IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Occular Drug Delivery System

Akash G. Tekale[1], Prof. Harish K. Rathod[2], Dr. Swati. P. Deshmukh[3], Girish R Ghatol[4], Vishal G Borkar[5]

1,4,5 Student,Shraddha Institute of Pharmacy Kondala Zambre Washim -444505

2Assistant Professor, Department of Pharmaceutics, Shraddha Institute of Pharmacy, Washim

3Professor, Department of Pharmacology, Shraddha Institute of Pharmacy, Washim.

ABSTRACT

Optical Drug delivery system is a lozenge form medium or structure calculated for edging in or delivering medicine to eye against any complaint or complaint involving or affecting vision. The most generally employed conventional medications. Ophthalmic lozenge forms are the emulsion, suspense and ointments which are fairly ineffective as remedial systems. It's deviates through a number of anatomical and physiological hedge, which have been tailback

for the ophthalmologist. Calculating an ideal medicine delivery scheme should included magnify medicine bioavailability and controlled release of the medicine at the point of action, which can control colorful occular walls. Contact lenses are arising as an indispensable ophthalmic medicine delivery system to resolve the fault of the conventional topical operation styles like eye drops and ointment. Such a medicine delivery can be achieved by designing conformation similar as microspheres, nanoparticles, liposomes which can act as methodical optical medicine delivery system.

Keywords: Conventional,Opthalmic lozenge, nanoparticles.

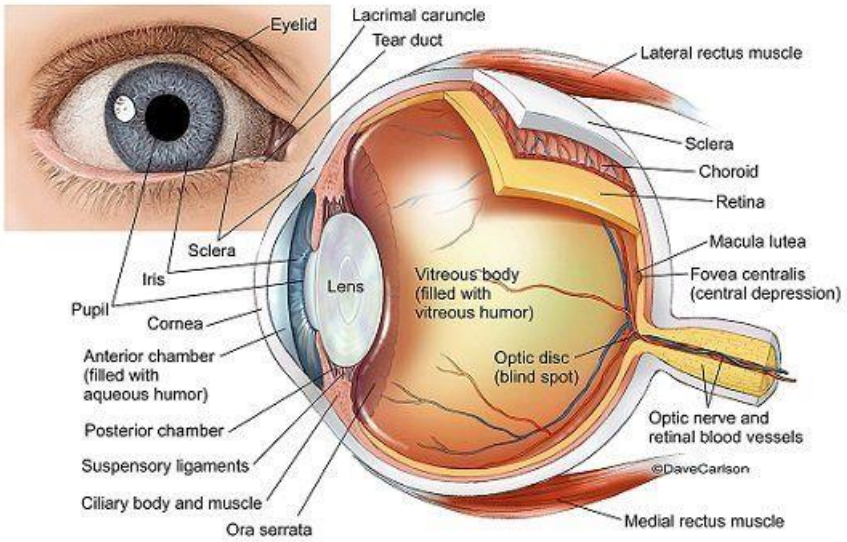
INTRODUCTION

Eye is the most important organ due to its medicine deposit characteristics. For optical delivery it provides numerous further advantages for . sterilization, minimal vexation. Eye is the most accessible point for for topical administration and it's most accessible and patient biddable route of medicine administration. The ideal ophthalmic medicine delivery must suitable to sustain the medicine release and to remain in the the vicinity of front of the eye for a long period of time. The eye is the veritably unique and veritably precious organ. new optical medicine- delivery systems include Nano micelles, nanoparticles, medicine- eluting contact lenses, optical inserts, and optical bias. remedial action of optical medicines can be divided into

two orders, the first one is grounded on use of sustainable medicine delivery system which can give control and nonstop delivery of ophthalmic medicines and alternate bone

involves maximizing corneal medicine immersion and minimizing precorneal medicine loss. The purpose of topical ophthalmic medicine delivery bias is to deliver an acceptable quantum of drug to the anterior member of the eye.

