effort. This is performed by having the patient read small print aloud from a card placed at 13 inches (33cm). This is done while the optometrist changes lenses to stimulate accommodation. The optometrist determines the final lens which can be read through.
This test is usually done binocularly. In this case, the final lens over the right eye is recorded under the O.U. (binocular) designation. Only the sphere value is recorded.

Number 20. Minus to blur out.  
Or, Positive relative accommodation  

Example: O.D. O.S. O.U. -3.50/-4.00/-3.50  
Phoria ph. 7 X0

Test number 20 is similar to test 19. Lenses are changed to stimulate accommodative effort. This test is done at 16 inches (40cm) while the patient looks at 20/20 letters. The patient is asked to report when he can no longer make out the letters (blur out) and when he can first regain clarity of the letters (recovery). A report of first blur may also be asked of the patient.

This test may be done monocularly and/or binocularly. If monocular, each eye is recorded separately. If binocular, the test results are recorded as O.U. figures. When blur, blur out and recovery are recorded, they are shown as an O.U. value with the lens values of the right eye. Thus, -3.50/-4.00/-3.50 means blur of -3.50, blur out of -4.00 and recovery of -3.50. A phoria is often taken through the recovery lens and recorded.

Number 21. Plus to blur out.  
Or, Negative relative accommodation.  

Example: O.D. +2.50 O.S. +2.50 O.U. +2.00/+1.50 Ph 6 X0

Test 21 follows the same procedure used in test 20, only accommodation is relaxed (instead of activated) by the use of lenses.
The recording of the two tests is also similar. Monocular and binocular sphere readings are both frequently taken, whereas test 20 is usually done binocularly. As in test 20, a phoria is taken and recorded. In both test 20 and test 21, the lens power through which the phoria is administered must be recorded. Hence, O.D. +2.50, O.S. +2.50, O.U. +2.00/+1.50 Ph 6 X0 means that the monocular finding was +2.50 right eye; +2.50 left eye; the binocular findings were +2.00 blur out and a recovery of +1.50, with a phoria of 6X0.

Special Tests

In addition to the 21 point exam, there are a few special or additional tests that optometrists employ. These may be added to or substituted for some of the 21 points. Some of these tests are done mainly in the presence of known dysfunction, such as in the troposcopie tests for people with eye deviations. While many of these tests used with dysfunction are widely used, they are not covered here as they are not part of the commonly accepted standard exam used for everyone. Should the optometrist wish them to be recorded, he can simply describe the type of value and show the assistant where and how to record it on his forms. There are other tests which are sometimes used in the standard exam, either as additions or substitutions to the 21 points. Two of these are included here, and the individual optometrist may have others he wishes to include. The two additional tests are accommodative rock and prism rock.
Accommodative rock.

Example: M (O.D.) +2.00 15/min
(0.S.) -2.00 21/min

The accommodative rock is a test for the speed of facility with which accommodation can change. This is done by counting the number of times in a minute a patient can make letters clear with different lenses. This can be done monocularly or binocularly or both.

The results are recorded with an M or a B to indicate whether the test is monocular or binocular. The value +2.00 15/min means that the patient could clear letters through a plus 2.00 lens 15 times in one minute.

Prism rock.

Example: @20 feet 8^A BO 15/min 8^A BI 15/min

Prism rocks are similar to accommodative rocks in that they are a test of facility of speed, only of the convergence system rather than of the accommodative system. The test determines the number of times in a minute a patient can make a target single and clear while a prism is interjected and removed.

This test can only be binocular. The amount of prism and its base direction is recorded, along with the count or frequency. Thus, 8^A BO 15/min means that the patient could clear and single the target 15 times in one minute while interjecting an 8^A BO prism.
To review, the following is an example of findings that might have been recorded in a visual function exam:

1) Ophthalmoscopy is done separately.
2) Keratometry is done separately.
3) 2 XO
4) O.D. +4.00 -1.00 X5
   O.S. -1.00 - .50 X15
5A) O.D. +5.00 w/cyl.
   O.S. plano w/cyl.
5B) O.D. +4.25 w/cyl.
   O.S. - .75 w/cyl.
6) O.D. +3.00 sph
   O.S. +2.00 sph
7) (R.G.) O.D. -2.00
   O.S. -2.00
   (C.D.) O.D. - .50 X180
   O.S. - .75 X180
   (JCC) O.D. plano
   O.S. - .50 X180
   (Equalization) O.D. -2.00
   O.S. -2.00
   (Subjective) O.D. -1.50 sph
   to 20/20
   O.S. -1.50 - .50 X180
7A) O.D. -2.00 sph
   O.S. -2.00 - .50 X180
8) 2 XO
9) 10
10) 18/12
11) 9/5
12) Ø
    ODS 3/1
    ODI 3/1
13B) 6 XO    Min plus 20/20 +1.00
14A) O.D. +2.00 - .50 X90
      O.S. +2.24 - .50 X90
15A) 6 XO
14B) O.D. +1.50 sph.
      O.S. +1.75 sph.
15B) 6 XO
16A) 10
16B) 20/15
17A) 12
17B) 24/15
18) Ø
      ODS 3/1
      ODI 3/1
19) O.U. -6.00
20) O.U. -3.50/-4.00/-3.50 Phoria 7 XO
21) O.D. +2.50
      O.S. +2.50
      O.U. +2.00/+1.50 Phoria 6 XO

Accommodative Rock:
  Monocular
  O.D. +2.00 15/min
  O.S. -2.00 21/min

Prism rock:
  8° BO 15/min
  8° BI 15/min
Recording Ocular Health

The optometrist is as concerned that his patients have optimal ocular health as he is that they have optimal visual function and performance. There are therefore a series of tests and observations that the optometrist uses to ascertain the state of the patient's ocular health. As in the testing of visual function, the use of an assistant to record ocular health findings can make the procedure smoother and more complete. Since some diseases can best be diagnosed by changes over time, it is especially important to have detailed and accurate records of ocular health status.

Five particular areas--general observation, ophthalmoscopy, biomicroscopy, photography, and tonometry--are presented here for recording by the assistant. Tonometry is also considered separately as a procedure that can, in some instances, be done by the assistant. Another test of ocular health, the visual field study, is also presented separately. While still other tests of ocular health can be performed, they are not usually part of a common or standard exam done on every patient.

General Observation.

Prior to specialized testing, the optometrist simply observes the eye, with the aid of nothing more than a small light called a transilluminator. He looks at the eyelids, lid margins, conjunctiva, iris, pupil, cornea, and all ocular structures visible
to the naked eye. The assistant's major occupation during this part of the exam will be to record the optometrist's spoken observations. For instance, the optometrist might note "a papilloma 5mm from the lateral canthus on the O.D. lid margins". The assistant simply writes down the doctor's words. Generally, nothing unusual will be detected at this part of the examination, and a notation is made of no apparent pathology. This is sometimes abbreviated NAP. The optometrist may prefer that specific structures be listed as clear of aberrations, in which case he will specify what is to be recorded.

Two specific tests are also normally performed at this time. These are the transillumination test for anterior chamber angle depth, and the pupillary response test. The chamber angle refers to the space between the iris and cornea at the limbus (see glossary). This is where the fluid or aqueous humor is drained. In order for the drainage to be adequate, the angle or iris-to-cornea gap has to be deep enough. One of the ways to judge angle depth is by transillumination and another is by using the slit lamp. In the transilluminator method, a light is shined at the limbus while looking at the contralateral side of the cornea. The optometrist will grade the angle depth by using a grading system of 1 to 4 points. The grades are as follow:

1) a narrow angle which seriously impedes the flow of aqueous out of the anterior chamber;
2) a narrow but adequate angle depth;
3) open or average angle; and,
4) an exceptionally wide angle.

The pupillary response to light is also tested with the transilluminator. The optometrist looks to see whether the pupil is reactive to light, and whether the patterns of response are normal. Some diseases cause particular and recognizable pupillary aberrations. This test is also graded on a four point system.

1) very unreactive pupil showing no appreciable response to light (Note: as this is often a concomitant of aging, the optometrist may have the assistant write "aged" after the figure 1 if the patient is elderly);
2) minimal pupillary response, about 1mm change;
3) normal pupil, contracting and relaxing to light and dark by approximately 3mm; and,
4) a very large pupillary response, greater than 3mm.

As reported by Schiffman, the pupil can also be graded according to its patterned responses. If the pattern is normal, the acronym PERRLA is recorded. It means that the pupils are equally round, reactive to light, directly and indirectly, and to accommodation. Should this pattern not be obtained, the optometrist will detail the aberrations.
Ophthalmoscopy.

The ophthalmoscope is an instrument used to see the inside of the eye, or fundus, and the ocular media. The media is usually clear and is so indicated. Any lack of clarity is recorded as an opacity. The fundus is normally orange-red. There may be scars, hemorrhages, edematous areas and other disease related signs on the fundus which the optometrist will detail when he sees them.38 There are three specific landmarks on the fundus: the macula, the optic nerve and the blood vessels. Each landmark is given special attention and has certain recording conventions associated with it.

