

**LATE PRENATAL & POSTNATAL DEVELOPMENT
OF THE CORNEOSCLERAL JUNCTION
IN ALBINO RAT**

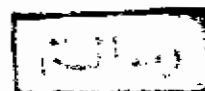
6/9.93
G.S

Thesis

SUBMITTED FOR THE PARTIAL FULFILMENT
OF THE MASTER DEGREE OF
Medical Sciences (M.Sc. Anatomy)

By

Gamal Said Abd El-Aziz



SUPERVISORS

Prof. Dr. Fakhry Amin
Prof. and head of Anatomy Dept.

Prof. Dr. Alla Nassar
Prof. of Anatomy

Dr. Marcelle Sadeek
Lec. of Anatomy

Dr. Ezz El-Din Helaiei
Lec. of Anatomy

**Anatomy Department
AIN SHAMS UNIVERSITY**

18722 ✓

1984



ACKNOWLEDGEMENT



ACKNOWLEDGMENTS

I would like to Acknowledge my deepest gratitude to Prof. Dr. FAKHRY AMIN ESKANDER , Head of anatomy department, Ain Shams University .

I would like to express my deep thanks for Prof. Dr. ALIA NASSAR , Prof. of anatomy for her cordial support and continuous encouragement .

I owe special thanks , to Dr. MARCELLE SALEK and Dr. EZZ EL-DIN HELAIEL lecturers of anatomy for their suggestion , supervision , guidance and criticism throughout the whole study .

CONTENTS

	Page
INTRODUCTION	1
REVIEW OF LITERATURE	
-Anatomy of the corneo -scleral junction	2
-Development of the corneo-scleral junction	22
-Physiology of the corneo-scleral junction.....	31
MATERIAL AND METHODS	36
RESULTS	42
-Structure of the corneo-scleral junction at the late pre-natal stage	42
-Structure of the corneo-scleral junction at the post-natal life	43
DISCUSSION	52
-The pre-natal corneo-scleral junction	52
-The post-natal corneo-scleral junction	53
SUMMARY	59
REFERENCES	63
ARABIC SUMMARY	

INTRODUCTION

INTRODUCTION

The anatomy of the corneo-scleral junction as the main site for the passage of aqueous humor to the anterior chamber had been described in man (Duke-Elder and Wybar , 1961 ; Wolff ,1961 ; Hogan , Alverado and Weddell ,1971 ; Fine and Yamoff ,1972 ; Cogan and Kuwabara ,1973 ; Leeson and Leeson ,1976 ; Ham ,1979 ; Williams and Warwick ,1980), and in Cynomolgus monkey (Inomata , Bill and Smfiser,1972).

Furthermore the development of the corneo-scleral junction had been described in man (Arcy ,1958 ; Duke-Elder and Cook ,1963 ; Hamilton , boyd and Mossman , 1966 ; Williams and Warwick ,1980) and in mice (Pel and Rhodin , 1961) but not in the albino rat .

Accordingly it became the aim of the present work to study the detailed histological structure of the corneo-scleral junction of albino rat at different developmental stages using a modified light microscopical method of a plastic embedded tissues. The purpose of this modified method was to obtain 1 μ m thick sections which is difficult to obtain by paraffin blocks and which are important for the detailed histology of that minute region in the eye .

REVIEW OF LITERATURE

ANATOMY OF THE CORNEO-SCLERAL JUNCTION

Duke-Elder and Wybar (1961) described the anatomy of corneo-scleral junction (limbal transition zone) in man . He reported that it was formed of elements of both cornea and sclera, being formed of a narrow circular strip of tissue which extended circumferentially around the eye , its depth was almost 1.0 mm., its grey color was due to both the transition from opaque sclera to transparent cornea , and also due to the underlying filtration meshwork and vessels in this area (Copenhaver and Bunge, 1967 ; Ham ,1979 ; Williams and Warwick ,1980) .

