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A Review On Ocuserts

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Abstract:
The eye is an organ that God created in the best way of all the senses in the human body, allowing us to see many things around us, near and far. The eye is one of the softest and most important of all the senses of the body, and the eye is a difficult subject to paint. Ocular ointment is an accepted method in the medical treatment of conjunctival, ocular influenza and other eye diseases. sought. The work of ocular drug delivery is one of the most interesting and challenging tasks that most pharmaceutical scientists/scientists face. Significant progress has been made in this area in the last 10-20 years.

Keywords: Ocuserts,Osmosis,Diffusion,Drug release,Contact Lnses.

1. INTRODUCTION :

The eye presents unique opportunities and challenges when it comes to drug delivery. Ophthalmic drug delivery is one of the most interesting and challenging tasks for pharmaceutical scientists. Ocuserts are defined as sterile preparations of solid or semi-solid materials in shapes and sizes designed for ophthalmic applications. All Ocusert types consist of three elements: a central drug reservoir where the drug is incorporated into the polymer; a ring that is easy to hold and use. Ocuserts extend contact time, prolong duration of action, increase bioavailability, and reduce dosing frequency, resulting in better patient compliance [1]. The eye medication balance eliminates side effects in the body and provides uninterrupted sleep due to the long-term use of the drug throughout the night. The application of drugs for eye pain is also promising since the drug is continuously released from the eye. Ocuserts also helps doctors save time. The effectiveness of ophthalmic drugs depends on the tissue that provides the desired response. Zero-order kinetics is a controlled release type where the drug is held in a tank and released into the tear film at a constant rate to provide a ten-fold constant impression, thus providing improved performance [2]. Ophthalmic implants, devices placed in the eye's blind spot, have many advantages over liquid preparations. The long-term retention and controlled release of the device allows the drug to remain effective in the eye for a longer period of time. Dosage is also more accurate and the risk of side effects is reduced [3]. It is a flat, flexible, solid and semi-solid material with a chemical reservoir and a rate-control membrane, using various polymers [4, 5]. The main purpose of the development of Ocuserts is the continuous delivery of ophthalmically active drugs to the eye. The eye plug is placed in the dead space or upper part of the eye to release the drug at a predetermined rate. Therefore, by reducing the frequency of eye drop use, patient compliance is improved, by reducing over/under use, clinical outcomes are improved, local side effects/toxicity are reduced, and bioavailability is improved [6, 7].

The eyes are difficult to study through drug delivery. The anatomy, physiology, and biochemistry of the eye make the body vulnerable to foreign bodies. Ensuring that the drug reaches the biophase in sufficient content by crossing the eye barrier is a challenge for manufacturers [7]. Ocular inserts have been developed that allow the drug to be delivered based on the diffusion mechanism. This type of drug provides ophthalmic medication at a close price, preventing high absorption and reducing side effects [8].

CONVENTIONAL OPHTHALMIC FORMULATIONS

Eye Drops

A liquid preparation in which all components are completely dispersed in the drug. Ocular absorption limitation occurs through the corneal epithelium. When used as an eye cream, less than 5% of the dose is absorbed. The retention time of the liquid in the eye will be affected by many properties of the eye, such as hydrogen ions, concentration, viscosity, etc. mixed with the liquid. The formula increases absorption, contact time, provides long-term effect/corrective effect and is less frequent than solutions when applied to the eye area.

Eye Ointment

A non-toxic, non-toxic food in which the drug is dispersed in a suitable non-irritating base such as mineral oil and white oil. Eye creams are also popular as children's medicine. Ointment provides longer contact time and increases bioavailability of the drug after ocular application, but its use is limited to sleep drops because its oily nature may affect vision.

Ophthalmic Suspension

A preparation in which the drug, insoluble in an aqueous vehicle, is dispersed with the aid of suitable suspending and dispersing agents. Ophthalmic suspensions contain small particles that do not irritate the eye. This product is stored in dead space, increasing the bioavailability of the drug [13].