The Anatomy of Eye



Right Eye (viewed from above)

1) SCLERA

It's the white subcaste of the eye that covers utmost of the outside of the eyeball. It's the thick connective towel of the eyeball that forms the white of the eye. The junction between the white clearer and the clear cornea is called the limbus. The sclera ranges in consistence about0.3 mm1.0 mm. It's fairly inactive metabolically and has only a limited blood force. The tough, stringy nature of the sclera also cover the eye from serious damage.

2) CONJUNCTIVA

The conjunctiva is a clear thin membrane that it covers the the part of the frontal face of the eye and inner face of eyelids. It has numerous small blood vessels that provides nutrition to the eye and lids. Conjunctiva is a loose connective towel. Conjunctivitis, also known as Pink eye is an inflammation of the conjunctiva.

3) CORNEA

The transparent part of the eye which can covers the iris and the pupil and allows light to enter the inside. Despite injury or complaint, the cornea can still repair by itself snappily. Cornea helps to Shield the rest of eye and dust dangerous matter.

4) AQUEOUS HUMOR

It's the fluid produced by the eye which is present between the cornea and front of the vitreous. It can helps in the aliment of the lenses. The main function of the waterless humor is to maintaining intraocular pressure. It's made up of99.9 water and other of sugar, vitamins and other nutrients. It's buried from the ciliary body. It can play an important part in occular physiology.

5) PUPIL

It's the round opening in the center of the iris. The function of the pupil is to allow end of the light into the eye. The size of the opening is operating by the muscles of the iris. The pupil opens and closes to control the quantum of light that's allowed to enter the eye. The pupil reacts to external light and changes its size according to the light intensity. A completely dilated pupil is about 4 to 8 millimeter in size, while a constricted pupil is in the 2 to 4 mm range.

6) IRIS

It's located in front of the lens and ciliary body and behind the cornea. The multicolored part of the eye is called iris. Irises are generally classified into six orders for eg. amber, blue, argentine and green etc. The iris is substantially divided into two main regions i.e.; pupillary zone and ciliary zone. Iris is made up of the iris painted epithelium, dilator and sphincter muscles and stroma. It's helpful in controlling the size of the pupil to let more or less light.

7) CILIARY MUSCLE

It's an natural muscle of the eye as a ring of smooth muscle in the eyes middle subcaste. Ciliary muscles also changes the shape of the lens within the eye but not the size of pupil. This muscles occupies the largest portion of the ciliary body which is in between the anterior border of the choroid and iris.

8) LENS

It's twisted structure in the eye that bends light and focuses it for the retina to help you see images duly. If is also works with the cornea to refract or bending of light. The lens is about 10 mm across and about 4 mm from frontal to back in grown-ups. It correspond of the lens capsules which is smooth and transparent and the lens filaments which are long, thin and transparent cells. The conditions of the lens.

9) VITREOUS HUMOR

It's a transparent tintless Jelly like substance located in the posterior Chamber of the eye. It also helps in maintaining the round shape of the eye. Vitreous humor is substantially composed of water, along with small chance of collagen, glycosaminoglycan's, electrolytes and proteins. Vitreous humors can play important part in in guarding our eye.

10) RETINA

It's a thin subcaste of towel that lines the reverse of the eye on the inside. Retina is substantially located near the optical whim-whams. The main function of the retina is to admit light that the lens has concentrated, convert the light into neural Signals and transferring this signals on to the Brain for visual recognition. It's

contains millions of light sensitive cells and other whim-whams cells that admit and organized visual information.

10) MACULA

It's an round shaped pigmented area in the center of the retina of the mortal eye and in other creatures. The periphery of the macular in mortal eye is of around5.5 mm and it's subdivided into umbo, foveola, foveal avascular zone, fovea, Para fovea and peritonea areas. It's responsible for the central high- resolution colour vision that's possible to good light and this kind of region is bloodied if the macular is damaged, for eg macular degeneration. The need of the macula is to easily see details of objects in front of you like faces and written textbook.

