# Treatment of Different Refractive Errors in Children

***Essay***
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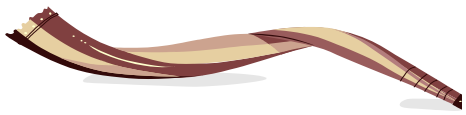

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# List of Abbreviations

| Abb. | Meaning |
|---|---|
| **AC/A** | Accomodation Convergence /Accomodation Ratio. |
| **AC PIOL** | Anterior Chamber Phakic Intraocular Lens. |
| **BCVA** | Best Corrected Visual Acuity. |
| **BSS** | Balanced Salt Solution. |
| **CH** | Corneal Hysteresis. |
| **CLE** | Clear Lens Extraction. |
| **CLSLK** | Contact Lens Superior Limbic Keratoconjuctivities. |
| **DLK** | Diffused Lamellar Keratitis. |
| **EUGA** | Examination Under General Anesthesia. |
| **GPC** | Giant papillary conjunctivitis. |
| **HSV** | Herpes Simplex Virus. |
| **ICL** | Implantable Contact Lens. |
| **ICO** | International Commission For Optics. |
| **ILO** | Interlenticular Opacification. |
| **IOL** | Intra-Ocular Lens. |
| **IOP** | Intra Ocular Pressure. |
| **LASEK** | Laser Assisted Sub-Epithelial Keratomileusis |
| **LASIK** | Laser Assisted In Situ Sub Epithelial Keratomileusis. |
| **NASIDs** | Non Steroidal Anti Inflammatory Drugs. |
| **OKN** | Opto Kinetic Nystagmaus. |
| **ORA** | Ocular Response Analyser. |

# List of Abbreviations Cont.

| | |
|---|---|
| **P.CPIOL** | Posterior Chamber Phakic Intraocular Lens. |
| **PCO** | Posterior Capsular Opacity. |
| **PIOL** | Phakic Intra Ocular Lens. |
| **PL** | Preferential Looking. |
| **PMMA** | Poly Methyl Methacrylat. |
| **PRK** | Photo Refractive Keratectomy. |
| **PRL** | Phakic Refractive Lens. |
| **RGP** | Rigid Gas Permeable. |
| **SPK** | Superficial Punctate Keratitis. |
| **TAC** | Tellar Acuity Card. |
| **UCVA** | Un Corrected Visual Acuity. |
| **VDT** | Video Display Terminal. |
| **VEP** | Visually Evoked Potential. |
| **WHO** | World Health Organization. |

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# Introduction

A refractive error is a very common eye disorder. It occurs when the eye cannot clearly focus the images from the outside world. The result of refractive errors is blurred vision, which is sometimes so severe that it causes visual impairment, Anisometropia and high refractive errors are very annoying problems, anisometropic amblyopia is one of the most common forms of amblyopia. [1]

The three most common refractive errors in children are:

- Myopia (nearsightedness): It is a refractive condition of the eye in which incident parallel rays are focused in front of the retina while accommodation is at rest. [2]
- Hyperopia (farsightedness): It is a refractive condition of the eye in which incident parallel rays are focused behind the retina while accommodation is at rest. [2]
- Astigmatism: It is a refractive condition of the eye in which incident parallel rays cannot be focused to a single point. [3]

There are three primary types of amblyopia:

Anisometropic, strabismic and deprivation amblyopia. Anisometropia refers to a difference in refractive errors between the two eyes in any meridian of greater than 1.00 diopter. Aniosmetropic ambylopia occurs in children having a

difference in refractive errors between the two eyes typically myopia, hyperopia or astigmatism, and occurs in the more ametropic eye. [4]

- Anisometropia may produce amblyopia by causing loss of foveal resolution in the less focused eye (suppression scotoma), or by loss of stereo acuity and binocular function. Studies of normal human subjects have demonstrated that induced anisometropia greater than 1 diopter causes abnormalities in resolution and induction of suppression scotoma. [5]
- Treatment of the refractive errors depend upon the severity of the condition.

