ATLAS OF STRABISMUS SURGERY

Eugene M. Helveston

SECOND EDITION

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STRABISMUS SURGERY

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With love and gratitude
to my wife

BARBARA

Foreword

The principles of strabismus surgery, consisting of weakening the action of an overacting muscle or strengthening the action of an underacting muscle, have remained unchanged for many years. Significant modifications and refinements during the last few decades, however, have enabled the surgeon to deal more effectively with clinical situations in strabismus, many of which were thought to be incurable only a short time ago. For instance, the improved preoperative and intraoperative diagnosis of mechanical factors and their elimination by conjunctival surgery and other means, the increased popularity and proved effectiveness of muscle transposition procedures, the use of plastic materials, the improvement of exposure techniques for surgery on the oblique muscles, and the reintroduction of marginal myotomies are some of the features that have recently received special attention.

Descriptions of these and other modern surgical approaches are scattered widely in the literature and are not readily accessible to most ophthalmologists. This atlas fills a definite void in presenting an up-to-date collection of current surgical techniques and indications for their use.

Dr. Helveston, an experienced strabismus surgeon, is a well-qualified authority on the subject. He has performed an invaluable service in assembling this atlas. The wealth of illustrative material and the accompanying succinct text should make this book indispensable for residents and ophthalmologists in practice. I predict that it will be received enthusiastically by the ophthalmologic community and am proud that it comes from the pen of one of my former students.

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Preface TO SECOND EDITION

In the 4 years since publication of the first edition, several new surgical techniques have become popularized, some older techniques have been refined, improved suture materials have been developed, and testing procedures have advanced in the field of ophthalmology. The Faden operation, or posterior fixation suture, has found a variety of uses. A simplified adjustable suture has proved extremely useful in the management of strabismus with restriction, as has expanded use of conjunctival recession. Synthetic absorbable sutures, while not yet of the ideal design, are probably made of the ideal material for buried sutures where absorption is desirable. Force and velocity tests have found expanded use.

Increased surgical volume and greater follow-up time produces widened experience, and this prompted several minor changes in the text. The occurrence of more and unique complications was expected; these will also be included.

Much of the material for this edition was obtained with the assistance and criticism of my colleague, Dr. Forrest D. Ellis. As in the first edition, Craig G. Gosling provided the illustrations.

The many readers of the first edition, including residents, fellows, and fellow ophthalmologists, supported my efforts by acknowledging what they thought was worthwhile and by offering suggestions for changes and additions where they thought such modification would be beneficial. Many thanks also to Joanna Jackson for typing the manuscript.

Eugene M. Helveston

Preface TO FIRST EDITION

There have been several excellent texts on strabismus including strabismus surgery in the past few years, but developments have moved rapidly. Recent advances in technique have greatly expanded the options available to the strabismus surgeon. More accurate diagnostic tests leading to a better understanding of the pathophysiology of strabismus and amblyopia have convinced some surgeons of the need for surgery in infants as young as 5 months of age. Improved anesthesia and an increasing boldness on the part of the strabismus surgeon have led to outpatient extraocular muscle surgery in some instances without patch and without ointment or drops. The limbal and cul-de-sac (or fornix) extraocular muscle exposure techniques have largely superseded the transconjunctival incision in the interpalpebral space among younger surgeons. The retinal surgeon has opened new dimensions in the degree to which sub-Tenon's space may be explored.

New sutures, adhesives, muscle sleeves, and implantation materials have proved useful innovations. Globe fixation sutures, conjunctival recession and relaxation procedures, forced duction and active forced generation tests, as well as topical anesthesia for extraocular muscle surgery, have greatly enlarged the vista of strabismus surgery.

For these reasons it seems appropriate at this time to compile an up-to-date atlas of strabismus surgery. This atlas employs schematic drawings designed to illustrate at each step only that anatomy significant to the step shown for easier orientation of the reader. Procedures that I have found useful have been given emphasis; those that are controversial or that I have not found to be particularly helpful have been omitted. A "favorite technique" may be omitted simply because I prefer an alternative choice; those that I think should be avoided will be clearly labeled so.

