

# OCULAR DRUG DELIVERY SYSTEM



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- Methods to overcome- preliminary studies
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## INTRODUCTION:

Ocular drug delivery system (ODDS) is a dosage form, vehicle, or a system intended for instilling, administering or delivering drug / medicine to eye against any ailment or disorder involving or affecting vision. The three primary methods of delivery of ocular medications to the eye are topical, local ocular (i.e. subconjunctival, intravitreal, retrobulbar, intracameral), and systemic. Novel approach of drug delivery in which drug is installed on 'cul de sac' the cavity of eye (space between eye lids and eye balls) known as Ocular Drug Delivery system

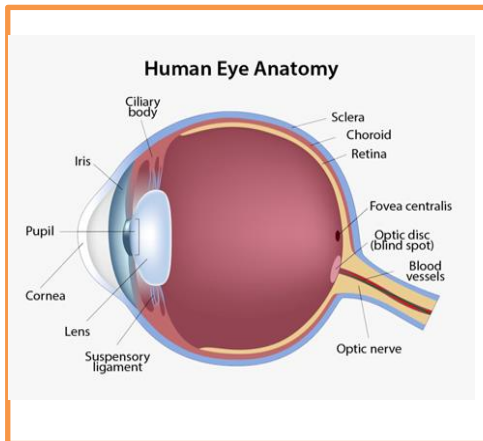


Fig.1:Anatomy of eye

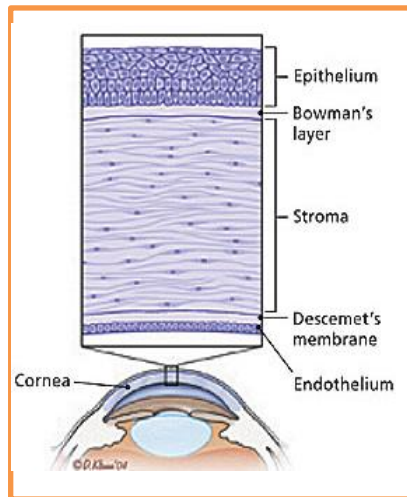


Fig.2:Structure of Cornea

## INTRAOCCULAR BARRIERS:

In ocular drug delivery system there are two types of barrier static and dynamic barrier.

Static barriers consist of different segment of eye (such as cornea, sclera, retina and blood-retinal barriers).

Dynamic barriers (choroidal and conjunctival blood flow, lymphatic clearance and tear dilution).

To overcome the ocular drug delivery barriers and improve ocular bioavailability, various conventional and novel drug delivery system have been developed such as emulsion, suspensions, ointments, aqueous gels, nanomicelles, nanoparticles, liposomes, dendrimers, implants, contact lenses, nanosuspensions, microneedles and *in situ* thermosensitive gels for ocular diseases.