11) CHOROID

It's the middle subcaste of towel In The Wall of the eye its set up between the sclera and the retina. It's the life so that keep the retina healthy and performing. The subcaste of choroid begins in the supplemental edges of the eyeball and lines the entire reverse of it. There's substantially different layers of choroid for illustration, brunch's membrane, choriocapillaris, Sattler's subcaste and haler's subcaste. The main functions of the choroid include furnishing nutrients for the retina macular and optical whim-whams, also helps in regulating the temperature of the retina, helping control pressure within the eye, also helps in absorbing light and limiting reflections within the eye that could detriments.

• **Accessory organs of the eye**

Eye brows Eyelashes and eyelids Lacrimal apparatus

Eye brows

It is an area of short hair above each eye that follows the shape of the lower margin of the bridges of some mammals. In humans the

eyebrows plate two main functions ,first , communication through facial expression and second prevention of sweat with water and

other debris from falling down into the eye socket. Eyebrows protect our eyes from moisture and light.

Eyelashes and eyelids

Eyelid is a thin layer of skin that covers and protect the eye. Human eyelids contain a row of eyelashes that protect the eyes from the

dust particles, foreign bodies and perspiration. The focus on eyelashes is often for their aesthetic beauty.

ROUTES OF OCCULAR DRUG DELIVERY

The three primary styles of delivery of optical specifics to the eye are topical original occular(i.e., subconjunctival, retrobulbar and intravitreal.)

• Topical route

The topical eye drop is the most accessible and patient biddable route of medicine administration especially, for the treatment of anterior member conditions. The optical medicine delivery is one of the most grueling and tough administration routes due to the eye's unique deconstruction and Physiology. •

.Subconjunctival route

The subconjunctival injections obviates the conjunctival epithelial hedge which is rate limiting for saturation of water answerable medicines. It's a type of periocular route of injection for optical medicine administration bi administration of a drug either under the conjunctiva or underneath the conjunctiva lining the eyelid.

• Intravitreal route

It's a route of administration of a medicine, or other substance, in which the substance is delivered into the vitreous humor of the eye. The meaning of intravitreal means " inside the eye ". The advantage of an intravitreal route is an immediate and remedial effect in the intended retinal towel.

Barriers for occular drug delivery

1) Anatomical Barriers

The sealed anatomical options of the attention and its physiological exertion that snappily removes drug square measure appertained to as anatomical and physiological walls, that square measure the reason for relatively ninetieth of medicine loss. This side remains a vital issue in eye face drug. It acts as a serious hedge to hydrophilic medicine transport through animate thing areas. On the contrary hand stroma, that consists of multiple layers of hexagonally organized albuminoidal filaments containing liquid pores or channels permit hydrophilic drug to simply repel still it acts as a major hedge for lipotropic drug.

2) Drug loss from the occular surface

After exploitation the indefinite volume type of the medicine within the optical system, inflow of lacrimal fluid wipes out some of the medicine from its face and its turnout rate is just regarding one µ l/ min, whereas, a serious portion of the medicine is drained through the channel snappily at intervals twinkles. indispensable sources of medicine junking embrace the general immersion of the medicine, rather than being absorbed through the optical route.

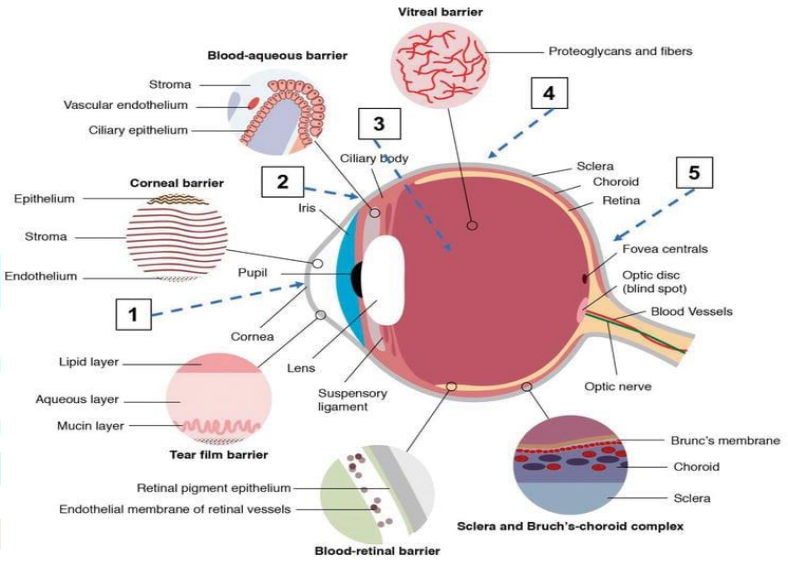
3) Blood-ocular barriers:

Blood- ocular barrier area unit gift within the blood, that defend the attention from enobiotics. It contains of 2 rudiments, specifically blood-waterless hedge and blood- retina hedge. The anterior blood- eye hedge consists of epithelial towel cells within the body structure, i.e., the center subcaste of the attention below

sclerotic fleece, iris, membrane and choroid fleece. Choroid vasculature contains of ferocious blood inflow and dense walls, thanks to that quick access of drug happens within the choroidal extravascular area, still their distribution within the towel subcaste is confined thanks to the presence of RPE and retinal epithelium.

4. Diffusion Barriers:

Vitamin E coatings form prolixity walls within the lens, which forces the target medicine to take long complex paths to diffuse from the lens and give extended medicine delivery.(61,62) Vitamin E loaded silicone contact lenses handed anesthetic release for about - 7 days and released0.5 mg of lidocaine and therefore could be veritably useful for postoperative pain control after corneal surgery similar as the photorefractive keratectomy.



Novel Occular Drug Delivery Systems

In a last many decades, numerous approaches have been employed for the treatment of optical conditions. Nanotechnology grounded ophthalmic phrasings are one of the approaches which is presently being pursued for both anterior, as well as posterior member medicine delivery. Nanotechnology grounded systems with an applicable flyspeck size can be designed to insure low vexation, acceptable bioavailability, and optical towel compatibilityTo overcome the downsides of conventional ophthalmic phrasings, colorful workups have been done to morepre-corneal medicine immersion and minimizingpre-corneal medicine elimination.

1) Liposomes

Liposomes are defined as simple bitsy vesicles in which waterless volume is entirelyenclosed by a bilayered phospholipids membrane. The lipophilic medicine is entangled in bilayerof lipids and hydrophilic medicine in waterless phase and therefore increased medicine hearthstone time in the eye isachieved.Liposomes are lipid vesicles with one or further phospholipid bilayers enclosing an waterless core(Figure 3). The size of liposomes generally range from0.08 to10.00 µm and grounded on the size and phospholipid bilayers, liposomes can be classified as small unilamellar vesicles(10 – 100 nm), large unilamellar vesicles(100 – 300

nm) and multilamellar vesicles(contains further than one bilayer)(71) For ophthalmic operations, liposomes represent ideal delivery systems due to excellent biocompatibility, cell membrane like structure and capability to synopsize both hydrophilic and hydrophobic medicines. Liposomes have demonstrated good effectiveness for both anterior and posterior member optical delivery in several exploration studies. Recent advancements in liposomal optical medicine delivery are epitomized in Table In a recent study, for delivery of latanoprost to anterior member optical apkins, liposomal expression was developed by Natarajan .

2) Nanoparticles

Nanoparticles are solid patches made up of polymers with flyspeck size ranging from 1- 1000 nm in which the medicine or active component is entangled. These entangled medicines give asustainedeffect.drug is enclosed inside the polymeric shell while in nanospheres; medicine is slightly distributed throughout polymeric matrix. From once many decades, nanoparticles have gained attention for optical medicine delivery and several experimenters have made attempts to develop medicine loaded nanoparticles for delivery to both anterior and posterior optical apkins .

3) Polyethylene Glycol (PEG)

Chitosan and hyaluronic acid are commonly employed to improve precorneal residence time of nanoparticles.