No attempt will be made to give a set of surgical recipes that will result in a predetermined amount of straightening. Instead, general concepts leading to a philosophy for strabismus surgery will be presented. My intent is that this atlas will be of help to the practicing strabismus surgeon and the resident in ophthalmology by bringing together in one volume many techniques from a variety of sources for quick and easy reference.

Several people who assisted significantly in their own way to make this atlas possible deserve my sincere thanks. Dr. Gunter K. von Noorden, teacher, critic, and friend, introduced me to strabismus and to the pursuit of academic ophthal-

mology. Craig G. Gosling worked with industry and imagination on the illustrations, the heart of any atlas. Ken Julian, Susan Argeroplos, and Joe Demma prepared the photographic material. Dr. Fred M. Wilson provided the departmental leadership that made it possible to complete this work. Dr. Merrill Grayson furnished helpful criticism. Bonnie Wilson made the operating room a pleasant place in which to work. My residents and many of my colleagues, in particular Drs. Marshall M. Parks and Phillip Knapp, provided both stimulus and direction. My thanks also to Mrs. Paul Sanders and Pamela L. Payne for typing the manuscript.

Eugene M. Helveston

ATLAS OF
STRABISMUS SURGERY

Contents

1 Surgical anatomy, 1

The palpebral fissure, 2
The conjunctiva, 8
Tenon's capsule, 10
The rectus muscles, 14
The inferior oblique, 18
The superior oblique, 20
The blood supply, 22
The sclera, 24

2 Instrumentation, anesthesia, preparation of the patient for surgery, and postoperative care, 27

Instruments used in strabismus surgery, 28
Anesthesia for strabismus surgery, 30
Preparation of the patient in the operating room, 32
Postoperative care of the patient, 34

3 Sutures, sleeves, implantation material, and adhesives, 35

Sutures for extraocular muscle surgery, 35
Techniques for handling synthetic absorbable suture, 36
Needles, 38
Plastic sleeves, implants, and adhesives, 38

4 Techniques of exposure, 39

The conjunctival incision, 39
The Swan transconjunctival incision, 42
The cul-de-sac incision (Parks), 46
The limbal incision, 50
Oblique surgery incisions, 54

5 Recession technique of a rectus muscle, 57

Medial rectus recession, 58
Lateral rectus recession, 60
Superior rectus recession, 62

Inferior rectus recession, 64
Rectus muscle recession technique, 66
Vertical displacement of the horizontal rectus, 72

6 Resection technique of a rectus muscle, 75

Horizontal rectus resection (medial and lateral rectus muscles), 76
Management of the check ligaments and intermuscular membrane in horizontal rectus resection, 78
Resection clamp technique for rectus muscle resection, 80
Double arm suture technique for rectus muscle resection, 86
Resection of the superior rectus, 88
Inferior rectus resection technique, 90
Displacement of the horizontal rectus muscles with resection for A and V patterns, 92

7 Surgery of the obliques, 95

Weakening the inferior oblique, 96
Strengthening the inferior oblique, 104
Weakening procedures of the superior oblique, 106
Superior oblique tenotomy after a temporal approach, 110
Recession of the superior oblique, 112
Sagittalization of the superior oblique, 114
Strengthening the superior oblique, 118

8 Marginal myotomy: technique and indications, 123

Marginal myotomy: historical review, 124
Quantifying the marginal myotomy, 126
Marginal myotomy, 130
Indications for a marginal myotomy, 132

9 The Faden operation (posterior fixation suture), 135

10 Diagnostic and surgical techniques for strabismus with restrictions, 143

Strabismus with restricted motility, 143
Saccadic analysis, 146
Forced (passive) ductions, 148
Strabismus with restricted motility, 150
Adjustable suture technique, 152
Surgical techniques, 158