When observing the macula, the optometrist will have the assistant record "m/r" if he sees a macula reflex (a reflection of light from the macula). If he sees eccentric fixation, he will have her record "e/f".

The optometrist will examine the optic nerve, which is whiter than the rest of the fundus and usually has an indentation, the physiological cup. He will have the assistant record the cup-to-disc ratio. The cup size is expressed in tenths of the disc size. For example, the cup-to-disc size may be expressed as .3 meaning that the cup is approximately three-tenths the size of the disc. If no appreciable cup is seen, "NAC" is recorded.

The depth of the cup is recorded as "S", "M" or "D" for shallow, moderate or deep. A "C" might be used to denote a swollen or choked disc.
The optometrist checks the disc margins for clear or blurred choroidal (black pigment) ring presence. He will dictate any findings.

Disc color is noted and recorded, using a four-point scale, as follows:

1) white or no color disc;
2) faint pink disc;
3) distinctly pink disc; and,
4) hyperemic or very red disc.

The optometrist looks for deflection of vessels within the disc. He will dictate any findings. Usually, nasal deflection is the only noteworthy variation.

He also examines the blood vessels of the fundus and he will indicate the ratio of arterial diameter to vein diameter. This is recorded as a ratio, for example: 4/5. This would indicate the diameter of the artery is four-fifths the size of the diameter of the vein.

Vein engorgement is recorded. Sometimes there is localized engorgement of veins. Any places on the fundus where the veins are especially swollen are designated by their distance and direction from the optic nerve. For example, "VE 3DD ST" means vein engorgement is seen three disc diameters supra (above), temporally (away from the patient's nose) to the disc. This same disc referent is used to locate all observations of the fundus.

The arterial light reflex is checked and recorded as a fraction, for example 1/3. These fractions are used to indicate
the ratio of the central light reflecting part of the artery to the total arterial diameter.

The presence of vessel or arterial tortuosity is recorded when found. This may be indicated as "A & V" tortuosity.

If arterial or venous crossings are noted, they are recorded and labelled to describe nicking, elevation, banking or compression. These terms are descriptive of what is seen and do not refer to physical conditions. For example, a "nicked" vessel looks like it is gone, or hidden, right where it crosses another vessel. The "elevated" vein or artery appears to hump up at the crossing point. Compression is the appearance of a narrowing or squeezing at the crossing point. Banking refers to a deviation of the course of the artery or vein. For example, a hypothetical case record might indicate "A&V X @ 2DD IT, nicking". This means an arterial/venous crossing, two disc diameters infra-temporally, with the appearance of nicking.

**Biomicroscopy.**

The biomicroscope or slit lamp is a specially built microscope and lighting system that allows the optometrist to see structure and details which are not otherwise visible. As with many optometric instruments, it is important that the patient be seated properly before the instrument. The chin must be in the chin rest and forehead placed firmly against the forehead rest.
In general, the assistant will write down those conditions reported by the optometrist. These will include observations of the eyelids, lid margins, puncta, conjunctiva, caruncle, cornea, anterior chamber, iris, and lens of each eye. There are no particular recording conventions, although the individual optometrist might develop some for his own practice. This is especially possible in a busy contact lens practice because the fitting and evaluation of contact lenses requires the use of the biomicroscope. The use of the slit lamp in contact lens work is not presented here because of the specialized nature of this work.

As noted earlier, the anterior chamber angle can be checked with the slit lamp as well as by transillumination. When this is done with the biomicroscope, the quadrant in which the angle checked is recorded, otherwise the recording is the same as in transillumination. For example, Angle: #2 nasal, #3 temporal (or, Angle: 2N, 3T) signifies that the nasal quadrant is a grade two angle depth (narrow but open) and that the temporal quadrant is grade three (normal and open).

Photography.

In order to better document and describe pathology, especially as seen through the slit lamp, a camera might be attached to the biomicroscope. This would not be meant to replace the recording of the normal slit lamp examination, but rather to augment it. It is the assistant's duty to be certain that the photographs are carefully documented. This is done by recording the relevant
information regarding each photograph in a special reference notebook. The patient's name, the number of the picture on the roll of film, and a brief description of the object of the picture should be recorded, along with the date the picture was taken. When the film is developed and returned, the pictures can be matched to the correct patients and case records using the reference notebook. Before attaching the pictures to the case records, the assistant should print on the back of each photograph the patient's name, the date the picture was taken, and the subject of the photograph. These recording procedures will keep the pictures from being lost or confused.

**Tonometry.**

Tonometry is the process of measuring the intra-ocular pressure (IOP) of the eye. The IOP is the fluid pressure of the eye and it must be within certain tolerances to maintain a healthy eye. The measurements are actually estimates of the IOP and the limits or range of a normal IOP therefore vary according to the instrument used. In order to increase the reliability of the measurement, a blood pressure reading is sometimes taken along with the IOP measurement.\(^{35}\) When the blood pressure is measured, a tonometric or IOP index value is computed (the TI). The tonometric index is the blood pressure value given by the optometrist, divided by the tonometry reading.

The tonometric values are recorded in millimeters of mercury or just abbreviated mm. The time of day and the eye measured are also recorded.
For example:

\[ \text{O.D. 15 mm} \quad \text{O.S. 17 mm} \quad @ 10:40 \text{ a.m.} \]
\[ \text{T/I O.D. 75/15=5/1} \quad \text{O.S. 75/17=4.4/1} \]

In the example, the reading of the right eye is 15 mm of mercury and the left eye is 17 mm of mercury, at a reading made at 10:40 a.m. on the date of the exam. The tonometric index of the right eye is blood pressure 75 over tonometric score 15, or a 5/1 ratio. Similarly the left eye reading is blood pressure 75 over tonometric reading 17, or a 4.4/1 ratio.

To review, the following is an example of findings that might have been recorded in a visual health exam:

**General Observation:**

- **O.D.** Entropion, occluded punctum of lower lid, conjunctiva injected. Cornea clear.
  
  Pupil #3, PERRLA

- **O.S.** Clear, NAP
  
  Pupil #3, PERRLA

**Ophthalmoscopy:**

- **O.D.** Clear media, M/R/ C/D of .2, S, margin clear temporally, #2 color; A/V 3/4, a light reflex 1/4, no tortuosity, no crossing phonemena apparent

- **O.S.** Small opacity in lens nasally
  
  M/R observed; C/D .2, M, margin clear, choroidal crescent, temporal to the disc; A/V 3/4, light reflex 1/4, no tortuosity; AV X 2DD SN, nicking; AV X 3DD ST, compression
Biomicroscopy:

O.D. Scar tissue of lower lid margin, associated with entropion. Punctum of lower lid occluded with an eyelash. Conjunctiva injected. Angle: 3T 2N

O.S. Opacity of scar at the temporal limbus, small lenticular opacity nasally. Angle: 3T, 2N

Photography:

Photo: John Smith, 29 Jan 1969, entropion of left eye
Goals for the assistant:

1. To know the name and designated test number for each visual function test
2. To know the type of value to be recorded for each visual function test
3. To be able to properly and accurately record results of a visual function test
4. To know each procedure in the visual health exam
5. To be able to use and understand all recording conventions of the visual health exam sequence
6. To be able to record such non-standard phenomena as the optometrist reports

Requirements to the optometrist:

1. To review and perform each test in the visual function and visual health exams and answer questions for the assistant
2. To write out and describe individualized recording conventions for the assistant's benefit
3. To illustrate or provide illustrations of as many landmarks and structures as possible
4. To check the assistant's early recording efforts for completeness and accuracy
Tonometry

Tonometry is the estimation or measurement of the fluid pressure or intra-ocular pressure (IOP) of the eye. The IOP must be within normal limits to maintain a healthy eye. The range of normal values is dependent on the instrument used to estimate the pressure. The normal range for the air puff or non-contact tonometer (NCT), made by American Optical Company, is not yet established, but the 10-20mm range generally would be considered within limits. The matter of deciding whether the IOP of a specific patient is acceptable is best left to the optometrist.

Unlike keratometry, the measurement of the IOP is not itself particularly diagnostic; only the reading obtained is valuable. Tonometry is therefore a procedure that can be assigned to the assistant. Unfortunately, most tonometers require either a great deal of skill and have some attendant dangers; or require the application of drugs as a part of the procedure. Because of these considerations, the only instrument with which the assistant can administer tonometry is the American Optical Non-Contact Tonometer already mentioned.

Procedure

Fortunately, the NCT is not only easy to use, it is one of the tonometric methods which is least offensive to the patient.
To reduce patient apprehension, however, it is best to demonstrate the instrument prior to actual measurement. The patient should be seated before the tonometer and instructed to hold his finger about two centimeters in front of the nozzle. The on/off selector should be turned to D (demonstrate). In the center of the vertical height adjustment knob is a button which the assistant presses to release a puff of air against the patient's finger. The assistant can explain that this is the same action that the tonometer uses in releasing a puff of air onto the patient's cornea. The patient should be advised that the nozzle will be very close to his eye but that it will not touch the eye. The selector dial should immediately be turned to M (measure) to assure that accurate readings will be given.

