Survey of Interpupillary Distance in Egyptian People

Theses

Submitted for Partial Fulfillment of Master Degree

In Ophthalmology

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2019

سورة الإسراء الآيه :٨٥

Acknowledgment

First and foremost, I feel always thanks to **ALLAH,** *the Most Beneficent and Merciful. I can do nothing without Him.*

I would like to express my sincere gratitude to ***Prof. Dr. Tarek Mohamed Mahmoud Abdallah,*** *Professor of Ophthalmology Faculty of Medicine-Ain Shams University, I am deeply grateful to him for his professional advice, guidance and support. Under his supervision, I had the honor to complete this work.*

My deep gratitude goes to ***Ass. Prof. Dr. Maged Maher Salib,*** *Assistant professor of Ophthalmology Faculty of Medicine-Ain Shams University, for his great support, tireless guidance and meticulous supervision through this work.*

I would like also to thank ***Ass. Prof. Dr. Yousra Ahmed Thabet Farweez,*** *Assistant professor of Ophthalmology Faculty of Medicine-Ain Shams University, for her effort and time she has devoted to accomplish this work.*

Last but not least, I would like to express my deepest gratitude to ***my Parents and my husband*** *who supported me a lot and without them the completion of this work would have not been possible.*

Marwa Kamel Anwar Elrazky

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List of Abbreviations

Abb.	Full term
ARM	*Autorefractometer*
BSV	*Binocular single vision*
CM	*Centimeter*
D	*Diopter*
FAZ	*Foveolar avascular zone*
FIPD	*Far IPD*
GAGS	*Glycosaminoglycan*
ICD	*Inner canthal distance*
IPD	*Interpupillary distance*
MM	*Millimeter*
MS	*Millisecond*
NIPD	*Near IPD*
OCD	*Outer canthal distance*
OX	*Orbital axis*
PD	*Pupillary distance*
PFL	*Palpebral fissure length*
PFW	*Palpebral fissure width*
S	*Second*
SD	*Standard deviation*
VX	*Visual axis*

INTRODUCTION

Interpupillary distance (IPD) is the distance between the centers of the pupils of the two eyes. IPD is critical for the design of binocular viewing systems, where both eye pupils need to be positioned within the exit pupils of the viewing systems ***(Moffitt, 1997)***.

IPD determines the degree of the retinal image disparity in fellow eyes which are combined in the brain to produce stereo perception ***(Jonasson and Thordarson, 1987).***

Familiarity with normal IPD values in population subgroups can help studies on orbitocranial growth patterns, diagnosis of certain syndromes, surgical management of craniofacial deformities and trauma, and manufacturing of spectacles ***(Murphy and Laskin, 1990) (Bogren et al., 1986).***

The IPD is an important measure widely used today as part of the process of eyeglasses formulation ***(Maclachlan and Howland, 2002) (Thompson, 2002).***

Mean IPD is statistically significantly different between the two genders, between near and far viewing, and between different age groups ***(Evereklioğlu et al., 1999).***

Moreover, it is known to be dependent on other factors as refraction and race ***(Murphy and Laskin, 1990)*.**

In UK survey, mean IPD has been quoted in the stereoscopic literature as being from 58 to 70 mm. It is known to vary with respect to age, gender, and race ***(Kaimbo et al., 2000)***.

In Iranian survey, mean IPD in adults was 61.1 ± 3.5 mm in women and 63.6 ± 3.9 mm in men. Mean IPD increased 4.8 mm during the second decade, 1.7 mm during the third decade and 0.6 mm during the fourth and fifth decades of life. The observed increase in IPD after age 30 years indicates that factors other than skeletal growth may affect this parameter. Mean and median IPD values for adult human are around 63 mm with regard to extremes. The most dramatic increase in IPD occurs in the first years of life ***(Jonasson and Thordarson, 1987)*.**

In the Turkish population, for a mean age of 48.42 ± 20.55 years, ranging from 19 to 89 years, the mean IPD was 62.5 ± 4.1 mm (range 49 to 76 mm**)** ***(Fesharaki et al., 2012)*.**

AIM OF THE WORK

The aim of this work is to study the values of the interpupillary distance (IPD) in Egyptian people and the factors affecting it. This helps accurate placement of the optical center of the lenses in binocular devices, to avoid visual discomfort, asthenopia, and induction of prismatic effect, and to help binocular stereoscopic vision.