11 Muscle transposition procedures, 165

Jensen procedure, 170
Knapp procedure, 174
Superior oblique tendon transfer, 176
"Super maximum" recession-resection, 180

12 Complications in strabismus surgery, 183

Acute, allergic suture reaction, 183
Chronic suture granuloma, 184
Conjunctival cysts, 186
Prolapse of Tenon's capsule, 186
Suture abscess, 188
Dellen, 188
Lid fissure anomalies, 190
Ptosis, 192
Scleral perforation, 192
Slipped or "lost" muscle, 193
Anterior segment ischemia, 193
Superior rectus denervation, 194
Persistent overaction of the inferior oblique, 194
Operation on the wrong eye, 195
Operation on the wrong patient, 195
Orbital cellulitis, 195
Panophthalmitis, 195
Brown's superior oblique tendon sheath syndrome, 196
Symblepharon, 196
Orbital hemorrhage, 196
Undesirable overcorrections and undercorrections, 198

13 A logical scheme for the planning of strabismus surgery, 201

Design of the surgical procedure, 201
Case reports, 220
Diagnosis of isolated cyclovertical muscle palsy, 236
Superior oblique palsy, 238
Nystagmus, 242
Other strabismus entities requiring special surgical techniques, 242

Bibliography, 247

CHAPTER ONE

Surgical anatomy

A clear understanding of the anatomy of the extraocular muscles and of the fascial structures associated with the globe and orbit is a prerequisite to successful strabismus surgery. The conjunctiva, anterior Tenon's capsule, posterior Tenon's capsule (intermuscular membrane), and muscle sheath play an important part in the movement of the globe. These structures perform a passive role in ocular movement with regard to initiation of movement, but they play an active role with regard to restriction of movement. Proper management of these structures can often spell the difference between successful and unsuccessful strabismus surgery.

The surgeon must be concerned with the mechanics of access to the operative site between the lids and through the conjunctiva and Tenon's capsule. A proper beginning is an obvious requisite to a successful conclusion. The location as well as the blood supply, innervation, and action of each extraocular muscle must be known, including the contribution of each muscle's intrinsic blood supply to the nutrition of the anterior segment of the globe. The scleral thickness, which varies according to location, must be taken into account when choosing needles to place into the sclera.

THE PALPEBRAL FISSURE

The dimensions of the palpebral opening increase nearly 50% in width and 20% in height between infancy and adulthood. The configuration of the palpebral opening varies with a person's physical and racial characteristics.

PLATE 1-1

A The average adult palpebral opening is 28 mm long and 10 mm high. A solid blade, spring-loaded lid speculum with 18-mm blades effectively holds the lids widely apart to provide ample exposure for extraocular muscle surgery. In performing extraocular muscle surgery, the lids are separated without concern for a slightly increased intraocular pressure; with intraocular surgery, however, increased intraocular pressure *is* a great concern.

B The average 18-month-old child has a palpebral opening that is 20 mm long and 8.5 mm high. A solid blade lid speculum with 8-mm blades is adequate for most children of this age.

C The newborn has a palpebral opening measuring 18 mm long and 8 mm high. A solid blade lid speculum with 6-mm blades is adequate for the newborn.

The size of the palpebral opening is a significant factor in extraocular muscle surgery technique. A lid speculum appropriate to the size of the palpebral opening should be used. The surgeon should also expect to encounter more difficulty with exposure and suture placement, particularly in medial rectus recession, in patients with a small palpebral fissure or deeply set eyes. However, measured recession can be accomplished even with the smallest lid fissure opening in a 6-month-old child. Limited working area is not an adequate reason for doing a marginal myotomy as an initial weakening procedure of a medial rectus muscle in infantile esotropia, simply because the marginal myotomy is easier to accomplish than a measured recession. Extraocular surgery in an adult with deeply set eyes and a smaller than average palpebral opening can be more difficult than such surgery in a 3- or 4-year-old child with a normal or larger than normal palpebral opening.