Fine and Yamoff (1972) mentioned that in ordinary histologic section the junction commenced at the end of Bowman's layer and extended posteriorly into the stroma in a concave arc. The deepest posterior extension was near to mid-point of the canal of Schlemm then curves forward external to the Descemet's membrane . According to this histologic arrangement of the corneo-scleral junction the authors suggested that the Schlemm's canal

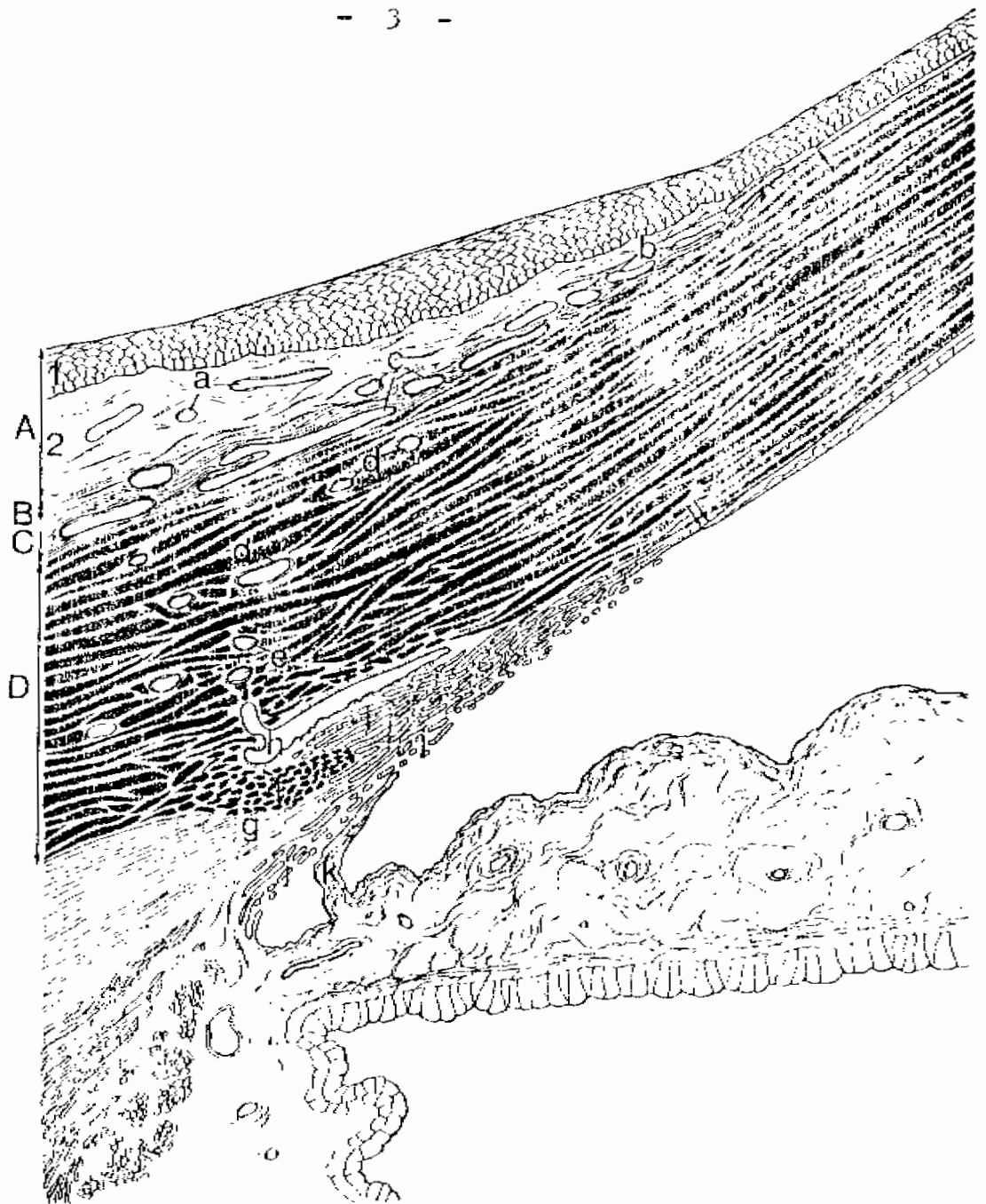


Diagram of corneo-scleral junction showing :limbal conjunctiva (A) which is formed of epithelium (1) and stroma (2), Tenon's capsule(B), The episclera (C) and the corneal and scleral tissues (D). Conjunctival stromal vessels (a) , episcleral venules(C). Bowman's membrane (↑) . Descemet's membrane (↑↑) , inter-scleral plexus (d) , the deep scleral plexus (e) , scleral spur (f) , ciliary muscle (g) . Schlemm's canal (h) ,trabecular meshwork (i) and iris process(K) (After Hogan et al.,1971).

and corneo-scleral meshwork were in the sclera and part of the venous system draining the canal was in cornea .