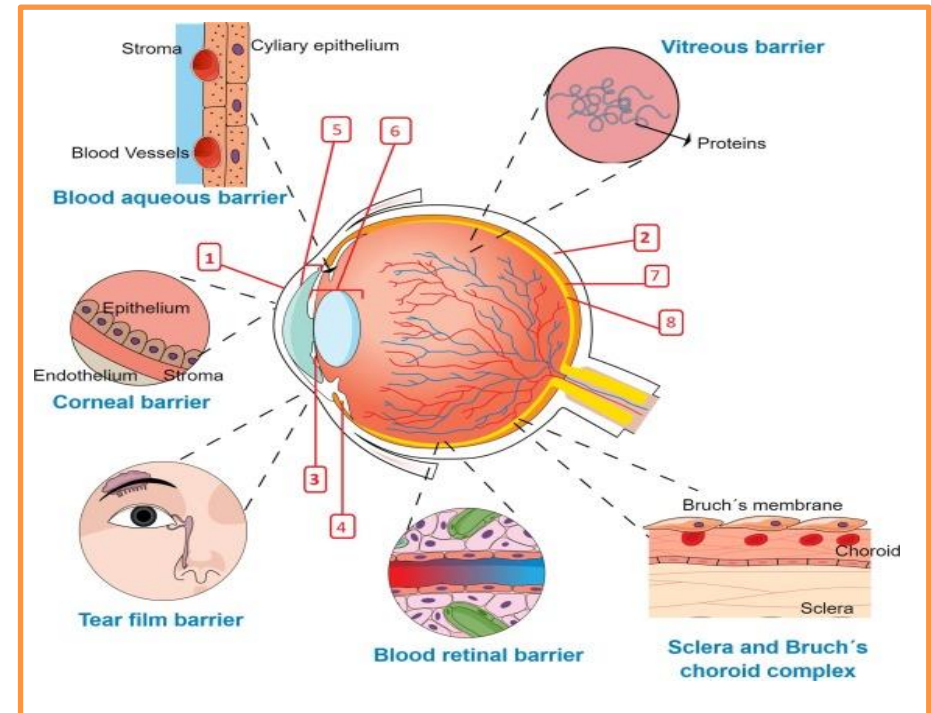
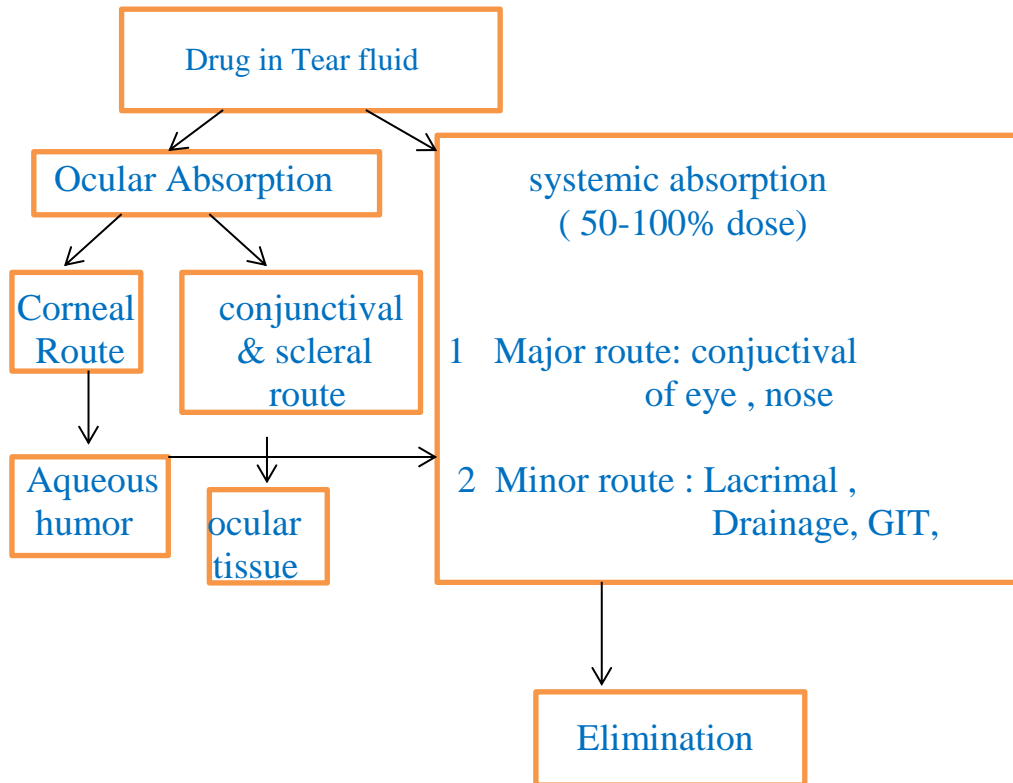


Fig.3:Intraocular Barrier

## MECHANISM OF OCULAR ABSORPTION :



## METHOD TO OVERCOME BARRIER : PRELIMINARY STUDIES

To overcome barrier there are two methods:

1. Alternative Drug Delivery Route
2. Novel Drug Delivery System

### A .Alternative Drug Delivery System :

It includes 4 route:

#### 1. Intra-vitreal injection (IVI):

Delivers the drug directly into the vitreous humor.

#### 2. Sub-conjunctival injections:

The drug is delivered beneath the conjunctival membrane to reach sclera.

#### 3. Retrobulbar & Peribulbar Route:

**Retrobulbar;** is given through eyelid and orbital fascia and places.

through the drug into retrobulbar space

**Peribulbar;** is given above &/or below the globe

### 5. Intracameral injections:

It is generally employed for anterior segment procedures such as cataract surgery.

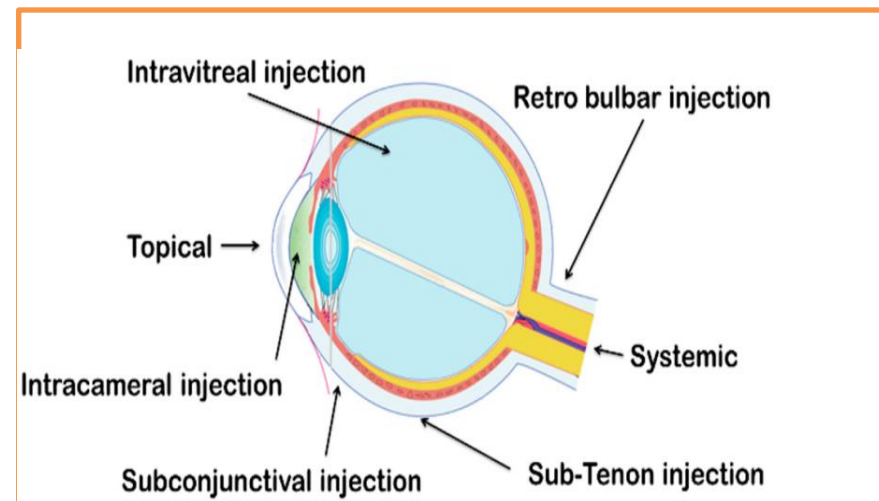


Fig.4: Routes of drug delivery

### Novel Ocular Drug Delivery System:

- ❖ To increase accurate dosing.
- ❖ To overcome side effect of conventional system.
- ❖ To achieve sustained and controlled drug delivery.
- ❖ To increase ocular bioavailability of drug by increasing corneal contact time.
- ❖ To provide drug targeting within the ocular globe so that loss to other ocular tissues can be prevented.
- ❖ To overcome the protective barriers like drainage, lacrimation and conjunctival absorption.
- ❖ To provide comfort, improve patient compliance and therapeutic performance of drug.

## OCULAR FORMULATIONS:

Some ocular formulations are as follow:

### Conventional Delivey System:

1. Solution
2. Ointments & Gels
3. Suspension
4. Inserts

### 2. Vesicular System

1. Liposomes
2. Niosomes
3. Discosomes

### 3. Control Delivery System :

1. Implants
2. Ocular Inotophoresis
3. Contact Lens
4. Dendrimers
5. Microneedles
6. Microemulsion
7. Polymeric solution

### 4 Particulate system:

1. Nanoparticle
2. Microparticle

### 5. Advanced system:

1. Gene delivery
2. Scleral plugs

## OCUSERTS:

It is flat, flexible, solid/ semisolid device which is insert in upper or lower cul-de-sac of eye, there release the drug at a predetermined rate constant. It was firstly discovered by Alza Corporation, USA in 1975. It is thin, single, multilayered, drug-impregnated, solid, or semisolid consistency devices placed into the conjunctival sac. Prolong residence time of drug in controlled release manner.