Unlike the palpebral opening, which is a significantly different size in adults, infants, and young children, the extraocular muscles are nearly equal in size throughout life. A child with a tiny palpebral opening is likely to have a medial rectus whose insertion is very close to the adult measurements of approximately 10 mm wide. The timing of early surgery is not in any way limited by the size of the palpebral opening or of the extraocular muscles.

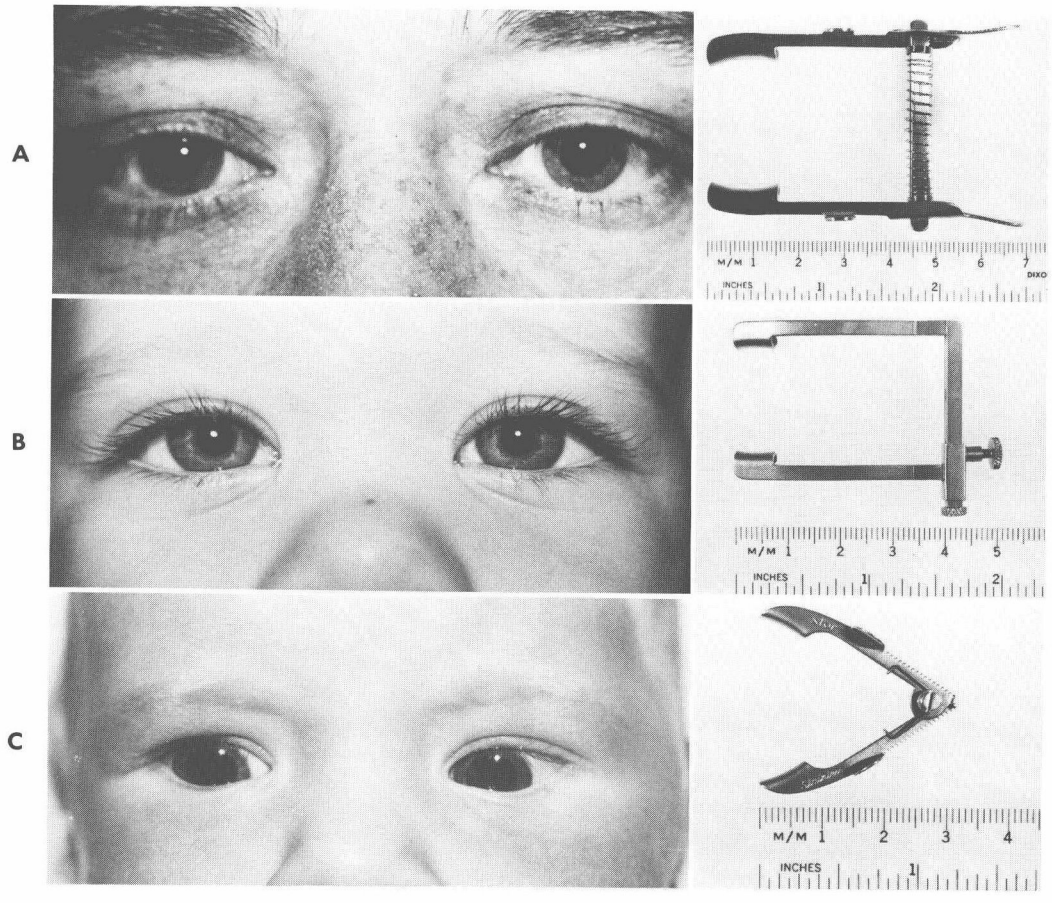
A
B
C
M/M 1 2 3 4 5 6 7
INCHES 1 2
DIXO
M/M 1 2 3 4 5
INCHES 1 2
M/M 1 2 3 4
INCHES 1