**Glasses** which are one of the commonest and effective lines of treatment in different refractive errors. Myopia is corrected using concave lenses, while convex lenses is used in hyperopia. Both lenses focus light rays on the retina, correcting poor distance or near vision. [6]

Astigmatism may be corrected using toric lenses which correspond especially to the patient's corneal deformations. [7]

**Contact lenses** are considered the second line of treatment often provide a better correction of both visual acuity and peripheral vision than glasses, Types of contact lenses may be soft, hard or toric according to the refractive error present. [8]

**Refractive surgery** aims to decrease the dependence on glasses and contact lenses. Different laser techniques, which involve the modification of the corneal shape, are available. In some cases, the placement of an intraocular implant is the preferred solution. [9]

Refractive surgery in children is controversial. It is mainly performed when conventional treatment has failed. The primary indications are anisometropic amblyopia and bilateral high myopia. The most popular procedures are photo refractive keratectomy (PRK), and laser assisted sub epithelial keratomileusis (LASIK). [9]

Bilateral refractive lensectomy or clear lens exchange improves functional vision in children who have high myopia beyond the range of excimer laser correction and difficulties in wearing the glasses. [10]

Surgical phakic intra ocular lens implantation appears to be an effective method to treat high myopia in children with amblyopia, good results with high satisfaction were noted. [11]

# Aim of the Work

The aim of this essay is to express recent and effective lines of treatment in different types of refractive errors in children.

Chapter (1):

# Visual Acuity in Children

# Visual Development

## Introduction:

The knowledge of critical period in which normal development occurs has wide ranging clinical implications it is important not only for the management of many eye diseases in infant and children, but also for improved understanding of many psychological and social problems that may develop. [12]

## Critical period:

In amblyopia,the concept of critical or sensitive period of visual development is central. Although, the actual time course of the critical period and its underlying neurophysiologic and neuroanatomic mechanisms involved, remain unclear. [12]

The term "pediatric population" can be applied to patients within a broad age range, including all those between birth and 18 years of age. [13]

## Monocular visual development:

At birth visual acuity is quite poor in the range of hand motion to counting fingers. This poor vision is mostly due to immaturity of the visual centers in the brain including the lateral geniculate nucleus and strait cortex. Rapidly over the first few weeks, retinal stimulation with formed image

stimulates specific drop out and growth of the cortical connections and the visual acuity improves. [14]

This early neural development gives rise to the organization of small high resolution receptive fields in the central foveal area. Central foveal fixation is established by 4 to 6 weeks along with accurate smooth pursuit. During the first few weeks, only saccadic (fast or jerk) eye movement are available for fixation. By 6 weeks of age, smooth pursuit and reproducible responses to optokinetic stimuli are seen. Central fixation and accurate smooth pursuit is an important clinical milestone of normal visual development. Most children will show central fixation and accurate smooth pursuit eye movement by 2 to 3 months of age, but some infants may show delayed visual maturation. Poor fixation at 6 months of age, however is usually pathologic, and should prompt a full evaluation for ocular, motor or afferent visual pathway diseases, including electro physiologic and neuroimaging studies.[14]

## Binocular visual development:

Binocular visual development occurs in concern with improving monocular vision. Basic neuroanatomy tells us that the two eyes are linked to provide binocular vision. Optic nerve fiber from the nasal retina cross in the chiasma to join the temporal retinal nerve fiber from the fellow eye. Together they

project to the lateral genicualte nucleus and on to the striate cortex. [15]

In the striate cortex the afferent pathway connect to the binocular cortical cells that respond to the stimulation of either eye and monocular cortical cell that responds to stimulation of one eye. Refinement of neuroanatomic connections and development of normal binocular vision function, are dependent on appropriate binocular visual development include equal retinal stimulation and proper eye alignment. Binocular vision and fusion have been found to be present between 1 and 2 months of age while stereopsis develop later between 3 and 6 months of age. [15]

## Visual acuity development:

Preferential looking and visually evoked potential are the most useful methods in measuring visual acuity in infants and toddlers. Using preferential looking new born visual acuity is estimated to be approximately 30 minute of arc (20/600 snellen equivalent). [16]

Although visual attention is poor in the new born period, most infants demonstrate convincing fixation to the near objects, some infants have significant delay in fixation and following, especially when they have other medical problems such as prematurity and delayed motor development. [16]

## Stereopsis development: