

**DYNAMIC SKIOMETRY AND
METHODS OF TESTING THE
ACCOMMODATION AND
CONVERGENCE OF THE EYES**

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Dynamic Skiametry and Methods of Testing the Accommodation and Covergence of the Eyes by
Charles Sheard

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DYNAMIC SKIAMETRY

and Methods of Testing

The Accommodation and Convergence of the Eyes

Being an Essay Contributed to *The American
Encyclopedia of Ophthalmology*

BY

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Illustrated with Eighteen Diagrams

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DEDICATED
to
All those scientifically
interested in the practices
of ocular refraction

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FOREWORD

Through the courtesies of Colonel Casey A. Wood, Editor-in-chief of the *American Encyclopedia of Ophthalmology*, and the publisher, Dr. Geo. Henry Cleveland, of the Cleveland Press, the writer of this monograph has been able to secure a number of reprints of the original essay for the use of students and practitioners who may be interested in some of the important clinical tests upon the eyes involving the functions of accommodation and convergence and their co-ordination.

This monograph is presented to the reader in the hope that it will call attention to the desirability—if not the necessity in most cases—of making various dynamic as well as static tests upon a pair of eyes. In the past, the practices of ocular refraction have consisted almost entirely of what are commonly classed as static tests. These static tests have consisted in large measure in the determination of the corrections of the eyes to give as nearly as possible standard acuity. Duotion measurements and tonicity tests have formed a part of the routine of some few practitioners. These tests, by whatever means they may be carried out, are wholly in the interest of determining ocular deficiencies when the eyes are engaged in distance seeing.

Normally, with fixation at twenty or more feet, there should be no demand upon either the accommodation or the convergence. When the eyes are engaged in binocular single vision at close points, however, both accommodation and convergence are normally involved and demanded. Energy must be delivered through the proper channels to enable a pair of eyes to be thus co-ordinated and engage in distinct, single vision at near points. The *dynamics* of vision are, therefore, involved at such points. Since binocular single vision is desired at near points with the proper innervation and action of the ciliary muscles to occasion the act of accommodation and the requisite innervation to the interni to produce the exact amount of convergence demanded, hence establishing a proper coordination of accommodation and convergence, and since it is desirable that these physiologic acts be performed without strain, fatigue or the useless expenditure of energy, it is certainly a logical procedure to make investigations upon these functions, as to their strengths and coordination, in every ocular examination. But it is illogical to investigate functions under conditions that are not normally existent; hence accommodation and convergence should be not investi-

gated by methods which alone involve tests at twenty feet since there is a minimum demand, to say the least, upon either function at such distances. Rather should they be investigated at the distance at which they are most often called into play. This distance may be very properly taken to be the ordinary reading or close-working point of the person under test.

Furthermore, it does not follow that a satisfying of the static demands of a pair of eyes will likewise afford a sufficient relief of, or aid to, these eyes when they are accommodating and converging. In other words, a pair of eyes may be emmetropic and in perfect muscular poise at distance by any or all of the systems of examination, and yet be decidedly in need of assistance when engaged in close work. Presbyopia, in those fortunate enough to be emmetropic at distance, is a simple illustration of just such conditions. And eyes in those of twenty years or less may be as old from the accommodative standpoint as those of a person of fifty years. And again, convergence is not normally demanded at distance and ordinarily the demands upon the fusion centers at such distances are negligible, whereas the conditions of convergence at close points are almost as varied as are the pairs of eyes tested. Certainly, then, the demands upon and the resources of the convergence functions should be investigated at close points. A scientific ocular examination, therefore, resolves itself into a determination of *supply* and *demand* from the accommodative and convergence standpoints. It, therefore, behooves every practitioner upon the eyes to engage in tests which may be classed as *dynamic* as well as those known as *static*. Only by such methods do we feel that the full assistance which may be rendered through the use of optical media such as lenses, cylinders and prisms, will be afforded and only by such tests will the real seat of ocular discomfort be disclosed in many cases.

The author presents to the reader the pages which follow in the hope that they may stimulate thought, suggest new methods and aid in the elucidation of some of the difficult problems of ocular refraction.

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Southbridge, Mass., 1920.*

Dynamic Skiametry

and Methods of Testing

Accommodation and Convergence

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Chapter I. GENERAL STATEMENT OF THE METHOD OF DYNAMIC
SKIOMETRY.

Static skiametry involves the determination of the refractive error of an eye when it is in the condition of passively fixing a very distant object or when its ciliary is under the subjugation of a cycloplegic. *Dynamic* skiametry, on the other hand, involves the determination of those lens quantities which make the retina of the eye under test and the object—definitely fixed and usually at a close distance relatively from the eye—conjugate points. In the former set of tests accommodative suppression and relaxation are demanded; in the second set, however, when both eyes are fixing in the act of binocular single vision and endeavoring to read a diminutive chart or card of printed matter at close range, the maximum stimulation to the development of the accommodative changes necessary is in-

voked. In so far as the technique of shadow movements in the two methods is concerned it may be stated that the dynamic method may be practised almost at will by a person thoroughly familiar with the principles of static skiametry, or retinoscopy as it is commonly called. Ordinarily it is taught, and correctly so from theoretical principles, that an allowance of one diopter should be made in static methods for a working distance of one meter: for example, a neutral shadow obtained with a + 4 D. S. at one meter would indicate a demanded correction, theoretically, of + 3 D. S. Parenthetically we would call attention to the statement made by Alger (*The Refraction and Mo-*



Fig. 1.—Fixation Stand and its Use in Dynamic Skiametry. Illustrative of fixation and observation in the same plane. (Sheard.)

tility of the Eye) that, when working at one meter and not using a cycloplegic, the skiametric findings in order to produce a neutral shadow at the distance of one meter should be recorded as the correct findings without making the allowance for the working distance. The writer cannot accept in full this statement, but here records the fact that for years he has worked at about 26 inches and allowed only one diopter instead of a diopter and a half for the working distance, and finds that the skiametric findings thus obtained approximate very closely the finally determined upon prescription in most cases presenting no peculiar conditions of muscular imbalance or accommodative anomalies. In dynamic skiametry, as practised in one of its phases, no allowance for the working distance is made, provided