

FACTORS INFLUENCING THE PREVALENCE
OF AMBLYOPIA IN CHILDREN WITH
ANISOMETROPIA

Thesis

*Submitted for Partial Fulfillment of Master Degree
in Ophthalmology*

Presented by

Ahmed Ibrahim Abd-El-Alim
(M.B., B.Ch.)

Under Supervision of

Prof. Dr. Tarek Mohammad M. Abd-Allah
Professor of Ophthalmology
Faculty of Medicine - Ain Shams University

Dr. Amany Abd El-Fattah El-Shazly
Lecturer of Ophthalmology
Faculty of Medicine - Ain Shams University

Faculty of Medicine

العوامل المؤثرة في تفشى الكسل البصرى عند الأطفال مع تفاوت الإنكسار

رسالة

رسالة توطئة للحصول على درجة الماجستير في طب وجراحة العين

مقدمة من

الطبيب / أحمد إبراهيم عبدالعليم

تحت إشراف

الأستاذ الدكتور / طارق محمد محمود عبدالله

أستاذ طب وجراحة العين
كلية الطب - جامعة عين شمس

الدكتورة / أماني عبد الفتاح الشاذلي

مدرس طب وجراحة العيون
كلية الطب - جامعة عين شمس

كلية الطب
جامعة عين شمس
2011

Summary

Amblyopia is a common disorder of the visual system without any structural anomaly.

Anisometropic amblyopia is a difficult type of amblyopia to be diagnosed, since the sound eye overlaps the visual defect of the amblyopic eye.

This randomized study included 60 children from the age of 6 – 12 years including 36 males, and 24 females with anisometropia and no structural ocular abnormalities including strabismus , previous ocular surgery, ocular trauma, neurologic disorders which could influence visual acuity, or with BCVA of the sound eye $<20/40$. The patients were selected from the outpatient clinic of Memorial institute of ophthalmological research.

The patients were classified into 4 groups:

Group I: Spherical anisometropic group: in which the difference in the spherical equivalent between the eye was >2 D (30 patients). This group will be subdivided into:

Myopic group: spherical power difference was >2 D (15 patients).

Hypermetropic group: spherical power difference was >2 D (15 patients).

Ain Shams University
2011

List of Contents

| Title | Page |
|-------------------------------------|------|
| ♦ Introduction | 1 |
| ♦ Aim of the Work | 3 |
| ♦ Review of Literature | |
| ✚ Errors of Refraction | 4 |
| ✚ Amblyopia | 36 |
| ✚ Amblyopia Treatment..... | 46 |
| ♦ Patients and methods | 60 |
| ♦ Results | 65 |
| ♦ Discussion | 115 |
| ♦ Summary | 123 |
| ♦ Recommendations | 126 |
| ♦ References | 127 |
| ♦ Arabic Summary | -- |

List of Tables

| Table No. | Title | Page |
|-------------------|--|-------------|
| Table (1) | Normal visual behavior of infants | 18 |
| Table (2) | Comparison between monocular & binocular fixation testing..... | 20 |
| Table (3) | Gender in the different 4 studied groups | 65 |
| Table (4) | Frequency and percent of males and females in the different 4 studied groups | 65 |
| Table (5) | Comparison in the different 4 studied groups regarding gender | 66 |
| Table (6) | Mean age in the different 4 studied groups | 69 |
| Table (7) | Frequency and percent of age in the different 4 studied groups | 69 |
| Table (8) | Comparison between age in the different 4 studied group | 72 |
| Table (9) | Comparison between uncorrected and corrected visual acuity in the different 4 studied groups | 74 |
| Table (10) | T-test results of uncorrected and corrected visual acuity in the different 4 studied groups | 75 |
| Table (11) | Frequency of uncorrected visual acuity in the different 4 studied groups | 76 |

List of Tables (Cont.)

