Ophthalmic Plastic and Reconstructive Surgery

Martin Hatt

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Translation by Frederick C. Blodi

Foreword by Rudolf Witmer

Drawings by Ivan Glitsch

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Foreword to the German Edition

Plastic and reconstructive surgery of the orbit, the lids, and the lacrimal apparatus combine in a fascinating way functional and cosmetic requirements. A perfect position and motility of the globe and of the lids, as well as a normal tear flow, have to be combined with a cosmetically acceptable appearance.
The ophthalmic surgeon will quite frequently encounter pathologic processes of the ocular adnexa. During the last few years, a number of articles have appeared that are concerned with diagnostic or therapeutic orbital problems.
Dr. Hatt establishes in this book modern concepts of orbital anatomy, physiology, and pathophysiology as the basis of exact, functional, and cosmetic operations. He discusses in the introductory chapters the pecularities of ophthalmic plastic surgery and of the required anesthesia. He then discusses the characteristics of various diseases and presents not only generally accepted surgical procedures, but also his own innovations and modifications that are based on the etiology and pathogenesis of these conditions. He has not confined himself to present only the essential data, but gives detailed descriptions of the examination and surgery. Further details can be obtained from the cited literature.
The topic is explained by numerous photographs and schematic drawings produced by the artist Ivan Glitsch.
We hope that this book will stimulate the ophthalmic surgeon to more creative activity in the area of the orbit, the lids, and the lacrimal apparatus.

Zurich, May 1984 Professor R. Witmer

Preface

Ophthalmic plastic surgery is first of all concerned with preserving vision; this is a principal difference from general plastic and reconstructive surgery. The delicacy and complexity of the orbital structures require that only experts in this field should be involved in these procedures.

The surgery of the orbit, the lid, and the lacrimal apparatus has commanded increasing interest over the last few years. This is due to new concepts about the anatomy and physiology of the orbital tissues and especially to the revolutionizing new diagnostic methods (echography and computed tomography, among others). These improved decisively the surgical techniques.

I therefore regard it as a challenge to present ophthalmic plastic surgery from a pathophysiologic point of view and to describe procedures that seem to be logical and that have proved their values on a large number of patients.

With these objectives in mind, this book will survey and emphasize the most important aspects of such surgical procedures. An all encompassing description and review of ophthalmic and surgical literature are not contemplated. I do not mean to claim that the described surgical techniques are the only ones that could lead to good results.

I hope that this book will be a stimulus for further investigations concerning diseases of the orbit, the lids, and the lacrimal apparatus. It should also stimulate the search for other treatment methods.

I would like to thank here all those who have made the publication of this book possible:

First of all, I would like to thank Professor Dr. R. Witmer, Director of the University Eye Clinic in Zurich, who made it possible for me to spend some time in the United States and who allowed me to take special training in ophthalmic plastic surgery. He also gave me, after my return to Switzerland, the opportunity to use my newly acquired skills on the patients of the University Eye Clinic.

I am indebted to my clinical teachers, especially Professor R. L. Anderson and Professor F. C. Blodi of the University of Iowa, Iowa City, and Professor C. Beard of the University of California, San Francisco. They all introduced me to the fascinating field of ophthalmic plastic surgery, which in the United States is recognized as a subspecialty. They have motivated me to follow this field independently in the future.

The value of this book is considerably enhanced by the sketches made by Mr. I. Glitsch and the photographs by Mr. P. Bär, the artist and photographer of the University Eye Clinic in Zurich. I would like to thank them and recognize their contributions. They have produced illustrations of unusual quality made with extraordinary talent and patience. I would like to thank especially the publishing company, Georg Thieme, for their cooperation and for the care that they spent on my manuscript.

Frauenfeld, Fall of 1983 Martin Hatt, M.D.

Foreword to the English Edition

It is a pleasure to introduce this book by my good friend, Dr. Hatt.

Oculoplastic and reconstructive surgery in Europe has a long and mixed history. Being introduced from India many centuries ago, it flowered first in Italy and then became an accepted subspeciality, especially in Germany, Hungary, and Austria.

After World War II, this area was in Europe somewhat neglected. Ophthalmic surgeons were fascinated by the microsurgical approach to the anterior segment, by scleral buckling procedures, by photocoagulation, laser treatments, and similar procedures on the eyeball itself, so that not much time was left for operations on the adnexa. Other specialists soon moved into this vacuum. Oculoplastic procedures were performed by general surgeons, plastic surgeons, otolaryngologists, neurosurgeons, and even dermatologists. However, we have to keep in mind that the primary function of the adnexa is the protection of the eyeball and the preservation of vision. Only the ophthalmologist is trained to keep these principles always upmost in mind.

For the last few decades, a new wave of interest in oculoplastic and reconstructive surgery has swept over Central Europe and involved many ophthalmologists. Dr. Hatt is a classic example of this new generation. He had his basic ophthalmic training in Switzerland and then acquired his subspeciality training in the United States. Here, he presents us with a book that in a clear and precise form describes and illustrates the state of the art in this field. May the English edition find the wide dissemination it deserves.