ANATOMY

The eyeball is made up of the segments of two spheres of different sizes placed one in front of the other. The anterior, smaller segment is transparent and forms about one-sixth of the eyeball; it has a radius of curvature of about 8 mm. The posterior, larger segment is opaque and forms about five sixths of the eyeball; it has a radius of about 12 mm ***(Snell and Lemp, 1998).***

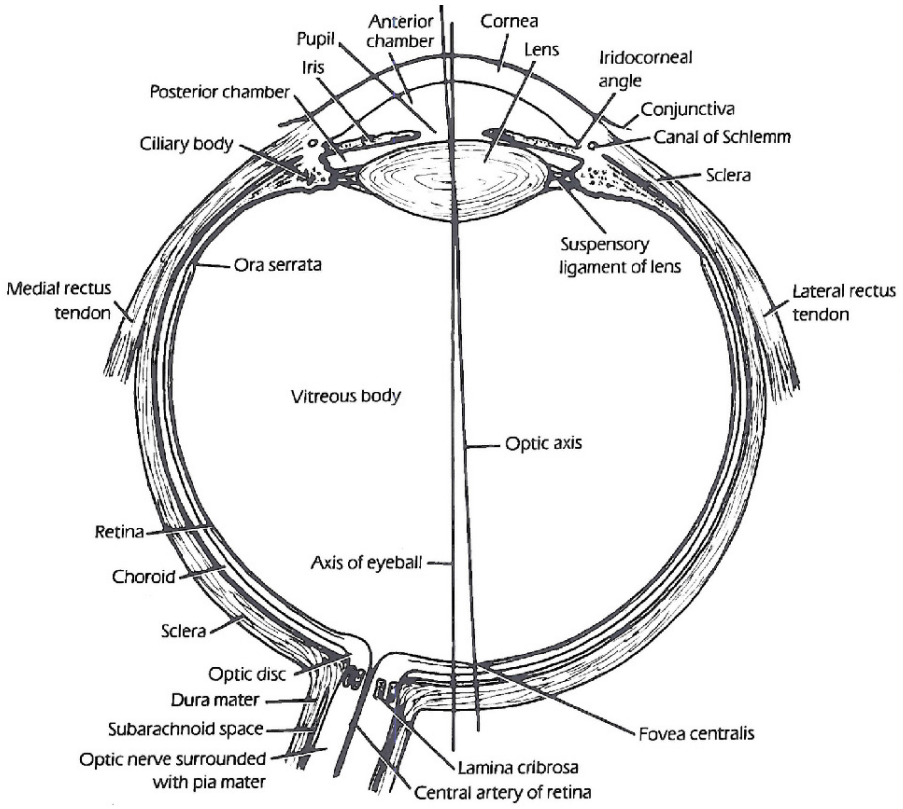
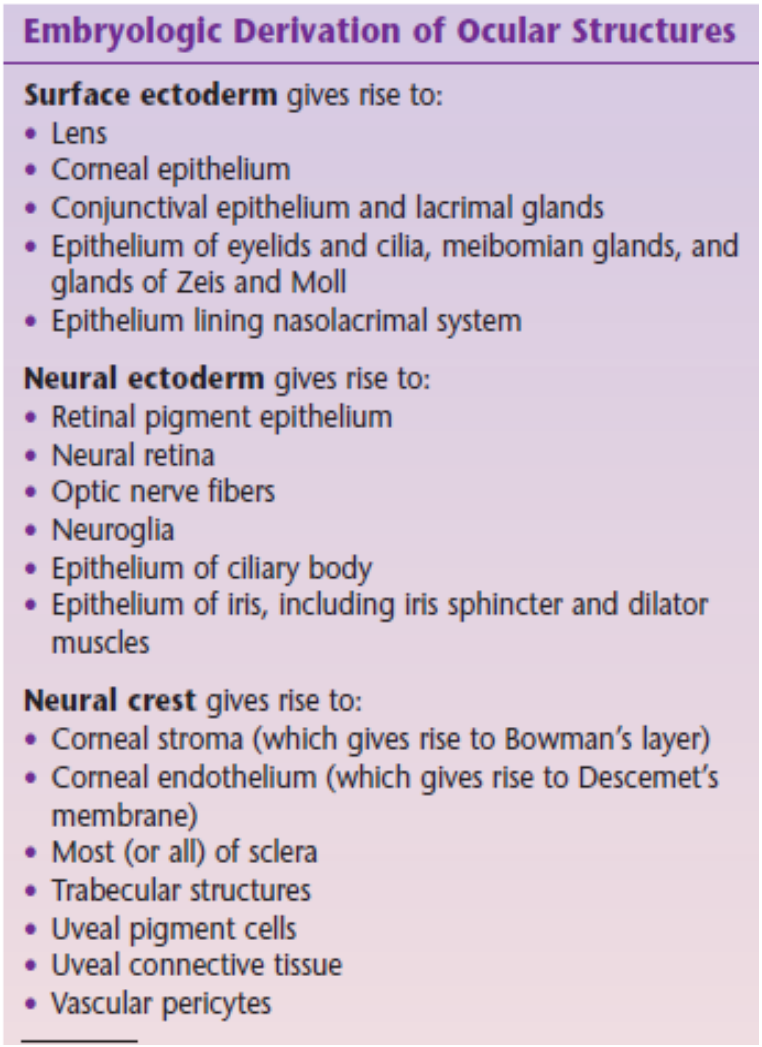


