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The Human Eye

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ABSTRACT

The biggest Challenge moon-faced by today's chemist and formulation mortal is ocular drug delivery. The route of drug administration and particularly for the treatment of anterior phase diseases the topical eye drop is that the most convenient and patient compliant. By numerous precorneal, dynamic and static ocular barriers, the delivery of medication to the targeted ocular tissues is restricted. In target tissues therapeutic drug levels aren't maintained for extended period. Within the past twenty years, ocular drug delivery analysis acceleratedly advanced towards developing a completely unique, safe and patient compliant formulation and drug delivery devices/techniques, which can surpass these barriers and maintain drug levels in tissues. By modulation of typical topical solutions with permeation and viciousness enhancers, anterior phase drug delivery advances.

Keywords: Accommodation, Myopia, Hypermetropia, Presbyopia, Cataract, Vascular System.

INTRODUCTION

The human eye is associate organ that is accountable for vision that detects light weight. Differing kinds of sensitive organ area unit found in several kind of organisms. The best eyes do nothing however find whether or not the environment area unit bright or dark, whereas a lot of complicated eyes will distinguish shapes and hues. These area unit then transmitted to brain via the optic tract. Such eyes area unit generally

roughly spherical, full of a clear gel-like substance referred to as the bodily fluid, with a focusing lens and sometimes associate iris that regulates the intensity of the sunshine that enters the attention [1-5].

The Human Eye

The most valuable and sensitive receptor of soul's eye. Its permits U.S. to envision the terrific world and also the colors around U.S.



Fig 1: Human Eye

- **(C)Cornea:** Cornea is the front part of the human eye. It's made up of transparent substances. And it's bulging outwards.
- **(I)Iris:** Iris is a dark muscular assembly that controls the size of the pupil.
- **(P)Pupil:** The amount of the light entering in the eye can be controlled by the pupil. The pupil becomes very small...when light is bright. However, in dim light, it opens up.
- **Eye Lens/Convex Lens:** The eye lens is the composed of the fibrous jelly like material .The focal length of the eye lens can be changed by the action of ciliary muscles.
- **Retina:** Retina is just like a screen, on which the image is formed .Its behind the human eye lens. Retina formed real and inverted image. Cones allow us to distinguish the colours basically cones are the light sensitive cells. These are present in the retina of the eye. Cone is of 3 types as given below [6-10]:
 1. Short or Blue
 2. Middle or Green
 3. Long or Red
- **Rods:** Rods can detect the lowest amounts of light. Rods are the light sensitive cells which response to intensity of light.
- **(A)Aqueous Humour:** The space between cornea and eye lens is filled with a viscous liquid, which is called as an aqueous humour.
- **(V)Vitreous Humour:** Vitreous humour the space between eye lens and the retina of eye.
- **Blind Spot:** Blind spot is a small region of retina, where the optic nerve enters the eye ball, is insensitive to the light.
- **(N)Optic nerve:** The image formed on retina is conveyed to the brain by optic nerve and gives rise to sensation of vision.
- **(S)Sclera:** Sclera the white part of human eye. Sclera is the part that surrounds the cornea.80% of surface area of the eyeball made sclera. Only a small anterior part of sclera is visual.
- **(x)Suspensory Ligament:** It's a series of fibers. It is connected with the ciliary body.
- **(O)Optic Disc:** Optic disc or optic nerve head is the exit for the ganglion Cell axons leaving the eye. There are no rods and no cones. It corresponds to blind spot.
- **(Q)Central Artery and Vein of Retina:** The blood vessel that supplies nutrition and blood to the retina.
- **Fovea:** Fovea is the tiny pit. This is located in macula of retina. Macula of retina provides the clearest vision of all. The retina layers spread aside to let light falls on cones .By which cells give sharpest image .It's also called as central fovea or fovea centralise.
- **(T)Choroids:** Choroids also known by the name of choroidea or choroid coat. Choroids are the vascular layer. It contains connective tissue. It's lying between sclera and retina. Anatomy of the Human eye: refracting tissues that focus light-sensitive tissues support tissues.
- **Refracting Tissues:** These tissues help in focusing incoming light. The refracting tissues are as given below [11, 12]:
 1. The Pupil
 2. The Iris
 3. The Lens
 4. Ciliary Muscles
 5. Cornea
 6. Vitreous Fluid
 7. Aqueous Fluid

- **Light Sensitive Tissues:** Light sensitive tissues include the human eye parts as following below:

1. Retina
2. Cones
3. Rods
4. Optic Nerve

- **Working of Eye**

The light rays comes from the object enter the pupil of eye and falls on the eye lens which

converges the light rays and produces a real and inverted image of the object on the retina. The image formed on the retina is conveyed to the brain by optic nerve. Our mind explicate image as that of an erect image.

Accommodation

The property to adjust its focal length. Eye has a accommodation power which enables objects as far as infinity and as close as 25 cm to be focused on the retina.

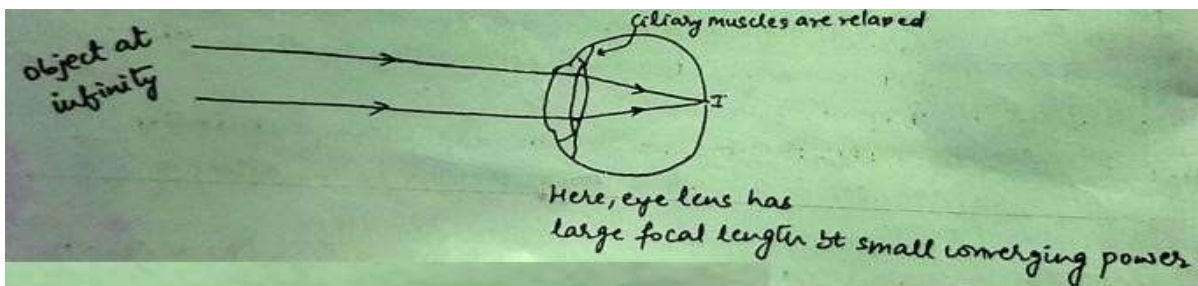


Fig 2: An eye focused on a distant object (at Infinity)

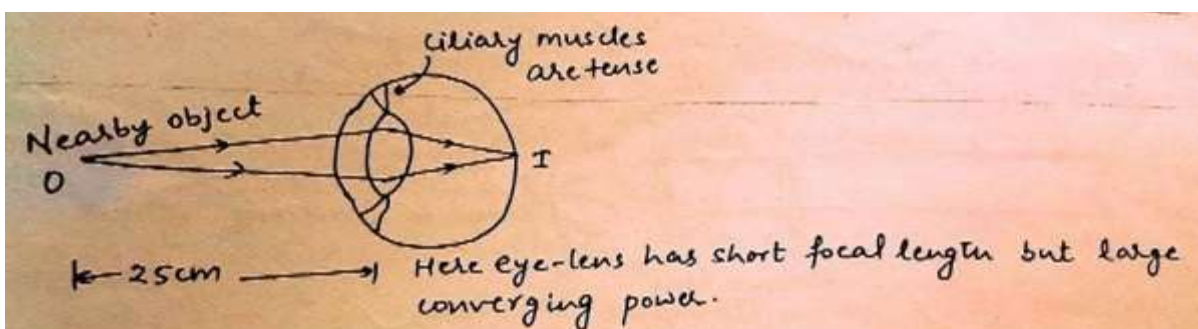


Fig 3: An eye focused on a nearby object

- **Far Point:** The farthest point from the eye which can be seen clearly is known as far point of the eye. The far point of normal human eye is at infinity.
- **Near Point:** When an eye can see objects clearly is called the near point of the eye. A distance of 25 cm from the eye is the near point of human eye.
- **Least Distance of Distinct Vision:** The minimum distance at which an object must be placed so that a normal eye may see it clearly is called the least distance vision.
- **Defects of Vision and Their Correction:**
 - In such conditions, the person can't see the objects distinctly and comfortably. The vision becomes blurred due to refractive defects of the eye. The use of Suitable spherical lenses can correct these defect. There are the types of defects of vision which are given below:
 - Myopia
 - Hypermetropia
 - Presbyopia
 - Astigmatism
 - Cataract
 - **MYOPIA:** Myopia is a defect of eye due to which a person can see nearby clearly but cant see distant object distinctly.

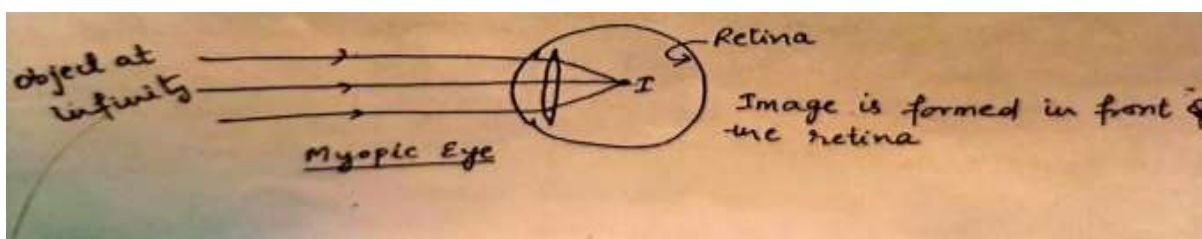


Fig 4: Myopic eye

Cause of myopia: due to excessive curvature of the eye lens due to elongation of the eye ball.

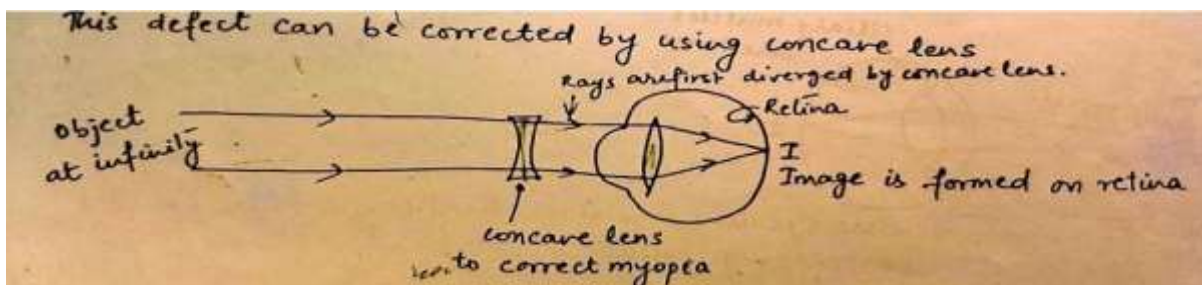


Fig 5: Concave lens to correct myopia

HYPERMETROPIA

It's a defect of eye due to which a person can see distant object distinctly but can't see nearby objects so clearly.

Cause of hypermetropia: Due to the low converging power of eye lens therefore focal length of the eye lens is too long due to the eyeball being too small.

This defect is corrected by using spectacles containing convex lens.

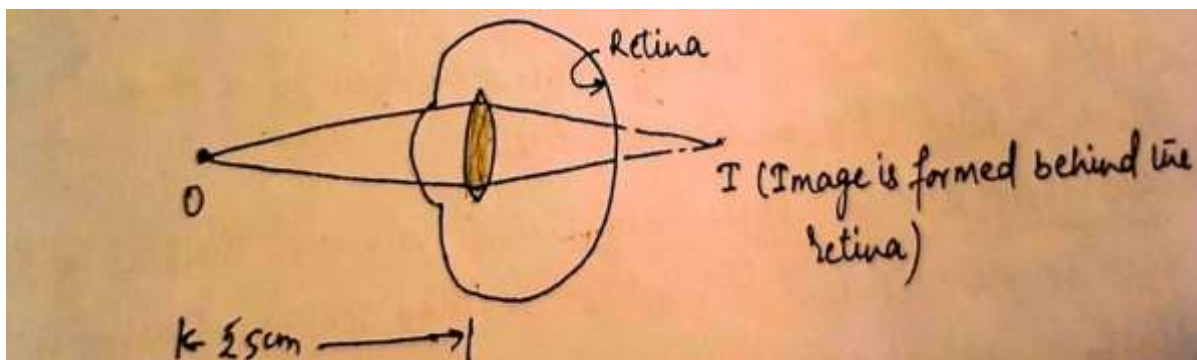


Fig 6: Hypermetropia

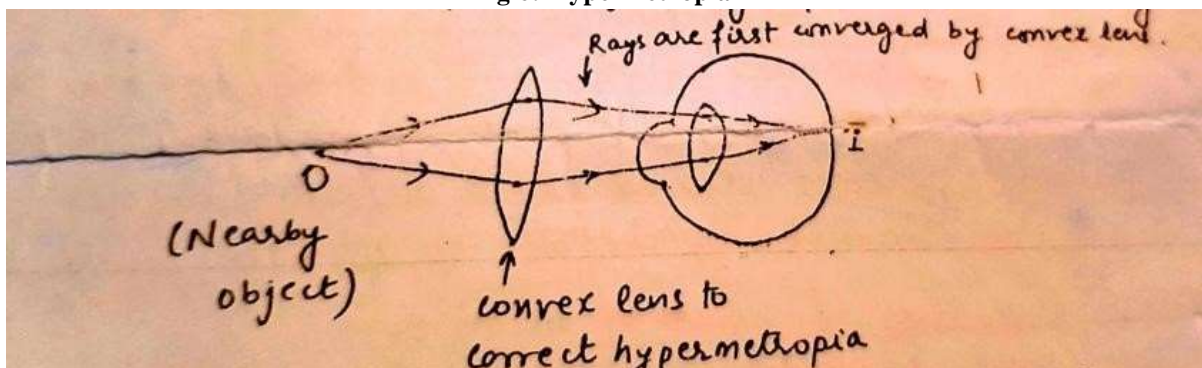


Fig 7: Convex lens used to correct hypermetropia

Presbyopia

It's the defect of the attention to that associate degree senior citizen can't scan well and clearly while not spectacles. Its arises thanks to the gradual weakening of the ciliary muscles and decreasing flexibility of the attention lens. Such individuals usually need central lenses. a typical variety of central lenses consists of each depressed and convexo-concave lenses. The higher portion consists of depressed lenses .It facilitates distant vision .The lower half may be a lens .It facilitates sight.

Astigmatism

It's that defect of the attention thanks to that an individual can't specialize in each horizontal and vertical lines at the same time. Cause of astigmatism: This defect arises thanks to the irregularities on the surface of membrane. It's not absolutely spherical. It's completely different curvatures in numerous directions. Astigmatism is corrected by superimposing cylindrical lenses upon the spherical form of spectacle lenses.

Cataract

Cataract develops once eye lens of an individual becomes lazy thanks to the formation of membrane over it. it's going to ends up in total loss of vision.

CONVENTIONAL DELIVERY SYSTEMS

1 **Eye Drops:** Active drug administered within the type of Solutions largely, Emulsion and Suspension. typically eye drops square measure used just for anterior phase disorders as adequate drug concentrations aren't reached within the posterior tissues victimization this drug delivery technique. varied properties of eye drops like cation concentration, osmolality, viciousness and instilled volume will influence retention of an answer within the eye. but five %of the dose is absorbed once topical administration into the attention. Ocular absorption is restricted by the membrane epithelial tissue, and it's solely moderately enhanced by prolonged ocular contact. The according highest gettable eye absorption is just concerning ten whatever the dose.

- 2 **Ointment and Gels:** The external ocular surface's achieved. But, the main downside of this dose type like, blurring of vision and matting of eyelids will limits its use. Piloting HS gel containing alkaloid was accustomed give sustain action over a amount of twenty four-hour.
- 3 **Ocuserts and Lacrisert:** Ocuserts square measure sterile preparation. Ocuserts square measure prolonging duration of drug with a controlled unharness manner and negligible or less tormented by nasolacrimal injury. Inserts square measure accessible in numerous varieties relying upon their composition and applications. Lacrisert is for the treatment of dry eye syndrome and inflammation sicca and was introduced by Merck, Sharp and Dohme in 1981. They act by consumption water from the membrane and mucosa and type a deliquescent film that lubricates the membrane.

VESICULAR SYSTEM

1. **Liposomes:** Liposomes or will say as biocompatible. they're perishable lipid additionally. that square measure created of natural lipids (25–10 000 nm in diameter). They having associate degree intimate contact with the membrane and mucosa surfaces fascinating for medicine that square measure poorly absorbed, the medicine with low partition constant, poor solubility or those with medium to high molecular weights and so will increase the chance of ocular drug absorption. The membrane epithelial tissue is thinly coated with charged glycoprotein to that the positive charged surface of the liposomes might bind.
2. **Niosome and Disomes:** The main limitations of liposomes square measure chemical instability, aerobic degradation of phospholipids, price and purity of natural phospholipids. Niosome the nonototoxic and don't need special handling techniques. Niosome square measure non-ionic chemical agent. Niosome have potential applications within the delivery of hydrophobic or amphiphilic medicine. Vyas and coemployees according that there was concerning a pair of.49 times increase within the ocular bioavailability of beta-adrenergic blocking

agent antidepressant drug encapsulated in noisome as compared to beta-adrenergic blocking agent antidepressant drug answer. Non-ionic surface active agents primarily based circular vesicles called (discomes) loaded with beta-adrenergic blocking agent antidepressant drug were developed and characterised for his or her in vivo parameters. in vivo studies showed that discomes discharged the contents during biphasic profile if the drug was loaded employing a hydrogen ion concentration gradient technique. Discomes might act as potential drug delivery carriers as they discharged drug during a sustained manner at the ocular website.

3. **Pharmacosomes:** It's used for pure drug vesicles .its shaped by the amphiphilic medicine. The drug that is possessing a free group is is esterifies (with or while not a spacer group) to the chemical group of a lipid molecule, so generating associate degree amphiphilic pro drug.

CONTROL DELIVERY SYSTEMS

1. **Implants:** Implants square measure effective drug delivery system. Presently perishable polymers like Poly carboxylic acid (PLA) square measure safe and effective to deliver medicine within the vitreous cavity and show no ototoxic signs. Intravitreal implants of fluocinolone acetonide were developed for the treatment of posterior phase and according to manage the ocular inflammation of tissue layer.
2. **Iontophoresis:** For therapy ions ought to be charged molecules of the drug.¹⁹ charged of drug square measure driven into the tissues at the anode and contrariwise. Disinfectant activity is of antibiotics however additionally antibiotic scale back the severity of illness. Equally application of anti-inflammatory agents will scale back vision threatening aspect effects.
3. **Dendrimer:** used for various routes of drug administration. Dendrimer have higher water solubility, bioavailability and biocompatibility. Vandamme and co employees have developed and evaluated poly (amidoamine) dendrimers containing fluorescent dye for controlled ocular drug delivery. The duration was longer

for the solutions containing dendrimers with chemical group and chemical group surface teams.

4. **Cyclodextrin:** Cyclodextrins (CDs) area unit cyclic oligosaccharides capable of forming inclusion complexes with several guest molecules. CD complexes area unit according to extend membrane permeation of medication like anti-inflammatory, anti-inflammatory acetate, cyclosporine and alkaloid resulted in higher bioavailability than the standard eye drops. This complexation of CD doesn't interrupt the biological membrane compared to standard permeation foil like benzalkonium chloride. CD molecules area unit inert in nature and were found to be non pain in the ass to the human and animal eye.
5. **Contact lenses:** Contact lenses area unit placed within the eye. lens releases the drug in eye for an extended amount of your time. bigger penetration of fluorescent dye has been according by Bionite lens made of deliquescent compound (2-hydroxy alkyl radical methacrylate) in human.
6. **Collagen Shield:** albuminoid protect primarily comprises cross connected albuminoid, unreal with foetalcalf skin tissue and developed as a membrane bandage to market wound healing. These devices soft thanks to tear fluids .And they type a skinny pliable film that has dissolution rate up to ten, twenty four or seventy two hours. They're structurally stable, sensible biocompatibility and biological immobility, albuminoid film established as a possible carrier for ophthalmic drug delivery system. albuminoidophthalmic inserts area unit Av small emulsion. Micro emulsion is dispersion of water and oil stable victimization wetter and co wetter to scale back surface tension and frequently characterised by little drop size (100 nm), higher natural philosophy stability and clear look. Choice of liquid part, organic part and wetter/co surfactant systems area unit vital parameters which may have an effect on stability of the system. important improvement in solubility of the drug molecule is thanks to optimization .e.g. nonsteroidal anti-inflammatory, antibiotic drug for eye diseases.
7. **Nano suspensions:** Nano suspensions area unit emerged as a promising strategy, for the

economical delivery of hydrophobic medicine. as a result of they increase not solely the speed however conjointly extent of ophthalmic drug absorption, intensity of drug action with important extended length of drug impact. For business preparation of Nano suspensions, techniques like media edge and high pressure blending are used. The maximum drug level within the bodily fluid was according victimization Eudragit RS100 Nano suspensions for the ophthalmic controlled delivery of Motrin.

8. **Micro needle:** The realm of lateral and transversal diffusion of sulforhodamine was according to be similar across human corpse albuginea. Small needle realize in vitro penetration into albuginea. And fast dissolution of coating answer once insertion whereas in vivo drug level was found to be considerably more than topical drug administration like alkaloid.
9. **Prodrugs:** The best Prodrugs for ocular medical aid not solely have multiplied lipophilicity and a high partition constant, however it should even have high protein condition to such AN extent that once membrane penetration or among the tissue layer they're either with chemicals or enzymatically metabolized to the active parent compound. The partition constant of ganciclovir found to be multiplied victimization AN acyl group organic compound prodrug, with well multiplied the number of drug penetration to the tissue layer that is thanks to multiplied condition of the ganciclovir esters to bear reaction by esterases within the tissue layer.
10. **Penetration Enhancers:** Transport of drug across the tissue layer is multiplied by increasing the permeableness, through membrane animal tissue membranes. For such purpose Penetration enhancers are often used. 34 samples of enhancers embrace simple protein filament inhibitors, surfactants, bile salts, chelators, and chemical compound Penetration enhancers themselves will penetrate the attention and will result in unknown metrika medica complications e.g., benzalkonium chloride (BAC) was found to accumulate within the tissue layer for days.

11. **Mucoadhesive Polymers:** These area unit organic compound hydrocolloids with plentiful deliquescent purposeful teams, like chemical group, carboxyl, organic compound and sulphate having capability for establishing static interactions. skinny films of the complexes unconnected to unharness the drug by natural action with artificial tear fluid.
12. **Phase Transition Systems/Insitu gel system:** Formulation from the liquid state to gel or solid part happens once these systems instilled into the cul-de-sac of eye result in increase the consistence of a drug formulation within the precorneal region ends up in multiplied bioavailability, thanks to slower drain from the tissue layer. It are often influenced by pH scale, temperature or by particle activation. A sol to gel system with muco adhesive property to deliver the steroid fluorometholone to the attention was ready by Middleton and Robinson.

PARTICULATES (NANOPARTICLES AND MICROPARTICLES)

The maximum size limit is regarding 5-10 millimeter on top of that a scratching feeling within the eye may end up upon ocular instillation for micro particles for ophthalmic administration. therefore microspheres and nanoparticles area unit promising drug. And these carriers for ophthalmic application. Nanoparticles area unit ready victimization bio adhesive polymers to supply sustained impact to the entrapped medicine. AN optimum membrane penetration of the encapsulated drug was according in presence of bioadhesive compound chitosan. equally Poly radical cyanoacrylate nanoparticles, containing alkaloid into albuminoid shields, showed bigger retention and activity characteristics with regard to the controls. Nano spheres created of poly carboxylic acid (PLA) coated with Poly antifreeze (PEG) shown higher effectiveness compared to standard indefinite quantity kind of medication for the treatment of ocular infective agent infections. Microspheres of poly lacto glycolic acid (PLGA) for topical ocular delivery of a amide drug vancocin were ready by AN emulsification/ spray-drying technique.

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