Leeson and Leeson (1976) mentioned that on the internal side of the corneo-scleral junction the limbus was bathed by aqueous humour over its entire surface. The corneo-scleral tissues were hollowed out on the internal surface to form the internal scleral sulcus. Within the sulcus were the corneo-scleral meshwork and Schlemm's canal , which completely filled the cavity of the sulcus, lying mainly in its postero-lateral part .

Hogan , Alvarado and Weddell (1971) classified the anatomy of the corneo-scleral junction into : -

- Conjunctiva with its epithelium and stroma .
- Tenon's capsule .
- Episclera .
- Limbal or corneo-scleral stroma .
- Aqueous humour outflow apparatus .

* Conjunctiva:-

Conjunctival epithelium :

The corneal epithelium had been described to consist

of 5 layers of cells. The deepest cells were columnar, their basal surfaces were flat. The second layer was polygonal with oval nuclei. The superficial layers of cells became progressively flat with flat nuclei (Williams and Warwick, 1980). At the corneo-scleral junction the epithelium became thicker up to 10-12 layers of cells and was continuous with the conjunctiva covering the sclera which was formed of 3 layers (Duke-Elder et al., 1961 ; Last, 1968; Williams and Warwick, 1980).

The basal layer of the corneal epithelium which had been kept straight by the underlying Bowman's membrane, became wavy and papillary in shape as soon as it lost its support of this membrane. The cells became smaller with poor cytoplasm and the nuclei were densely stained (Copenhaver et al., 1967 ; Last, 1968). No goblet cells were present in the limbal epithelium but some were found at its periphery (Last, 1968 ; Hogan et al., 1971 ; Williams and Warwick, 1980).

The superficial cells contained some glycogen but

their surfaces were not so smooth as those of the cornea (Hogan et al.,1971) .

Lymphocytes and melanocytes were found in the basal and suprabasal layers (Ham ,1979) .

Conjunctival stroma : -

The conjunctival stroma as described by Hogan et al.(1971), formed papillae at the periphery of the cornea . The papillae were oriented like the spokes of a wheel,radiating outward from the corneal edge into the conjunctiva to form the palisades of Vogt . The small vessels and nerves which run along the length of the papillae were located along their lateral edges , while the lymphatics were central and deeper .

The conjunctival stroma was composed of loosely arranged bundles of coarse collagenous tissue containing numerous fibroblasts. The bundles of collagen were generally oriented parallel to the surface of the eye , but they intermingled in a random fashion at various levels (Copenhaver et al.,1967; Leeson and Leeson,1976 ; Ham ,1979). Fibroblasts , melanocytes,macrophages ,

mast cells, lymphocytes and occasionally polymorphonuclear and eosinophilic leukocytes were found in the loose connective tissue of the conjunctiva .

* Tenon's capsule :

Hogan et al. (1971) described the tenon's capsule as a dense , collagenous layer which lies between the episclera and the loose conjunctival stroma. It extended forwards from the rectus muscle insertions over the surface of the episclera as a more condensed fascia-like layer that became thinner anteriorly. It finally terminated in the limbal episclera a short distance from the cornea (Copenhaver et al.,1967 ; Ham ,1979).

Tenon's capsule was found to be thicker in the eyes of children , but it thinned out and atrophied with increasing age. It was composed of compactly arranged collagen and a few fibroblasts, the collagen bundles were oriented parallel to the scleral surface .

* The episclera :

According to Last (1966) and Hogan et al . (1971)

the opsiolera was a thin , dense connective tissue layer , that differed from the sclera in its looser texture . It connected the conjunctiva to the sclera anteriorly . Its collagen bundles were circumferentially arranged and contained relatively few cells . It differed from the sclera in having a relatively large number of blood vessels (Copenhaver et al.,1967) .

* The limbal or corneo-scleral stroma :

Anteriorly the collagen bundles of the limbal stroma were found to be arranged regularly like those of the cornea, while posteriorly this arrangement was gradually lost like those of the sclera (Copenhaver et al., 1967; Hogan et al.,1971).

The regular corneal lamellae continued a little beyond the line joining Bowman's and Descemet's membranes (Last ,1968) .

The fibres of the corneal lamellae which were transparent and regular ran directly into the fibres of the sclera which were opaque and less regular. The corneal