Figure (1): Horizontal section through the eyeball at the level of the optic nerve. The optic axis and the axis of the eyeball are included ***(Snell and Lemp, 1998).***

During the third week of embryonic development, the three primary germ layers: ectoderm, mesoderm, and endoderm have formed the embryonic plate ***(Remington, 2005).***

The eye is formed from both ectoderm and mesenchyme ***(Snell and Lemp, 1998).***



Embryologic Derivation of Ocular Structures

Surface ectoderm gives rise to:
- Lens
- Corneal epithelium
- Conjunctival epithelium and lacrimal glands
- Epithelium of eyelids and cilia, meibomian glands, and glands of Zeis and Moll
- Epithelium lining nasolacrimal system

Neural ectoderm gives rise to:
- Retinal pigment epithelium
- Neural retina
- Optic nerve fibers
- Neuroglia
- Epithelium of ciliary body
- Epithelium of iris, including iris sphincter and dilator muscles

Neural crest gives rise to:
- Corneal stroma (which gives rise to Bowman's layer)
- Corneal endothelium (which gives rise to Descemet's membrane)
- Most (or all) of sclera
- Trabecular structures
- Uveal pigment cells
- Uveal connective tissue
- Vascular pericytes

Figure (2): Development of ocular structures ***(Remington, 2005).***

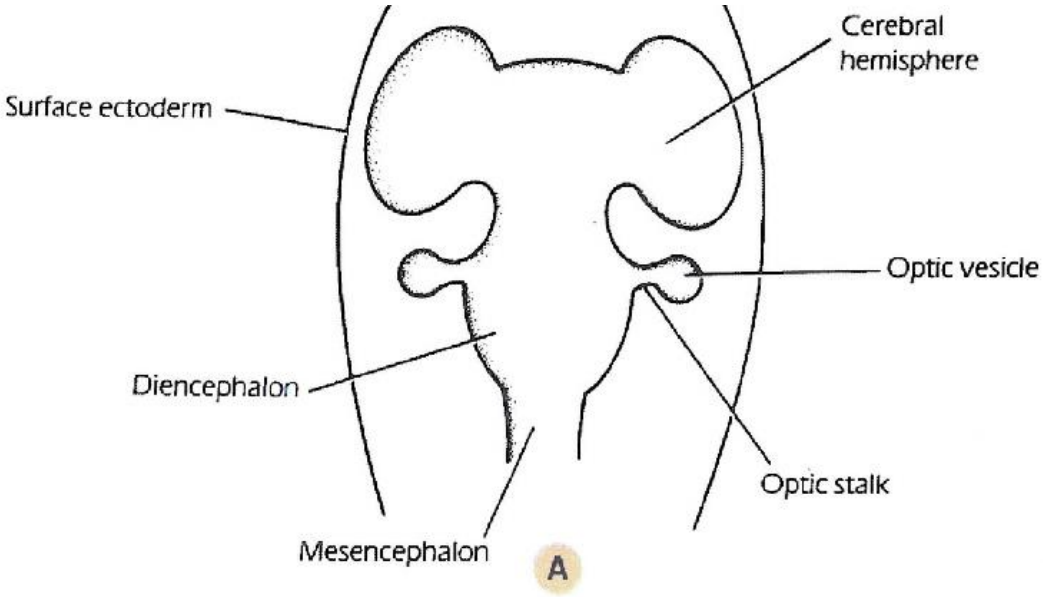


Figure (3): (A) Dorsal view, showing the formation of the optic vesicle, which grows out as a diverticulum from the lateral aspect of the forebrain ***(Snell and Lemp, 1998).***

Orbit:

The cavity of the orbit has a truncated pyramid shape, with a posterior apex, and a base corresponding to the anterior aperture. The orbit contains mainly adipose tissue, and the globe is suspended in the anterior part. The four recti muscles of the eye insert anteriorly near the equator of the globe ***(Duker et al., 2008)*.**

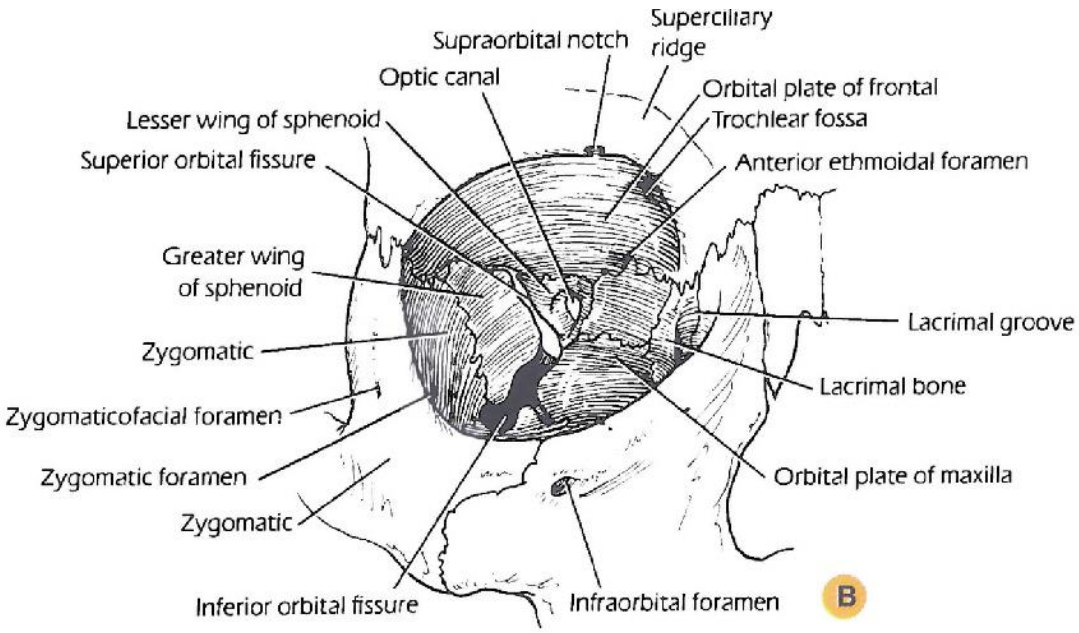


Figure (4): The right orbit, anterior view ***(Snell and Lemp, 1998)*.**