PLATE 1-1

THE PALPEBRAL FISSURE—cont'd

The palpebral fissure may be level, mongoloid, or antimongoloid, depending on the relative positions of the medial and lateral canthi. If the outer canthus is higher than the inner canthus, a mongoloid palpebral slant exists. If the outer canthus is lower than the inner canthus, an antimongoloid palpebral slant exists. A straightedge held in front of the palpebral fissure connecting the canthi may be used to compare the relative canthal height. The "normal" relative canthal height is dependent upon what is considered normal for a given race. In whites, the palpebral fissure is usually slightly "mongoloid"—that is, the lateral canthus is slightly higher than the medial canthus. Careful measurements of the Oriental palpebral fissure indicate less mongoloid slant than would be expected from casual observation. The mongoloid illusion in many cases is accentuated by the lack of a skin fold in the upper lid.

The palpebral fissure configuration imparts a characteristic appearance to an individual including, at times, a pseudostrabismus. Vertically incomitant strabismus (A and V patterns) in esotropia follow a pattern related to the slant of the fissures. This was first pointed out by Urrets-Zavalia. In esotropia, a mongoloid fissure is associated with an A pattern, an antimongoloid fissure with a V pattern. No firm anatomic basis for this relationship has been established. In exodeviations there seems to be no such correlation. When examining a strabismus patient who has either a mongoloid or an antimongoloid lid fissure, one should always be on the lookout for vertical incomitance.

PLATE 1-2

A V esotropia in a patient with antimongoloid palpebral fissures.
B A esotropia in a patient with mongoloid palpebral fissures.

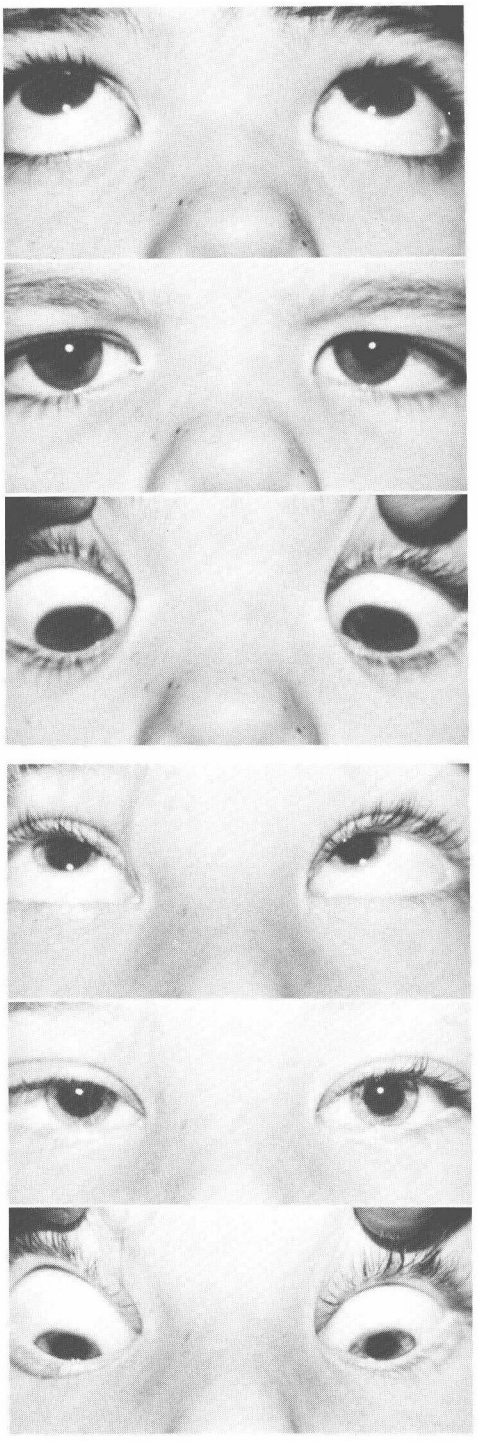

PLATE 1-2