| Table No. | Title | Page |
|-------------------|--|------|
| Table (12) | Frequency of uncorrected visual acuity in the different 4 studied groups | 79 |
| Table (13) | Frequency of best corrected visual acuity in the different 4 studied groups | 82 |
| Table (14) | Frequency of best corrected visual acuity in the different 4 studied groups | 85 |
| Table (15) | Difference between amblyopic and non amblyopic BCVA of the group IA..... | 88 |
| Table (16) | Difference between amblyopic and non amblyopic BCVA of the group IB | 88 |
| Table (17) | Difference between amblyopic and non amblyopic BCVA of the group II..... | 89 |
| Table (18) | Difference between amblyopic and non amblyopic BCVA of the group III..... | 89 |
| Table (19) | Comparison between amblyopic and non amblyopic BCVA of the different studied groups..... | 90 |
| Table (20) | Comparison of refraction in the different 4 studied groups | 91 |
| Table (21) | Frequency of refraction in the different 4 studied groups | 92 |
| Table (22) | Frequency of refraction in the different 4 studied groups | 95 |

List of Tables (Cont.)

| Table No. | Title | Page |
|-------------------|---|------|
| Table (23) | Comparison between the different 4 studied groups whether the patient is right or left handed | 98 |
| Table (24) | Comparison between right handed and left handed patients in the prevalence of amblyopia | 99 |
| Table (25) | Correlation between best corrected visual acuity (BCVA) of right & left eye of the group IA and the other different parameters | 100 |
| Table (26) | Correlation between best corrected visual acuity (BCVA) of right & left eye of the group IB and the other different parameters | 101 |
| Table (27) | Correlation between best corrected visual acuity (BCVA) of right & left eye of the group II and the other different parameters | 102 |
| Table (28) | Correlation between best corrected visual acuity (BCVA) of right & left eye of the group III and the other different parameters | 103 |
| Table (29) | Regression summary for dependent variable in relation to RT BCVA of group IA..... | 104 |
| Table (30) | Regression summary for dependent variable in relation to Lt BCVA of group IA..... | 105 |

List of Tables (Cont.)

| Table No. | Title | Page |
|-------------------|---|------|
| Table (31) | Regression summary for dependent variable in relation to Rt BCVA of group IB | 106 |
| Table (32) | Regression summary for dependent variable in relation to Lt BCVA of group IB | 107 |
| Table (33) | Regression summary for dependent variable in relation to Rt BCVA of group II..... | 108 |
| Table (34) | Regression summary for dependent variable in relation to Lt BCVA of group II..... | 109 |
| Table (35) | Regression summary for dependent variable in relation to Rt BCVA of group III..... | 110 |
| Table (36) | Regression summary for dependent variable in relation to Lt BCVA of group III..... | 111 |
| Table (37) | Amblyopia prevalence in the different studied groups..... | 112 |
| Table (38) | Prevalence of amblyopia and non amblyopia in the different studied groups | 113 |
| Table (39) | Prevalence of amblyopic and non amblyopic patients % in each group in relation to the total number amblyopia and non amblyopic patients | 114 |

List of Figure

| Fig. No. | Title | Page |
|--------------------|--|-------------|
| Figure (1) | The cyclopean eye | 8 |
| Figure (2) | The Horopter | 7 |
| Figure (3) | The changes in lens shape and position with accommodation..... | 10 |
| Figure (4) | (A) Emmetropia; (B) myopia; (C) hyperopia; (D) astigmatism | 15 |
| Figure (5) | Teller acuity card | 22 |
| Figure (6) | Cardiff cards | 23 |
| Figure (7) | Spatial frequency paddles | 24 |
| Figure (8) | Broken wheel cards..... | 25 |
| Figure (9) | Lea symbol tests | 27 |
| Figure (10) | HOTV Chart | 29 |
| Figure (11) | Landolt C chart | 30 |
| Figure (12) | Snellen's chart | 31 |
| Figure (13) | Tumbling E chart | 32 |
| Figure (14) | The Algorithm for treatment of Amblyopia in children | 54 |
| Figure (15) | The gender in the group IA..... | 67 |
| Figure (16) | The gender in the group IB..... | 67 |
| Figure (17) | The gender in the group II..... | 68 |
| Figure (18) | The gender in the group III..... | 68 |
| Figure (19) | The age in the group IA | 70 |
| Figure (20) | The age in the group IB..... | 70 |

List of Figure(Cont.)