It mainly consist of 3 component:

- A Control Drug Reservoir
- Rate Controlling Membrane
- An Outer Annular Ring

### Types of ocusersts :

- Insoluble Ocusersts
- Soluble Ocusersts
- Bio-erodible ocular insert

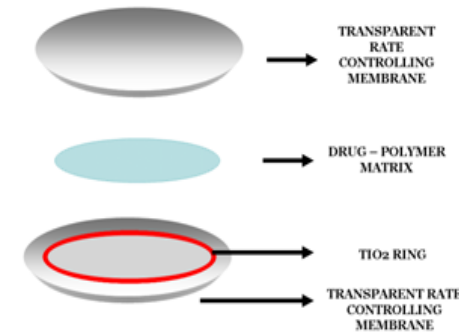


fig.6: Ocusert

### 1. Insoluble ocusersts:

Solid inserts with non-erodible porous body release the dispersed drug at controlled rate through the pore via diffusion into a tear fluid. Sub divided into 2 groups : Reservoir system & Matrix system.

### 2. Soluble inserts:

These are completely soluble once placed at the application site thus limiting the interference to insertion only.

### 3. Bio-erodible ocular inserts|:

They are matrix of homogenous dispersion of a drug coated with hydrophobic material which is impermeable to the drug.

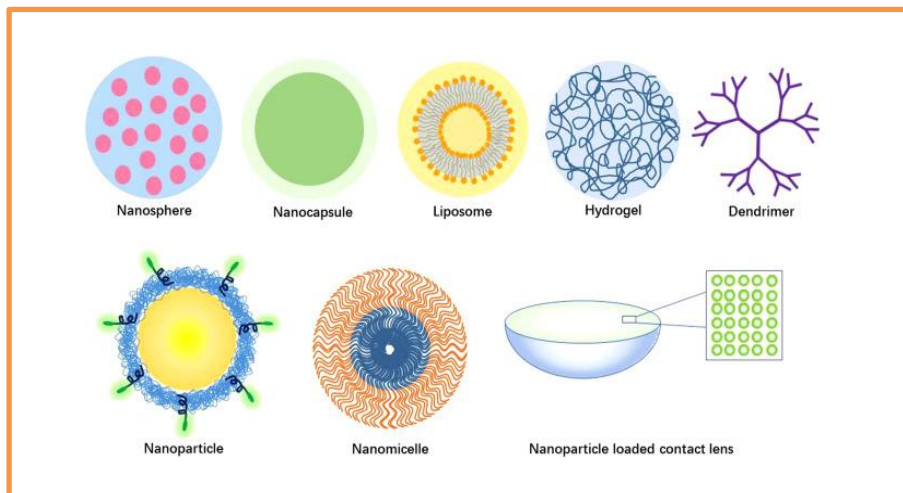


Fig.5: Novel Ocular Drug Delivey System

## OBJECTIVES:

Various objectives are there to develop ocuserts for control release such as :

- 1.Continuous control delivery of ophthalmically active drug to eye.
- 2.Improved patient compliance.
- 3.Reduce dose frequency .
- 4.Better therapeutic outcomes by reduce over /under dosing.
- 5.Lesser local side effect/toxicity.
- 6.Increased bio-avaibility by increase drug-eye contact time.

## PREREQUISITES FOR OCUSERTS:

Before development ,various criteria needs to be consider such as:

- Comfort :properly design ocular insert will minimize sensation cause by its insertion and wear.
- Ease of handling and insertion.
- Lack of expulsion during wear.
- Reproducibility of release kinetics .
- Applicability to variety of drug
- Non interference with vision and oxygen permeability
- Sterility, Stability, Ease of manufacture.



Fig.7 Ocular insert

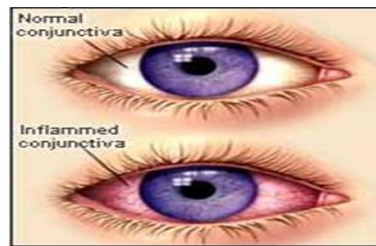


fig. 8:Eye infection

## MARKETED PRODUCTS :



BRAND NAME	DRUG	DOSAGE FORM	USE
Retasis	Cyclosporine	Emulsion	In dry eye
Ciplax	Ciprofloxacin	Eye drop	Conjunctivitis
Acicvr eye	Acyclovir	Ointment	In eye infection
Geltear	Carbomer	Bioadhesive gel	Lubricant
Pred forte	Prednisolone acetate	Suspension	Antiallergic

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