For the actual measurement, the patient places his chin in the chin rest and puts his forehead in contact with the two white forehead buttons. If the forehead buttons are not pressed, the target cannot be seen well by the examiner and accurate measurement is jeopardized. The assistant should explain to the patient the importance of his remaining still against the forehead rest buttons.

Looking from the side of the instrument, the assistant then brings the nozzle close to the patient's eye (within three or four centimeters). Since the vertical adjustment of the instrument is limited, it might be necessary to move the chin rest up or down to position the nozzle vertically before the eye. The
instrument platform must be unlocked before lateral positioning is attempted. When the nozzle is approximately centered before the cornea, the nozzle is moved toward the cornea until it is about the length of an eyelash away from the cornea, but no closer than five millimeters. The assistant then locks the special locking mechanism that prevents the nozzle from moving in any closer. She may find that it reassures the patient to know that there is this safety provision.

The patient is then instructed to look through the instrument and focus on the red dot he sees. The assistant looks through the examiner's side of the instrument at the mire, or target, which reflects from the patient's cornea. The mire is a small red dot centrally placed within a larger white disc. This dot and disc target will move when either the patient's eye moves, or when the instrument controls are manipulated.

A fixed, immobile, thin, black line in the shape of a ring will also be seen when the assistant looks into the instrument. The assistant's task is to center the red dot within the black ring by moving the controls and to simultaneously trigger the release of the puff of air, while maintaining proper focus.

Because the patient's eye will be in constant motion large enough to affect the procedure, the assistant's task requires speed and dexterity. Proper hand placement on the control knobs is therefore important. The left hand should manipulate the knurled vertical control knob, with the index finger lightly poised over the triggering button. The right hand should control the joy stick.
By moving the joy stick to and fro, the mire should first be focused. Focus is obtained when the disc is solid white and the red dot is clear. If the dot is clear but white concentric rings are seen instead of a white disc, the nozzle is too far from the patient's eye; the joy stick must be moved in. After the mire is in focus, the red dot must be centered both vertically and laterally within the black ring. Vertical control knob movements and lateral joy stick movements will therefore have to be made simultaneously. As the moving red dot passes into the black ring, the trigger must be instantly depressed, for the dot will not stay in any position for more than a moment. This means that the vertical control knob, the joy stick and the trigger will all have to be manipulated at once. This requires dexterity, but with practice it becomes an easy task. Normally, the instrument will be properly aligned when the triggering button is depressed and a low numbered (less than 60) digital readout is obtained. If the instrument was not properly aligned, 99 or a very high number will appear in the readout window, in which event the process must be repeated. If very high numbers are repeatedly obtained, the optometrist should be called immediately. In the case where high readings are valid, an ocular emergency may exist.

Three readings are taken for each eye, and the average of the three is recorded, along with the time, date and examiner's initials.
Example:

<table>
<thead>
<tr>
<th>O.D.</th>
<th>O.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

Notation: NCT pressure O.D. 13/O.S. 13  2:15 p.m. 12-5-77 mlj
Goals for the assistant:

1. To know what tonometry is.
2. To be able to explain the procedure adequately to patients.
3. To be able to quickly and safely perform accurate tonometry with the Non-Contact Tonometer

Requirements for the optometrist:

1. To show the assistant all of the control knobs and devices of the NCT and demonstrate how to manipulate them.
2. To perform the entire procedure for the assistant to observe.
3. To monitor and coach the assistant through the initial attempts at performing the procedure.
4. To periodically check the assistant as she is using the NCT and help her to correct any errors in performance.
Visual Fields Testing

Introduction

The visual field, according to Harrington, is "that portion of space in which objects are simultaneously visible to the steadily fixating eye." This is the amount of visual information the eye can obtain without changing its position. The sensitivity of the eye to objects and visual input in general is dependent on the integrity of the retina and neural pathways of the visual system. Visual field testing is, therefore, primarily concerned with the detection of any loss of vision.

Visual loss can be of several different types. A certain part of the field may be totally insensitive, or blind, to any object or stimulus (type one). A field loss may consist of an inability to perceive objects smaller than a certain given size (type two). A field loss could also be dependent mainly on brightness, where objects must have a certain luminosity to be seen (type three).