| Fig. No. | Title | Page |
|--------------------|--|-------------|
| Figure (21) | The gender in the group III..... | 71 |
| Figure (22) | The gender in the group III..... | 71 |
| Figure (23) | The comparison between ages in the different 4 studied groups | 73 |
| Figure (24) | The UCVA of Right eye – Group IA | 77 |
| Figure (25) | The UCVA of Right eye – Group IB | 77 |
| Figure (26) | The UCVA of Right eye – Group II..... | 78 |
| Figure (27) | The UCVA of Right eye – Group III | 78 |
| Figure (28) | The UCVA of left eye – Group IA..... | 80 |
| Figure (29) | The UCVA of left eye – Group IB..... | 80 |
| Figure (30) | The UCVA of left eye – Group II | 81 |
| Figure (31) | The UCVA of left eye – Group III..... | 81 |
| Figure (32) | The BCVA of right eye – Group IA | 83 |
| Figure (33) | The BCVA of right eye – Group IB | 83 |
| Figure (34) | The BCVA of right eye – Group II..... | 84 |
| Figure (34) | The BCVA of right eye – Group III | 84 |
| Figure (36) | The BCVA of left eye – Group IA | 86 |
| Figure (37) | The BCVA of left eye – Group IB..... | 86 |
| Figure (38) | The BCVA of left eye – Group II | 87 |
| Figure (39) | The BCVA of left eye – Group III | 87 |
| Figure (40) | The refraction of right eye – Group IA | 93 |
| Figure (41) | The refraction of right eye – Group IB | 93 |

List of Figure (Cont.)

| Fig. No. | Title | Page |
|--------------------|--|-------------|
| Figure (42) | The refraction of right eye – Group II | 94 |
| Figure (43) | The refraction of right eye – Group III | 94 |
| Figure (44) | The refraction of left eye – Group IA | 96 |
| Figure (45) | The refraction of left eye – Group IB | 96 |
| Figure (46) | The refraction of left eye – Group II | 97 |
| Figure (47) | The refraction of left eye – Group III | 97 |
| Figure (48) | The comparison between the different 4 studied groups whether the patient is right or left handed..... | 98 |
| Figure (49) | The prevalence of amblyopia and non amblyopia in the different studied groups | 112 |
| Figure (50) | The prevalence of amblyopia and non amblyopic patients in each group in relation to the total number of amblyopia and non amblyopic patients | 113 |

List of Abbreviations

BCVA..... Best Corrected Visual Acuity

PL..... Preferential Looking

TACs..... Teller Acuity Cards

UCVA..... Un-Corrected Visual Acuity

Acknowledgement

This thesis would not have been possible without the support of many people.

I would like to thank Professor Dr. Tarek Mohammad Abd Allah, Professor of Ophthalmology, Faculty of Medicine, Ain Shams University, for his valuable advices.

I wish to express my gratitude to Dr. Amany Abd El-Fattah El-Shazly, Lecturer of Ophthalmology, Faculty of Medicine, Ain Shams University, for suggesting and supervising this work.

I wish to express my deepest gratitude for all my Consultants, Specialists, and Resident doctors in the Memorial Institute of Ophthalmology for their kind help and support and continuous encouragement in working in the field of Ophthalmology.

I would also like to convey my thanks to the members of my family for their continuous support, encouragement and understanding throughout the duration of my study.

Ahmed Ibrahim Abd-El-Alim



Introduction

Amblyopia is a disorder of the visual system that is characterized by a decrease in the best corrected visual acuity (BCVA) in an eye with no organic pathology (*Shimko, 2001*), anisometropia is a well-known cause of amblyopia (*Sjostrand J and Abrahamsson M, 1990*).

Unequal refractive error between the two eyes produces abnormal binocular interaction and/or visual deprivation. Patients with anisometropic amblyopia usually have no identifiable ocular defects and the visual acuity of the sound eye is normal, which makes it difficult to diagnose the symptoms, and thus early treatment is often delayed. Because improvement in visual acuity with amblyopia treatment depends on the age at which treatment begins, earlier detection of children with anisometropic amblyopia is desired (*Shaw et al., 1988*).

According to *Weakley (1999)*, there is an increased risk of amblyopia with myopic anisometropia >2 diopters (D), hyperopic anisometropia >1 D, and astigmatic anisometropia >1.5 D.

Hussein et al. (2004), in a study of amblyopic children older than six years of age, found that the risk factors for anisometropic amblyopia treatment failure were age >6 years at the onset of treatment, the presence of astigmatism of >1.5 D in

the amblyopic eye, poor compliance with treatment, and initial visual acuity in the amblyopic eye of $\leq 20/200$.