Atlas of STRABISMUS

GUNTER K. VON NOORDEN

Fourth edition

Atlas of STRABISMUS

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FOURTH EDITION

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Drawings by **Robert B. Wingate, D.Sc., F.R.S.A.**

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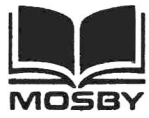

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Preface to fourth edition

It is gratifying to witness the fourth edition of the *Atlas of Strabismus* and to see it change into a more convenient format that should enhance its value as a handy study guide and reference source. A few illustrations and tests have been deleted because their relevance has become questionable; others have been added or substituted to illustrate additional diagnostic steps or to depict motility disorders not considered in previous editions.

The text has again been revised where necessary to improve its conciseness. Readers who wish to go beyond the bare essentials of strabismus diagnosis illustrated in this atlas are encouraged to continue their studies in *Burian–von Noorden's Binocular Vision and Ocular Motility: Theory and Management of Strabismus* to which this atlas serves as an adjunct and introduction.

I am grateful to my faithful editorial assistant, Mrs. Joan Trammell, for her help with the preparation of this manuscript and to my readers for their criticisms and suggestions.

Gunter K. von Noorden

Preface to first edition

The diagnosis of strabismus, including its sensory adaptations and motor characteristics, depends on thorough examination and correct interpretation of a great number of subjective and objective tests. In recent years our diagnostic resources have become enlarged and refined by new procedures, and new information on the nature of sensory adaptations in strabismus has necessitated a different interpretation of some of the older tests. Information on this subject is scattered throughout national and world literature and cannot easily be assembled by the ophthalmologist.

This atlas does not attempt to fill the need for a comprehensive textbook on strabismus; rather, it illustrates and provides basic information for the examination and diagnosis of strabismic patients in the light of present knowledge. It is not written for the expert but is designed primarily for the ophthalmologist-in-training, for the practicing ophthalmologist who is confronted by diagnosis of complex muscle problems only occasionally, and for the orthoptist.

Many diagnostic procedures to which the expert is accustomed are not included in this book. We have not endeavored to be comprehensive, but rather to include and describe only those tests that in our experience have proved most practical, do not require elaborate equipment and extensive space, and are frequently employed in our Motility Clinic.

It would exceed the purpose of this atlas to provide a complete list of references pertaining to all subjects under discussion. However, a few references have been selected for the student of strabismus who desires additional information on the more recently introduced tests.

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We hope this atlas may be of assistance to our colleagues in recognizing and analyzing strabismus problems, and that it will aid the understanding of the basis and interpretation of the described diagnostic procedures.

We are deeply indebted to Robert B. Wingate, without whose imaginative and artistic drawings this atlas could not have been completed. We also wish to express our gratitude to the Wilmer Photography Service for their cooperation, to David Andrews for his editorial suggestions and for preparing the index, and to Patricia Bond for typing the manuscript.

Gunter K. von Noorden
A. Edward Maumenee

Contents

I

Anatomy and physiology of extraocular muscles

ACTION OF EXTRAOCULAR MUSCLES

Under normal conditions no extraocular muscle contracts individually; innervational and inhibitional impulses flow simultaneously to all muscles. The action of a muscle is dependent on the angle between its *plane* (determined by the center of rotation of the globe and the centers of origin and insertion of the muscle) and the *optical axis* of the eye. It follows that the action of the muscle may vary according to the position of the globe in the orbit.

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Horizontal rectus muscles

The muscle plane of the horizontal rectus muscles coincides with the optical axis when the eye is in primary position. The action of the medial rectus is one of pure adduction and the action of the lateral rectus is one of pure abduction when the eye is in primary position. Secondary actions of the horizontal rectus muscles when the eye is in other than primary position are of less importance clinically.

Figure 1

A Action of the medial rectus muscle (adduction).

B Action of the lateral rectus muscle (abduction).

Vertical rectus muscles

Figure 2. Right superior rectus.

A When the eye is in primary position, the muscle plane of the superior rectus forms an angle of 23 degrees with the optical axis. In this position the superior rectus elevates the globe. Secondary actions include incycloduction and adduction.

B As the eye moves into adduction, the superior rectus becomes less of an elevator and more of an adductor and incycloductor. In 67-degree adduction the superior rectus would become the exclusive source of incycloduction while still having adductive power. The position of 67 degrees is chosen for theoretical reasons only. The eye is never adducted that far.

C In 23-degree abduction the superior rectus becomes a pure elevator. In this position the muscle plane coincides with the optical axis.

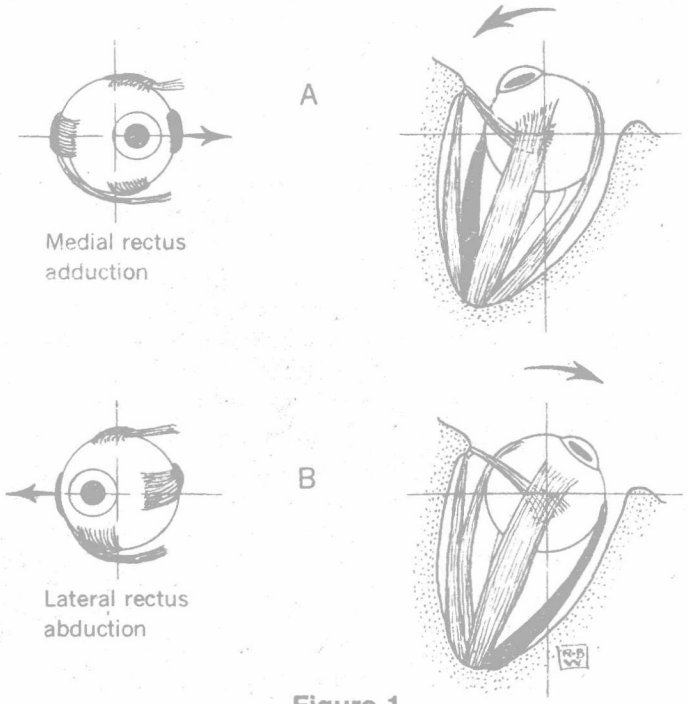

Figure 1

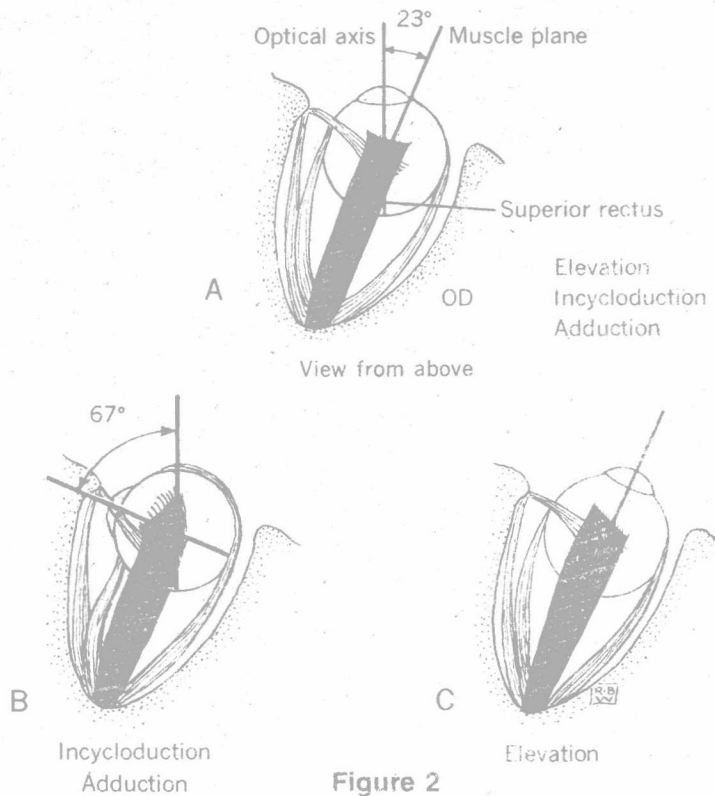

Figure 2

Figure 3. Right inferior rectus.

A With the eye in primary position the inferior rectus forms an angle of 23 degrees with the optical axis. Thus the relationship between muscle plane and optical axis is identical to that of the superior rectus. In primary position the inferior rectus depresses the globe. Secondary actions include excycloduction and adduction.

B As the eye moves into adduction, the inferior rectus becomes less of a depressor and more of an excycloductor and adductor. In 67-degree adduction it would become the exclusive source of excycloduction and aid adduction. However, the eye is never adducted that far.

C In 23-degree abduction the inferior rectus becomes a pure depressor. In this position the muscle plane coincides with the optical axis.