Contact lenses

The medicine impregnated contact lenses are placed in the eye which release the medicine in the eye for a prolonged period of time. Hydrophilic or water answerable medicines soaked in medicine result can be absorbed through contact lenses and therefore hydrophilic contact lenses can be used for perfecting optical hearthstone time ofdrug.It's supposed that in presence of contact lens, medicine motes have longer hearthstone time in thepost-lens tear film which eventually led to advanced medicine flux through cornea with lower medicine flux into the nasolacrimal conduit. generally, medicine is loaded into contact lens by soaking them in medicine results. These soaked contact lenses demonstrated advanced effectiveness in delivering medicine compared to conventional eye drops. Kim et al(102) observed much advanced bioavailability of dexamethasone(DX) from poly(hydroxyethyl methacrylate)(PHEMA) contact lenses in comparison to eye drops.

4) Pharmacosomes

pharmacosomes are vesicles made up of amphiphilic medicines. Any medicine having a free carboxylic group or active hydrogen snippet can be esterified to the amphiphilic prodrug. These amphiphilicpro-drugs are converted to pharmacosomes on dilution with water and therefore show lesser shelf stability and eased transport across the cornea and a controlled release profile.

5) Ophthalmic Inserts

Ocusert system was originally developed in 1975 by ' Alza Corporation, in the United State of America. It's a flat, flexible, solid and circumfluous device which consists of medicine force and rate controlling membrane by using colorful polymers.(4,12) The high ideal of development of the ocuserts is nonstop controlled delivery of ophthalmically active medicine to the eye. The ocusert is fitted in the upper or lower cul-de-sac of the eye, which releases the medicine at a destined rate constant.

6) Nanogels

These are hydrogels that have sizes in nano- governance, made up ofcross-linking of polymer chains. They swell into a considerable volume when dispersed in waterless medium. Nanogels may be loaded with remedial agents byinter-action between agent and functional group present in the polymer either physically or chemically.

Challenges and Future

Perspectives for optical medicine- DeliveryTechnologiesThe failings of the current optical medicine- delivery sys- tem, similar as lower medicine bioavailability for topically adminis- tered medicines and the invasive nature of posterior implants, produce challenges, allowing new technologies to rise withsuperior and effective treatment of optical diseases. optical diseases similar as cataract, dry eye complaint, wet and dry AMD, Ocularisorders similar as cataract, dry eye complaint, wet and dry AMD, glaucoma, DR, and DME are prognosticated to escalate in the nexttwonexttwo decades. For a maturity of the anterior member diseases, eye drops are regarded as the safest and most convenientdosage form. Eye drops face the challenge of having low drugbioavailability at the target towel. Controlled medicine deliverywith the help of nanoformulations similar as nanomicelles, nanoparticles, liposomes, dendrimers, nanowafers, andmicro-needles can achieve high bioavailability of medicines at theanterior apkins, similar as the conjunctiva and cornea. dastard- rently, all treatments for reverse of the eye diseases are invasivein nature. Frequent intravitreal injections can lead to retinaldetachment, hemorrhage, and discomfort to thepatients.Design of a noninvasive sustained medicine-delivery system forthe posterior member is challenging for optical medicine- deliveryscientists. therefore, there's an critical need for the developmentof new noninvasive medicine- delivery systems that can overcomeocular walls, sustain medicine release, and maintain effectivedrug situations at the reverse of the eye.

Conclusion

The new ophthalmic delivery system includes optical inserts, collagen securities, disposable contact lens and other Novel medicine delivery systems like liposomes 20 and nanoparticles. The administration of medicine results as topical drop with conventional phrasings was associated with certain downsides which initiated the preface of different carrier systems for optical delivery. medicine motes are being reprised into nanosized carrier systems or bias and are being delivered byinvasivenoninvasive or minimally invasive mode of medicine administration. Several nanotechnology grounded carrier systems are being developed and studied at large similar as nanoparticles, liposomes, nanomicelles, nanosuspensions and dendrimers. Many of these are commercially manufactured at large scale and are applied clinically. Nanotechnology is serving the patient body by minimizing the medicine convinced venom and vision loss. Also, these nanocarriers bias sustain medicine release; ameliorate particularity, when targeting moietiesare used, and help to reduce the dosing frequence.