Riyadh, Saudi Arabia
Spring of 1985

F. C. Blodi, M.D.

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Chapter 1 Surgical Anatomy and Physiology

The Orbit

The bony orbit has the shape of an irregular horizontal pyramid, the apex of which is the optic foramen; the base is delineated by the orbital margins. Nearly all the bones of the middle facial area participate in the formation of the orbit (Fig. 1.**1**). The orbital rims are quite thick and strong, the orbital walls are in some areas quite thin. The lateral wall is covered and proctected by the temporalis muscle. The orbital roof separates the anterior cerebral fossa from the orbit. The other two orbital walls and part of the orbital roof are in extensive contact with the paranasal sinuses[41, 42] (Fig. 1.**2**).

The orbital contents are surrounded by the firm periorbit (periosteum of the orbit) and anteriorly by the orbital septum[36]. The connection between the bones and the periorbit is a loose one. The exceptions are the orbital apex, the origins of the extraocular muscles, the margins of the orbital fissures, the orbital rims, and the insertions of the canthal tendons and of the trochlea (Fig. 1.**3**).

The recti muscles and the connective tissue and septa between them divide the orbital space into two compartments: One compartment lies within the muscle cone and is anteriorly delineated by the eyeball; the other lies outside the muscle cone. In both compartments mostly radially running connective tissue septa are found, which divide the orbital adipose tissue longitudinally[2, 28, 30, 31] (Fig. 1.**4**).

The bony orbit has a volume of 25 to 30 cm^3, 6.5 to 7 of which are occupied by the eyeball[13, 33]. The eyeball lies well protected in the orbit and is held in its primary position by the extraocular muscles and the connective and adipose tissues of the orbit. There are no obstacles against free motions of the globe.

The vascular and nervous supply to the orbit comes from the orbital apex through the optic canal and the superior and inferior orbital fissures (Figs. 1.**5**, 1.**6**, and 1.**7**). There are considerable individual variations in the course of the vessels and nerves. Anomalies are frequently found[4, 5, 14, 21, 22, 45].

The Lids

The lids are shown in Figure 1.**8**, and in Figures 1.**9** and 1.**10**. The anatomy of the lids is shown in a

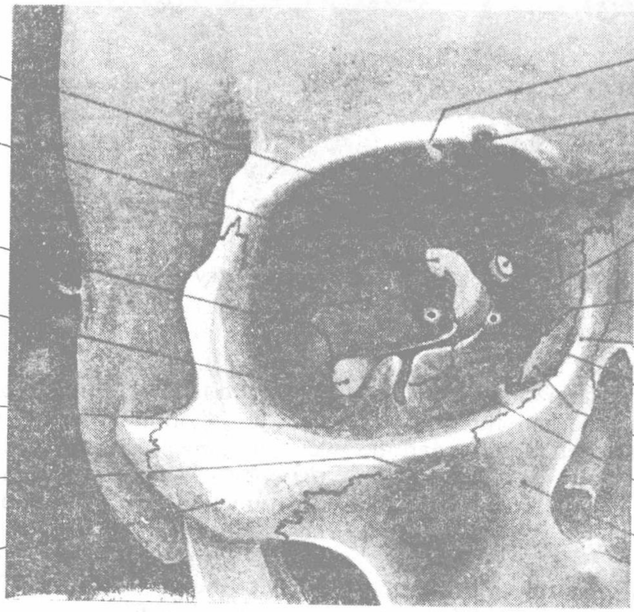

Fig. 1.**1** Bony orbit.

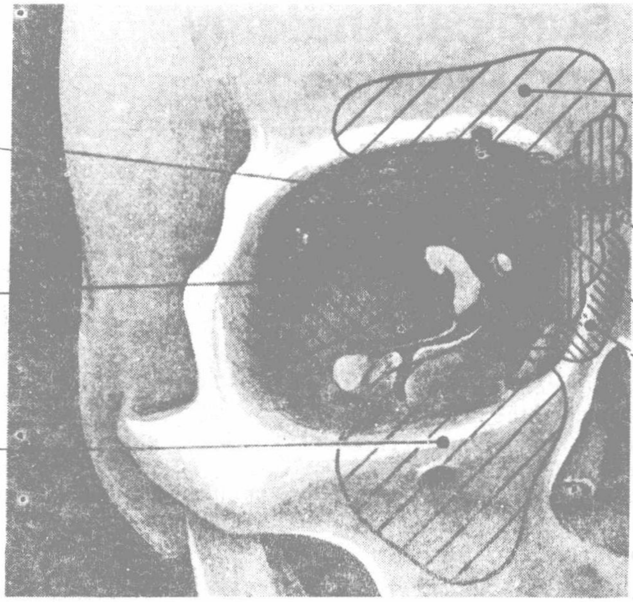

Fig. 1.2 Orbit and adjacent spaces.

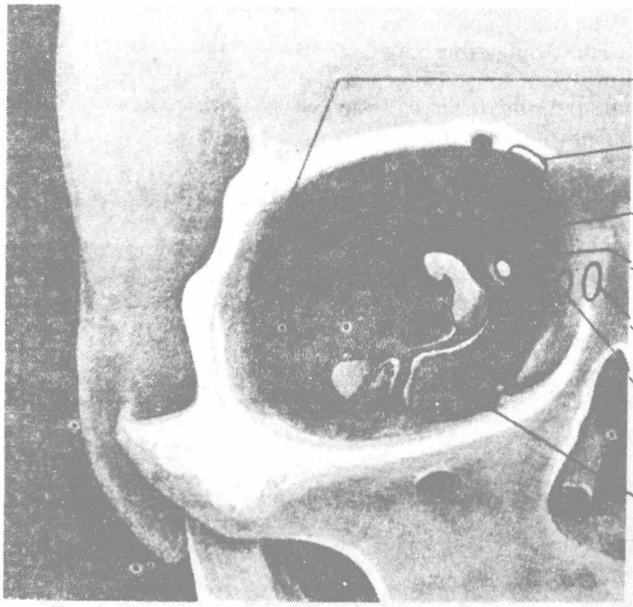

Fig. 1.3 The origin of the extraocular muscles and tendons from the bony orbit.

schematic drawing. From a surgical point of view, it seems useful to divide the lids into three parts: a deep layer, the layer of striated muscles, and the skin.

The Deep Layer

The deep layer consists primarily of dense connective tissue (Fig. 1.**11**). The two tarsi are medially and laterally connected by the canthal tendons to the orbital margin. The tarsal part of the levator aponeurosis and Müller's muscle insert in the upper lid into the deep layer; in the lower lid the retractor (the capsulopalpebral ligament) connects the deeper layer with the inferior rectus muscle. Tarsal conjunctiva covers the interior aspects of the deeper layer in both lids. The function of the deep layer is passive: It gives shape and

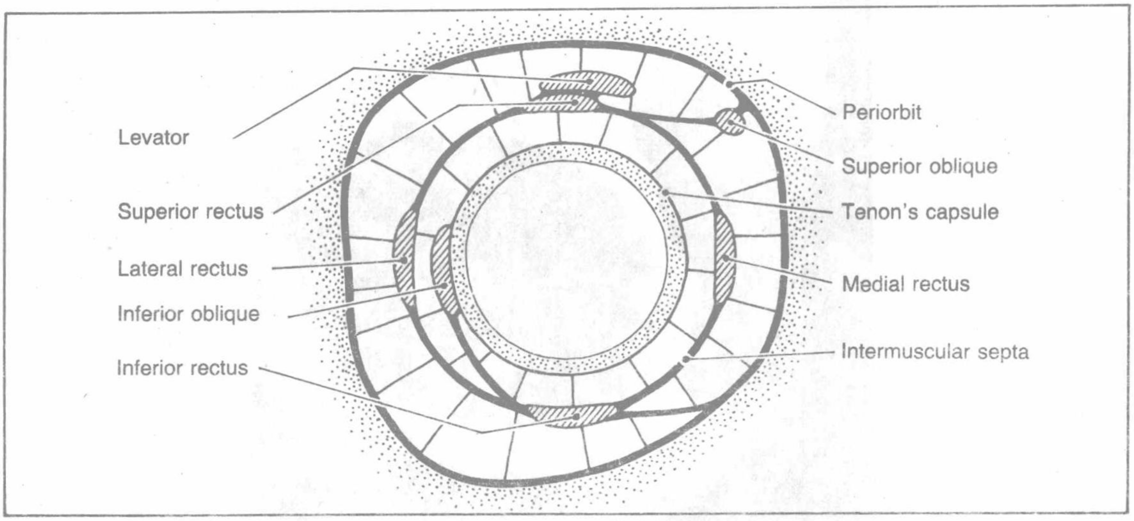

Fig. 1.4 Connective tissue septa of the orbit (derived from Koornneef[30].

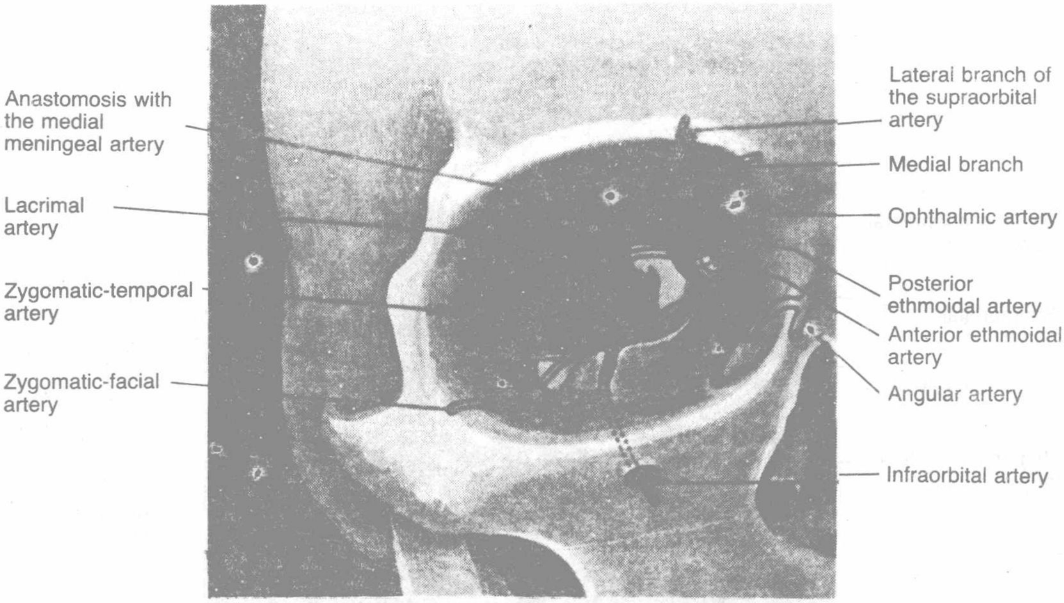

Fig. 1.5 The arteries in the orbit (frequent variation).

stability to the lids. Because of its consistency, it determines the configuration and position of the palpebral margin. Because of its firm connection to the orbital margin and its taut apposition to the globe, only lid motions in a vertical direction are possible; only a slight motion medially can be made with lid closure. Backward or forward motions are normally impossible. This stability of the deep layer compensates in the lower lid in erect position for the force of gravity[34].

The levator muscle of the upper lid (Fig. 1.**12**) has its origin in the periorbit of the lesser sphenoidal wing, immediately above the anulus of Zinn (Fig. 1.**3**). It courses directly above and somewhat medially of the superior rectus muscle with which it is connected by fine connective tissue strands. Its muscle belly usually ends in the area of the orbital rim, at the superior transverse ligament of Whitnall. This is a suspensory ligament that runs from the trochlea to the lateral canthus[3]. Anterior

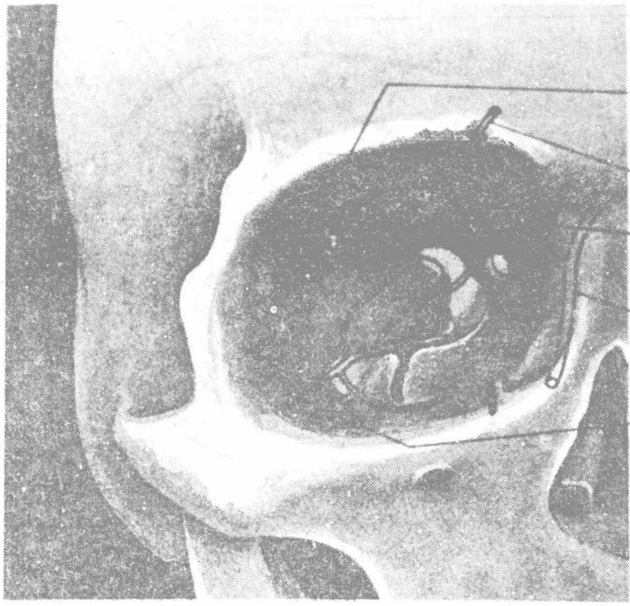

Fig. 1.6 The veins in the orbit (a frequent variation).

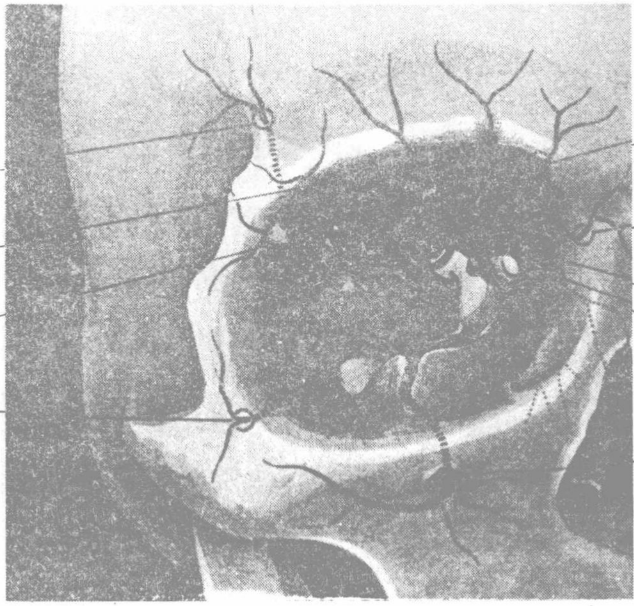

Fig. 1.7 The sensory nerves in the orbit (from Hatt, M.: Klin. Mbl. Augenheilk. 178: 424–430, 1981).

to the ligament, the levator muscle is changed into the aponeurosis. A few millimeters in front of it, the aponeurosis divides at an area that is characterized by a thickening of the tissue. The deep part inserts into the lower third of the anterior tarsal surface; the superficial part inserts into the orbicularis muscle of the upper lid. These insertions involve the entire width of the lid: the nasal and lateral margins of the aponeurosis constitute the so-called levator horns and are connected to the canthal tendons. The lateral part of the levator muscle separates the palpebral from the orbital part of the lacrimal gland[1,3,10,32] (Fig. 1.**22**).

Müller's muscle (the smooth muscle of the upper lid) originates from the lower surface of the levator muscle approximately in the area of the upper conjunctival fornix. It inserts into the upper

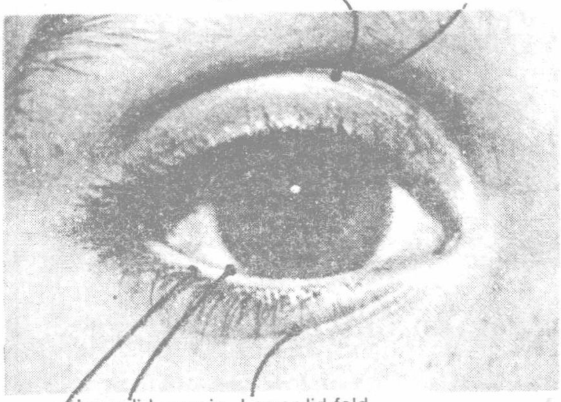

Fig. 1.8 The lids.

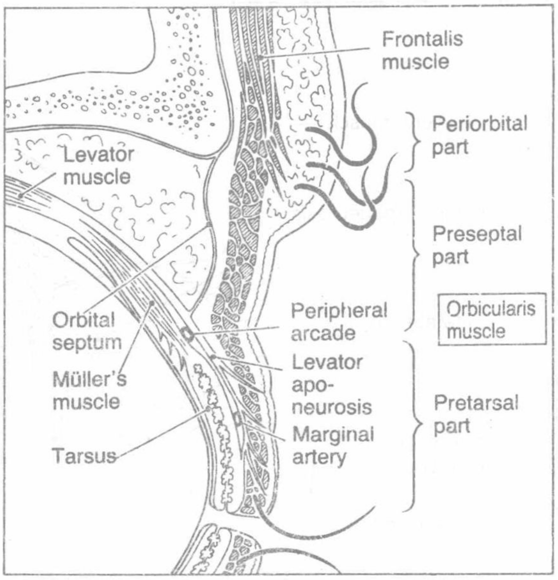

Fig. 1.9 Cross section through the upper lid.

tarsal margin and into the conjunctiva above the tarsus (Fig. 1.9).

These two levators of the lid have the following functions: The levator muscle, which is innervated by the oculomotor nerve, will elevate and retract the upper lid; Müller's muscle, which is innervated by the sympathetic nerve, will regulate the width of the palpebral fissure. The maximal effect of Müller's muscle amounts to 4 to 5 mm. The orbicularis oculi muscle is the antagonist of these elevators. In addition, we have the force of gravity in an erect patient[34].

According to Hering's law, the two levator muscles receive, under normal conditions, nervous impulses of equal amplitudes[17].

The retractor of the lower lid (capsulopalpebral ligament; Fig. 1.11) is derived as a coarse strand of connective tissue from the inferior rectus mus-

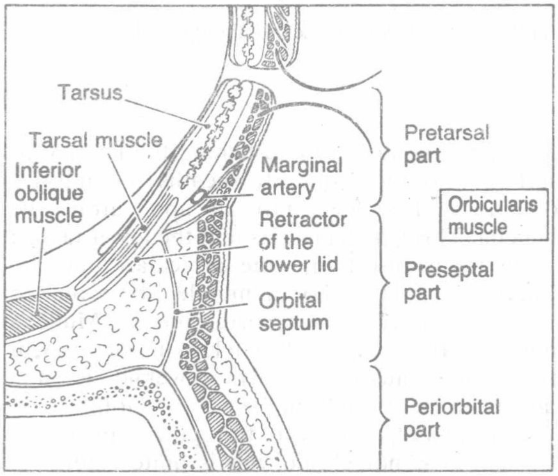

Fig. 1.10 Cross section through the lower lid.

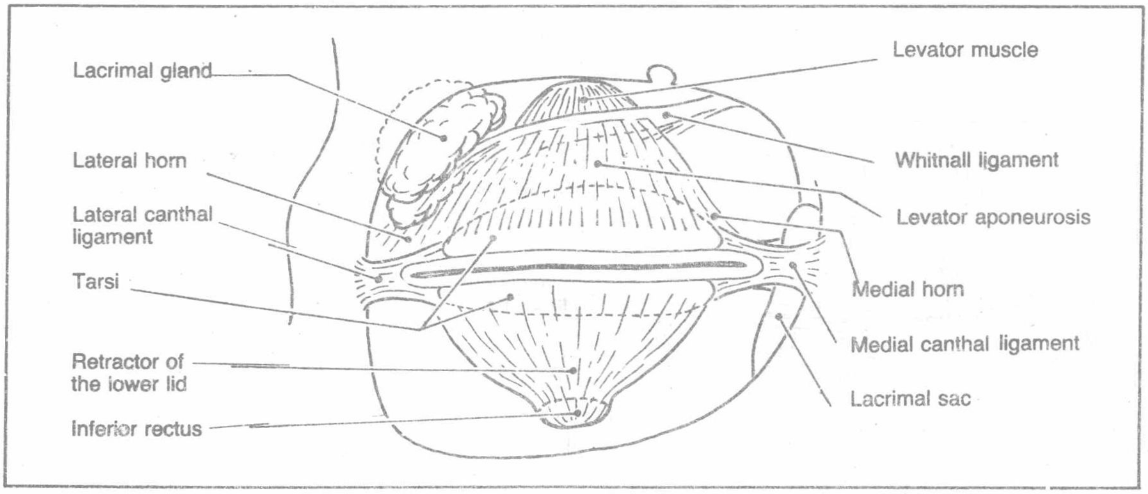

Fig. 1.11 The deep layer of the lids.

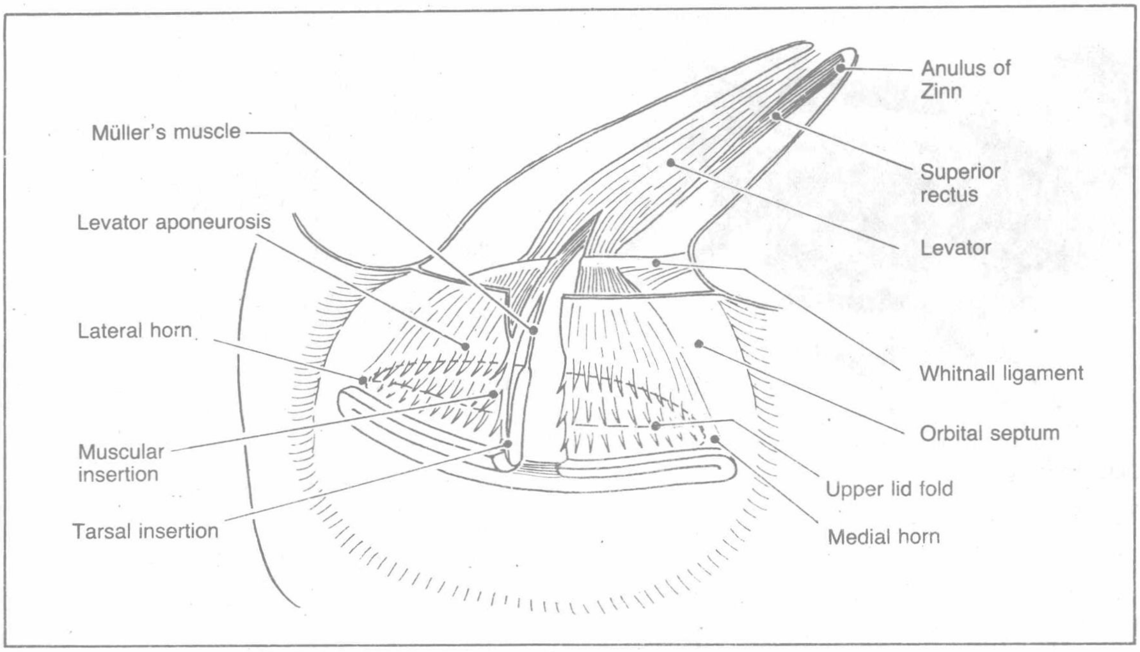

Fig. 1.**12** The levator muscle of the upper lid.

cle, approximately 10 mm behind the latter's insertion into the globe. It sheaths the inferior oblique and widens into an aponeurotic-like lamella. This lamella inserts into the lower tarsus; some fibers insert into the orbicularis muscle. There are a few smooth muscle fibers on the conjunctival side which correspond to Müller's muscle in the upper lid. When looking downward, the retractor muscle will pull the lower lid 2 to 3 mm down and therefore form the lower lid fold[20, 27, 35].
The conjunctiva consists of the epithelium and the stroma. It is not elastic, but is quite extensive. This becomes only obvious when it is dissected from the adherent subconjunctival fibers.

The palpebral conjunctiva is connected to Müller's muscle in the upper lid and to the retractor muscle in the lower lid. The conjunctiva is here firmly adherent to the tarsus so that it cannot be dissected.
In the area of the upper and lower fornix dense connective tissue fibers radiate from the rectus muscles and from the levator into the conjunctiva, thereby preventing a collapse of the fornices[27, 28].
The bulbar conjunctiva lies on a layer of loose connective tissue and can therefore easily be moved. The exception is the limbus. This loose connective tissue extends backward as Tenon's capsule.

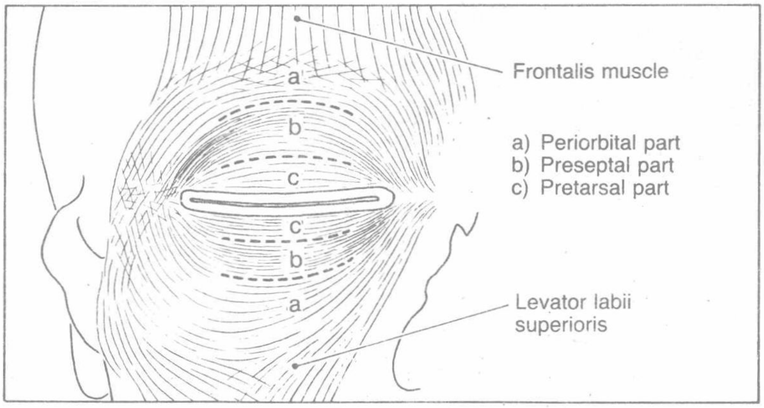

Fig. 1.**13** The orbicularis muscle.

The Orbicularis Oculi Muscle

The muscular layer of the lid contributes a considerable amount to the lid volume and is represented by the orbicularis muscle (Fig. 1.**13**). We distinguish a pretarsal, preseptal, and periorbital part of this muscle (Figs. 1.**9** and 1.**10**). The orbicularis is a flat sphincter muscle and its fibers form over the lids a flat arch around the palpebral fissure. On the nasal side, all muscle fibers insert into the canthal tendon. On the temporal side, these muscle fibers intertwine and a small part forms a raphe of the tendinous insertion of the lateral canthal tendon[39, 42].

We use mainly the pretarsal and the preseptal part of the orbicularis muscle for blinking; the periorbial part is only used for forceful lid closures[18, 34].

On lid closure, the medial canthus remains stationary while the lid margins perform a sweeping motion nasally until they touch each other. The lateral canthus moves a few millimeters nasally and somewhat downward. This will tighten the normally loose lateral canthal tendon[12, 39] (Fig. 1.**14**).

There is therefore an antagonistic effect between the levator and the retractor of the lower lid on the one hand, and the orbicularis muscle on the other hand, although the action of these muscles is only partly in direct opposition. This antagonism, despite different directions of contraction, is explained by the restriction of motility of the tendons and of the globe (Fig. 1.**15**).

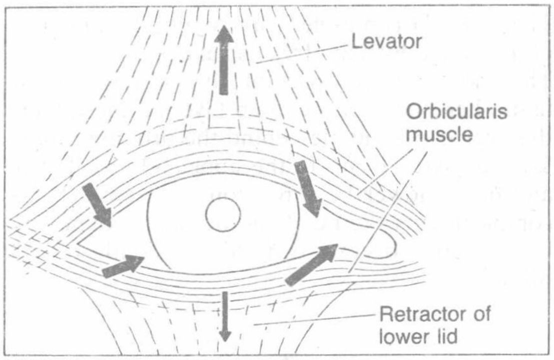

Fig. 1.**15** Direction of action in lid opening and closure.

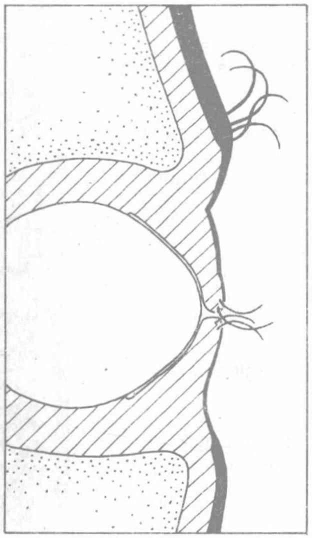

Fig. 1.**16** The thickness of the skin around the orbit.

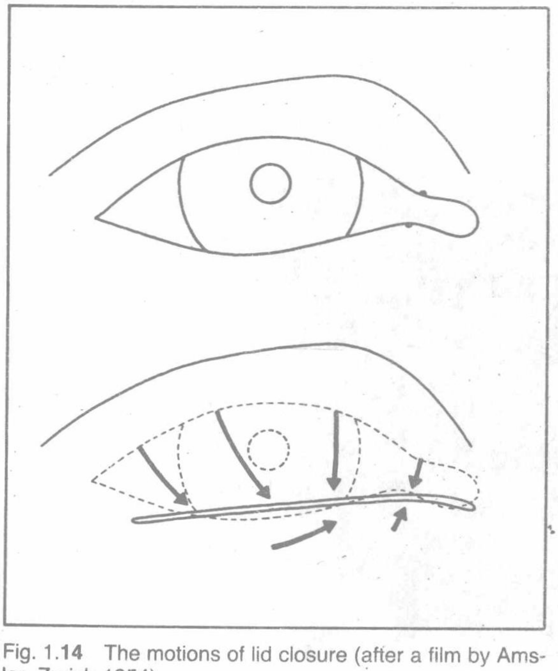

Fig. 1.**14** The motions of lid closure (after a film by Amsler, Zurich 1954).

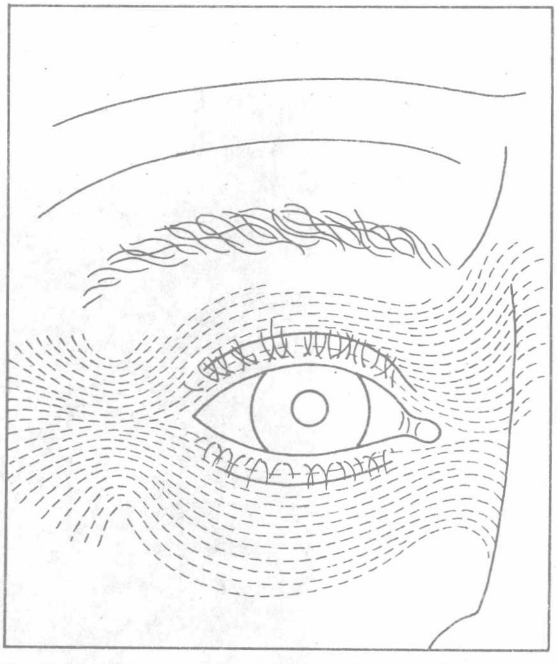

Fig. 1.**17** The course of the skin folds around the orbit.

The orbicularis muscle is innervated by branches of the upper portion of the facial nerve.
The most anterior part of the orbital adipose tissue lies between the deep layer of the lid and the orbicularis muscle behind the orbital septum. This fat tissue forms in the upper lid usually two and in the lower lid three compartments. These compartments extend along the radial connective tissue septa backward into the depth of the orbit[29,30].

The Lid Skin

In general, the skin over the lids is quite thin and its thickness decreases toward the lid fissure (Fig. 1.**16**). When the lid skin changes into the skin of the face, approximately at the area of the orbital margins, we find an abrupt change in thickness. The skin folds of the orbit show a typical course (Fig. 1.**17**). There is no subcutaneous adipose tissue in the lids and the skin is supplied by the

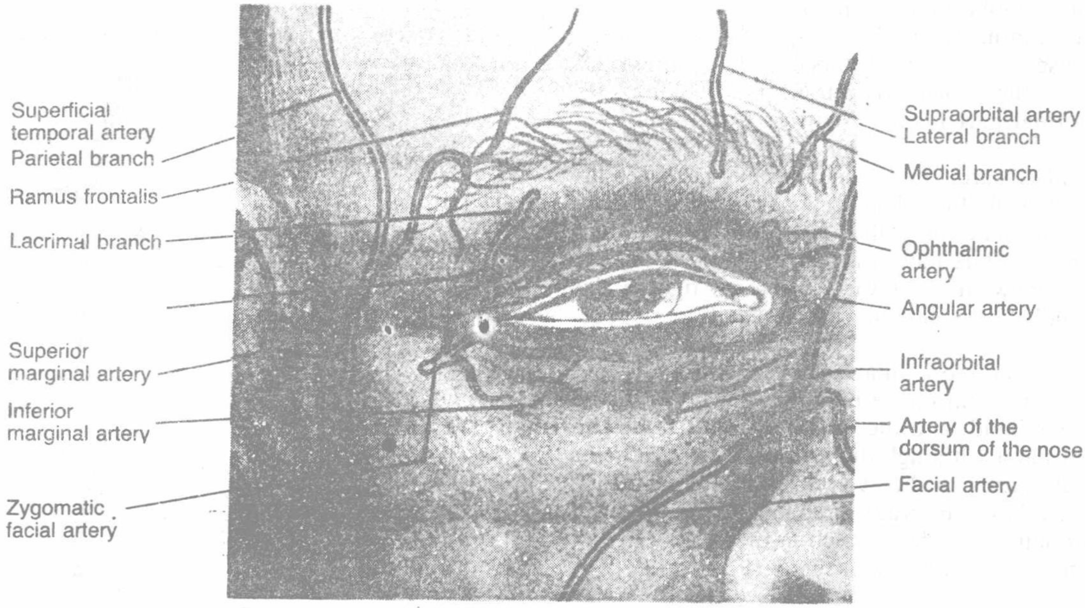

Fig. 1.**18** The arteries of the lids.

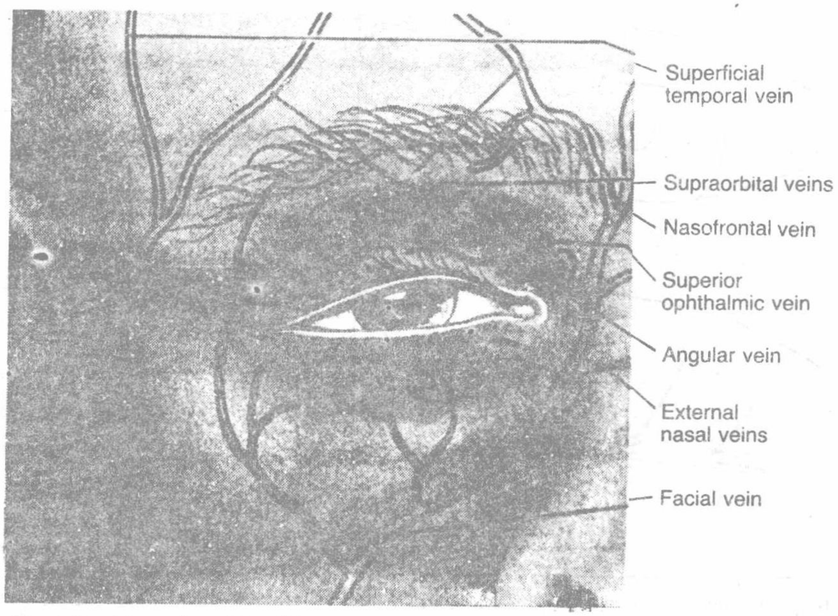

Fig. 1.**19** The veins of the lids.