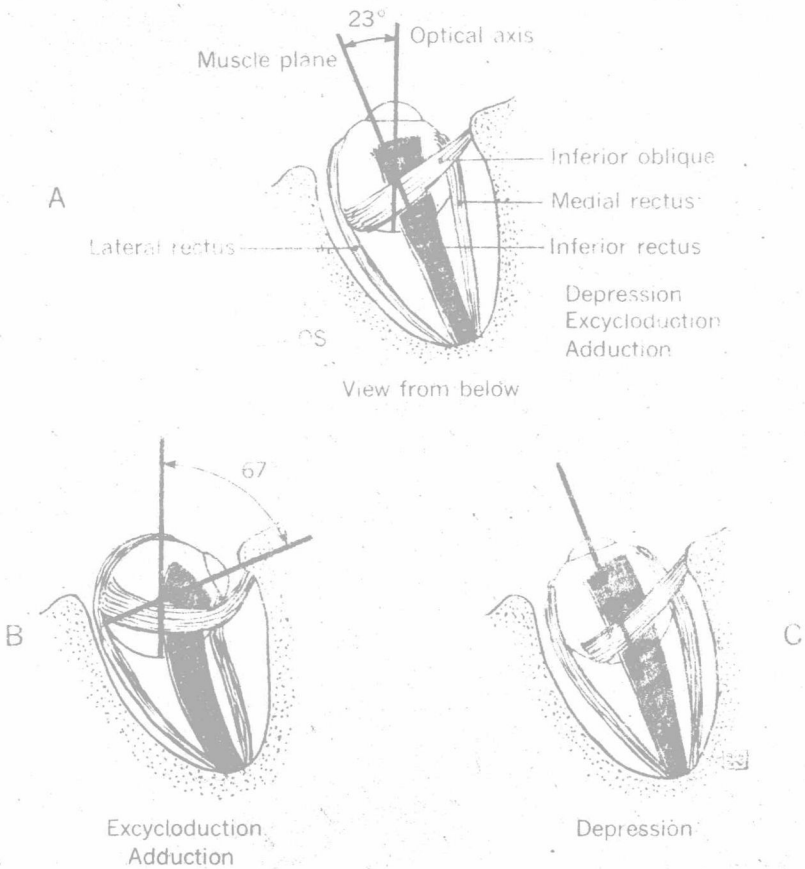
23°
Optical axis
Muscle plane
A
Inferior oblique
Medial rectus
Lateral rectus
Inferior rectus
Depression
Excycloduction
Adduction
OS
View from below
67
B
C
Excycloduction
Adduction
Depression

Figure 3

Oblique muscles

Figure 4. Superior oblique.

A When the eye is in primary position, the plane of the superior oblique muscle forms an angle of 54 degrees with the optical axis. In this position incycloduction is the principal action of the superior oblique. Secondary actions are abduction and depression.

B When the globe is adducted 54 degrees, the optical axis coincides with the muscle plane. In this position the muscle still acts as an incycloductor, but its vertical action becomes more significant.

C When the globe is abducted, the superior oblique muscle acts primarily as an incycloductor and secondarily as an abductor.

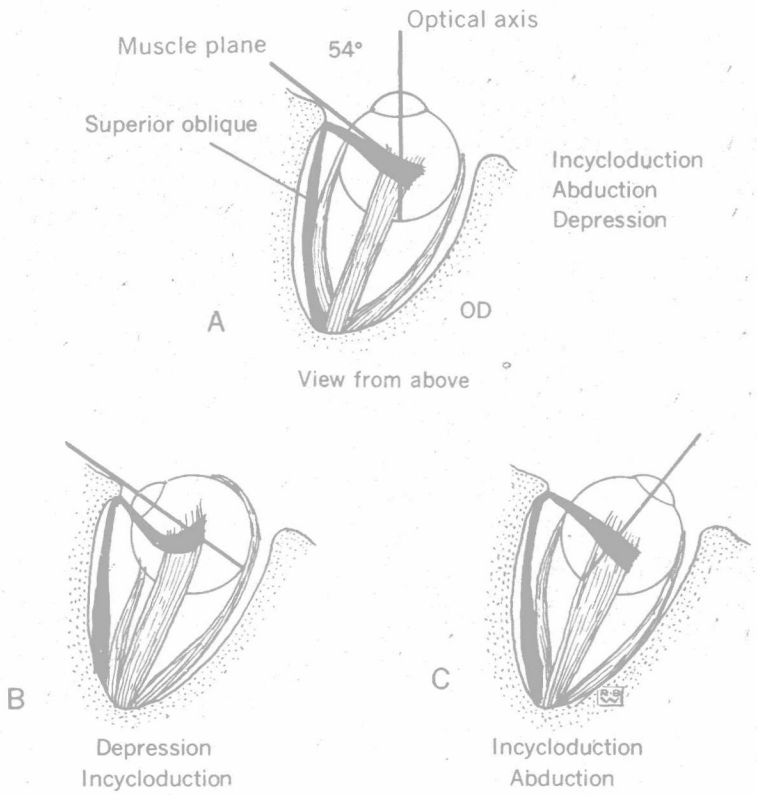

Figure 4

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