There are visual field "losses" or perturbations that are normal. There is a blindspot (type one loss) in everyone's eye. This corresponds to the place in the retina where the optic nerve leaves the eye; this site is the optic disc (see recording ophthalmoscopy). Since there are no photoreceptors over the optic disc, that part of the retina is totally blind. This area of blindness is called the physiologic blindspot or simply the blindspot.
A type two loss is represented by the sensitivity to size change between the macula and periphery. An object just large enough to be seen by the macula or central field will not be perceivable to the peripheral retina.

A type three loss is represented by the greater sensitivity of the peripheral retina to low light level than is the macula. A light just bright enough to be seen in the peripheral field (by the peripheral retina) would, therefore, not be seen by the macula (central field).

Obviously, the relative sensitivities of the peripheral and central fields are opposite. The periphery is more sensitive to low levels of light than to small size; the central field is not sensitive to low light level but is very sensitive to small size. The peripheral part of field which follows this relationship is much larger than the central part of the field. The part of the field which is very sensitive to size is only about 5° wide—about the same size as the blindspot.

The purpose of visual field testing is to discover any unusual or non-physiologic field losses. In taking a visual field, one must, of course, be aware of and account for the physiologic field perturbations or discontinuities. The type one loss or blindspot is accounted for by measuring out its size and shape. The normal type two and three losses, or variations, are accounted for by using a target which is large and bright enough so that they are not manifest.
The Auto Plot

There are several methods of measuring and evaluating the visual field. The only one covered here involves the use of the Auto-Plot tangent screen made by Bausch and Lomb. The Auto-Plot is standardized, as the target size is consistent for all instruments and the distance from the patient to the screen is a standard one meter. Further, most of the variables which make field testing difficult are controlled. The Auto-Plot has the added advantage of producing a record of the visual field simultaneously with the performance of the test.

The responses and results from field testing are diagnostic of many different diseases. The optometrist might have his assistant perform visual field tests to screen for loss of function. If abnormalities are found, however, he may wish to repeat the test himself or do it differently to assist in diagnosing the problem.

Testing Procedure

Prior to bringing the patient in for field testing, the instrument should be checked for readiness. The supporting arms from the table which hold the screen should be fully extended. A piece of recording paper should be placed over the illuminated recording surface. A pencil should be in its holder on top of the recording surface. The assistant should be familiar with the switches which turn on the instrument and recording light, and which adjust the size of the target. The target is simply a disc of light projected onto the screen that exactly follows the movements
of the pencil holder; the light is, in fact, moved by moving the pencil holder. The assistant adjusts the target size to that prescribed for the patient, which is usually the two millimeter size. The recording form should be labelled at the bottom of the page with the patient's name, the size of target, the time of day, the date and list of known diseases. The patient should wear his prescription lens if he has one.

Before performing a visual field test, the patient should first be dark-adapted. This is to allow the peripheral retina to come to a resting level, which assures that it will be optimally sensitive during the procedure. To accomplish dark-adaptation, the patient is seated in the darkened field testing room for approximately ten minutes.

After the patient has been dark adapted, one of his eyes is covered with an eye patch. Each eye will, of course, be tested separately and the procedure is the same for each. The instrument is turn on. The patient places his chin in the chin rest, with the uncovered eye looking through the fixation ring, which is about three inches from his eye. The patient is instructed to look through the ring at the X on the center of the projection screen. To check, the assistant asks the patient if he sees the X as though it were inside the ring. If not, the assistant instructs the patient to move his head until he sees the X in the ring. The patient must be told to look at the X and not at the spot of light. The patient is advised that the light will be moved around, but that he is not to look at it,
but only to stare at the X. The assistant may demonstrate this movement for the patient before beginning the test. The patient is told to tap on the table once or to say "gone" when the light disappears, and to tap twice or to say "here" when the light reappears. Periodically during the test, the assistant should remind the patient to stare only at the target.

After instructing the patient, the assistant begins by moving the light to the patient's blindspot. The blindspot will be to the temporal side, or to the patient's right when his right eye is left uncovered. The light is then made to disappear by moving it into the blindspot, which should correspond to the outlined oval on the recording form (see appendix this section). The assistant plots the blindspot by making a mark by pressing down on the pencil when the patient reports that the light reappears. By moving the light back into and out of the blind spot and marking exit points with the pencil at several points, the blindspot becomes apparent. The assistant should make as many marks as needed to plot the size and shape of the blindspot. At least four marks are needed, one each at the top, bottom and sides, to plot the blindspot. Once the form of the blindspot is apparent, the assistant will cross-hatch or mark out the total area of the blindspot.

Once the blindspot has been plotted, and starting at the fixation X on the screen, the assistant moves the light in a spiral out from the center. Anytime the patient reports that the light disappears, the blind area so discovered is plotted
in exactly the same manner as the blindspot. This could indicate a type two or type three field loss. The optometrist might indicate other strategies than the spiraling out from center technique to uncover blind areas other than the blindspot. If so, he will demonstrate them.

Most recording forms have a space to indicate the assistant's subjective evaluation of the patient's performance. The assistant should briefly indicate whether the patient was alert, cooperative, etc.
Goals for the assistant:

1. To know what the visual field is and why it is tested.
2. To know what kinds of field losses there are.
3. To know what the blindspot is.
4. To be able to plot the blindspot and perform the field test on an Auto-Plot.

Requirements for the optometrist:

1. To show the assistant how to set up the instrument and to indicate all of its working parts and how to manipulate them.
2. To perform a visual field test to demonstrate the procedure.
3. To coach as necessary when the assistant attempts to administer the test for the first time.
Lensometry

Introduction

A lensometer is an instrument that measures the power of lenses. It is used to verify the optical prescription of spectacle and contact lenses. That is, when a prescription is received, the lensometer can ascertain whether the prescription has been manufactured exactly as ordered.

To fully understand the instrument, the assistant should have an understanding of optics. This can best be acquired from a text which the optometrist can provide, such as Ophthalmic Mechanics and Dispensing by Epting and Morgret.

Briefly, there are five components that a lens might have: prism, optical center, sphere, cylinder, and axis. They are defined as follows:

1. Prism: This is a lens or a component of a lens that deviates light at an angle without focusing the light or affecting it in any other way.

2. Optical Center: A point on a lens through which light is not affected by any focusing properties the lens might have is the optical center. This can be considered to be the point through the lens from which there is no prism or prismatic powers. (Note: A lens with prism may not have an optical center within its boundaries.)
3. Sphere: This is the property of a lens which focuses a point source of light to a point. A plus power sphere lens brings light together toward a point in space. A minus power sphere lens spreads light apart so that it appears to come from a point in space.

4. Cylinder: The cylinder is the property of a lens which focuses a point source of light into a line. Optometrists work only with minus power cylinders. The power of a cylinder changes in regular steps from the axis until it reaches maximum, $90^\circ$ from the axis.

5. Axis: A cylinder lens has a different power in each meridian. The meridian of no power or least power is the axis. The full amount of the cylinder power overlaid on any sphere power is $90^\circ$ from the axis.

Any one of the five properties can be found alone or in combination with the others in any given lens. The only exception is that cylinder and axis must by definition be found together. When cylinder power is overlaid on sphere power, the amount adds to the sphere power. The sphere, cylinder and axis are always written in conventionalized form. Examples of the basic combinations of power follow.
1. Sphere alone: +1.00 sphere

When there is no cylinder power, the amount and sign are always written and are followed with the word sphere, sometimes abbreviated as "sph".

2. Minus sphere and cylinder: -1.00 -1.25 X180

The sphere power is always written first and is always the least minus number before the cylinder is overlaid. It is the power which exists in the axis meridian, in this case, -1.00.

The cylinder power, in this case -1.25, is always the second number written. The actual power of the lens where the cylinder is maximal is 90° from the axis (90° in this case) and is the sum of the sphere and the cylinder power. The lens power at 90° is therefore -2.25 or (-1.00 + -1.25 = -2.25). The signs of the cylinder and sphere power follow the laws of addition and subtraction.

The axis is always written last and is preceded by an X.

3. Plus sphere and cylinder: +1.50 -1.00 X30

The sphere power is +1.50. The cylinder power is -1.00. The total lens power at 120° or at maximum cylinder overlaid on the sphere is +.50. That is +1.50 + -1.00=+.50.
Use of the Lensometer

The lensometer is rather difficult to learn to use well. To use it properly, one must understand the principles presented. It can also be difficult to learn to manipulate the instrument properly. The assistant will need to spend time with the optometrist, as he shows her what should be seen and how to find the required results. The optometrist, of course, can familiarize the assistant with each of the parts of the lensometer. The principle working parts of the instrument are: the eyepiece and prism reticle, lens holder, power wheel, cylinder axis dial and lens marking device. Each of the five lens values can be found by following the given procedure.

The mire in most lensometers is a set of lines. One line, call it the "fat" line, is wider than the others and may actually be three lines separated by very small gaps. The other set of lines, perpendicular to the first, is composed of three lines separated by significant gaps. The fat line is the sphere line; the set of three lines is the cylinder set.

Before using the lensometer, the eyepiece must be focused. A piece of paper is placed over the nose piece. The eyepiece is turned out by turning it counterclockwise. It is then turned clockwise until the reticle is focused. With the power wheel at zero, the target, or mires, should also be clear and distinct when viewed through the eyepiece with nothing in place.
1. **Optical center.** To find the optical center (O.C.), the lens is moved until the fat line and center cylinder line are centered within the reticle. The O.C. is marked with the lens marker. The O.C. is always positioned and marked before determining sphere and cylinder. The lens with the concave side is always positioned against the stop. After all measures are finished in the instrument, the distance between the marked O.C.s or the two lenses can be measured with a ruler.

2. **Sphere power.** The procedure is started with the power wheel in plus. The wheel is turned toward minus until the mires become clear. The power is read from the power indicator. All of the lines, the sphere and cylinder set together, will come into focus at once if sphere power alone exists.

3. **Sphere with cylinder determination.** The power wheel is turned up into plus power. Then the power wheel is turned toward minus until one of the mire lines starts to become clear. Next the axis dial is turned until the sphere line is clearest. The power is read and recorded when the sphere line is in focus. The assistant continues to turn the power wheel into minus until the cylinder lines are focused and she records that power. This second reading is the amount of power of the cylinder meridian. The difference between the sphere reading and second reading
is the cylinder power. The axis is recorded from the setting established to make the sphere line clear. Thus, if sphere power was -2.00, axis setting 15 and the second reading is -3.00, the total lens power is: -2.00 -1.00 X15 (see description of sphere and cylinder power and axis).

4. **Bifocals.** The segment side is placed against the stop. One of the mire lines is cleared in the distance portion of the lens as with any lens. That value is recorded. The lens is then moved up so that the bifocal or segment portion is over the stop. The same mire line chosen in the distance portion is refocused. It is irrelevant which of the sets of lines is chosen to focus initially, but the same set must be focused when the measurement is made through the segment. The difference between the distance and segment power readings is the power of the bifocal segment. (Note: The segment will be more plus than the distance; therefore, this is the only time the power wheel is turned in the plus direction.)

5. **Prism.** Prism is uncommon in a lens and the optometrist will probably evaluate those lenses which have it. If the optical center cannot be found on the lens, it is not necessary to be concerned with the possibility of prism—the optometrist will take care of it. If prism is found, the target or mires will be displaced and will not center no matter where the lens is moved. The lens, then should be approximately centered over the lens
stop or nosepiece. The juncture of sphere line and center cylinder line of the mire will fall on or near one of several concentric circles in the reticle. The number on the circle is the number of prism diopters of prism. The prism alignment or meridian is found by turning the base indicator line so that it passes through the sphere-cylinder juncture of the mires. The reticle direction is the meridian of the prism. Base direction is in the direction of displacement of the center of mire from the target center. The optometrist will need to make the final determination of prism powers and direction.
Goals for the assistant:

1. To know what prism, sphere, cylinder, axis and optical centers are and how to find them on a lensometer.
2. To know how to record lensometer findings.

Requirements for the optometrist:

1. To show the assistant where all of the working parts of the lensometer are and how to manipulate them.
2. To show the assistant how to focus the eyepiece.
3. To demonstrate to the assistant how to place the lens or spectacle in the instrument.
4. To show the assistant what the mires look like and how they are made to come into focus with different lenses.
5. To give the assistant practice lenses to develop her skill.
Afterward and Recommendations

The project has been read, edited and utilized by some of the wives of my colleagues, none of whom has an optometric education. These ladies were specifically chosen as representative of intelligent and motivated, but untrained, persons. It is assumed that they would function approximately like an untrained but newly hired optometric assistant. The women who studied the material found it to be readable and understandable. Their suggestions for improvements have been incorporated into the paper. They found that the project prepared them to perform the outlined optometric procedures. Since these ladies found the material to be a valuable learning device, there is at least an indication of the practical value of the project.

Due to limitations of time and resources, much of the follow-up work required for the project has not yet been done. The material should actually be given to practicing optometrists and their assistants. Only in this way can proof be offered of the worth of the material in an actual practice. From such an experience, suggestions for further improvements could be derived.

There is also more material than could be prepared for this project. The areas of spectacle dispensing, contact lens assistantship and vision training assistance could be prepared in the same manner.
Hopefully, the project fulfills its objective of making optometric technicianry organized and understandable in a work-day situation. While the project is longer than originally conceived, the attempt was to cover the material as briefly as possible without sacrificing thoroughness. If the ultimate purpose is fulfilled, all optometrists will find something of value in the project.
Bibliography