Reference

1. Sasaki H, Yamamura K, Nishida K, Nakamurat J, Ichikawa M. Delivery of drugs to the eye by topical application. Progress in Retinal and Eye Research, 15 (2), 1996, 553-620.

2. Macha S, Mitra AK. Ophthalmic drug delivery systems; second edition revised and expanded. Chapter 1, Overview of Ocular Drug Delivery. p 1-3.

3. Mundada AS, Avari JG, Mehta SP, Pandit SS, Patil AT. Recent advances in ophthalmic drug delivery system. Pharm Rev., 6(1) 2008, 481-489.

4. Jain N.K., “Controlled and novel drug delivery”, First Edition 1997, Reprint 2009, CBS publishers and distributors, 11 Darya Ganj, New Delhi-110002 (India), page no. 82-89.

5. Beringer paul, et.al., “Remington the science and practice of pharmacy”, 21st edition 2005, third Indian reprint 2009, Wolter kulwer publication (India) Pvt. Ltd., New Delhi, page no. 850-862.

6. Thamizhvanan K., et.al., “Current status and advanced approaches in ocular drug delivery system”, IJCP and CR 2012; Volume 2(2): 77-82.

7. Cheien Y.W., “Drugs and the pharmaceutical sciences novel drug delivery systems”, Second edition, revised and expanded, volume 50, Informa health care USA inc. 52 Vanderbit avenue New York NY 10017, page no. 269-270.

8. Thakur Richa and Swami Gaurav, “Promising implication of ocuserts in ocular disease”, JDDT 2012; Volume 2(2): 18&19.

9. Gamal El S. Safaa, et.al., “Formulation and evaluation of Acyclovir ophthalmic inserts”, AJPS 2008; Volume 3(2): 58.

10. Imam Sarim, et.al., “Novel ocular dosage form in the treatment of glaucoma”, The pharma research 2009; volume 1: 76-78.

11. Gevariya Hitesh B., “Formulation and evaluation of sustained release ocular drug delivery system for an anti-glaucoma drug”, Saurashtra University 2013, page no. 121.

12. Bankar G.S. and Rhodes C.T., "Drug and the pharmaceutical sciences modern pharmaceutics", Second edition, revised and expanded, Volume 40, Marcel Daker, inc., 270 Madison avenue, New York, New York 10016, page no. 573-574.

13. Brahmankar D.M. and Jaiswal S.B., "Biopharmaceutics and pharmacokinetics a treatise, second edition, reprint 2010, Vallabh prakashan New Delhi-110088.

14. Willoughby CE, Ponzin D, Ferrari S, Lobo A, Landau K, Omidi Y. Anatomy and physiology of the human eye: Effects of mucopolysaccharidoses disease on structure and function–a review. Clin Exp Ophthalmol 2010.

15. Garhart C, Lakshminarayanan V. Anatomy of the Eye. In: Handbook of Visual Display Technology. Berlin Heidelberg: Springer; 2012.

16. Wilmer HA, Scammon RE. Growth of the Components of the Human Eyeball: I. diagrams, calculations, computation and reference tables. Arch Ophthalmol 1950.

17. Syed BA, Kumar S, Bielory L. Current options and emerging therapies for anterior ocular inflammatory disease. Curr Opin Allergy Clin Immunol 2014.

18. Artal P, Guirao A. Contributions of the cornea and the lens to the aberrations of the human eye. Optics Lett 1998.

19. Atchison DA, Smith G, Smith G. Optics of the Human Eye. Oxford: Butterworth-Heinemann; 2000.

20. Snell RS, Lemp MA. Clinical Anatomy of the Eye. Verlag: John Wiley & Sons; 2013