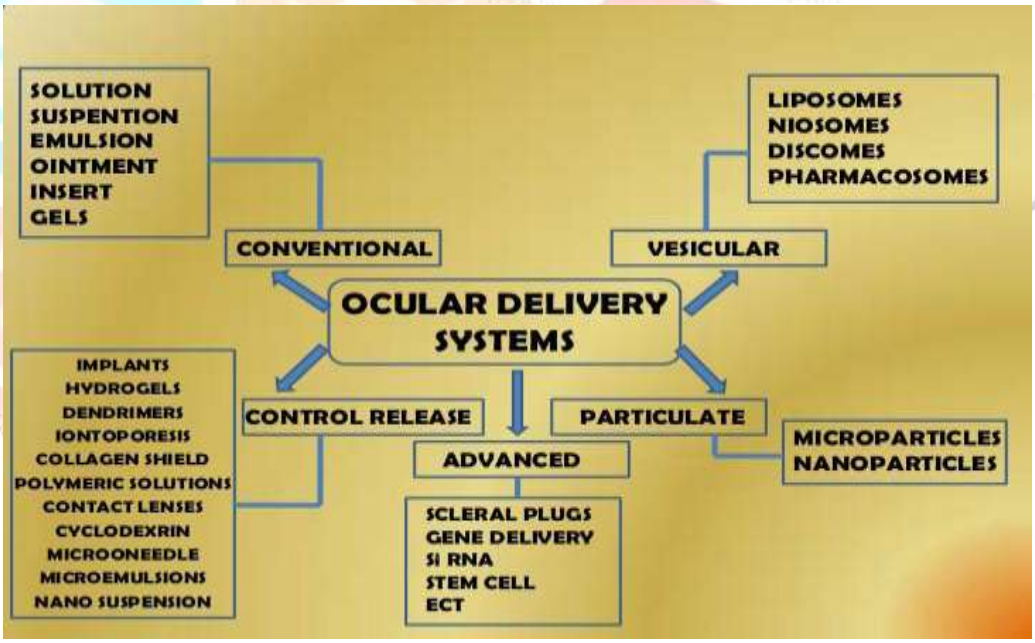

Fig-1: Various Ocular Delivery Systems.

DRAWBACKS OF CONVENTIONAL OPHTHALMIC FORMULATION

- They have poor bioavailability due to:
- **Conjunctival Absorption**: Drugs are absorbed through the conjunctiva, but this pathway doesn't always provide optimal delivery to the target tissues in the eye.
- **Nasolacrimal Drainage**: After eye drops are instilled, they can drain into the nasolacrimal duct (leading to the nose or throat), reducing the amount of drug that stays in the eye.
- **Rapid Pre-Corneal Elimination**: The drug may be quickly washed away by tears or blink reflex before it can be effectively absorbed.
- **Tear Turnover**: The natural cycle of tear production and drainage continually refreshes the tear film, further washing out the drug before it has a chance to act.

- Eye drops with higher viscosity (thicker formulations) may provide longer contact time, but they can also cause temporary blurred vision, which could be problematic for patients who need clear sight after instillation.

- To maintain therapeutic drug levels in the eye, patients may need to use the medication frequently, as the drug is often washed out rapidly.
- Due to nasolacrimal drainage, drugs or additives from eye drops may enter the systemic circulation, leading to unwanted side effects in other parts of the body.
- The inconsistency in the size of the drops (due to variability in how the dropper dispenses the medication) can affect the accuracy and consistency of the dose, leading to ineffective treatment or overdose. [14].

Novel Ophthalmic Drug Delivery Systems

To overcome the shortcomings of traditional ophthalmic drugs, various tests have been conducted to improve precorneal drug absorption and reduce precorneal drug clearance.

Phase Change System

Phase Change System is a liquid form that turns into a gel or solid phase when dropped into the tail of the eye. T hese conversion gels remain in contact with the cornea of the eye for a long time due to the slow corneal flow.

Liposomes

Liposomes are defined as small, simple particles that contain water and are surrounded by a bilayer of phospholipid membrane. Lipophilic drugs are embedded in the bilayer of lipids and hydrophilic drugs in the aqueous phase, increasing the residence time of the drug in the eye.

Contact Lenses

The medication-impregnated contact lens is placed on the eye to ensure that the medication remains in the eye for a longer period of time. Hydrophilic medications or water-soluble medications soaked in treatment solution will be absorbed by the lenses, so hydrophilic contact lenses can be used to improve the time the medication enters the eye.

Pharmacosomes

Pharmacophores are vesicles containing amphiphilic substances. Any drug containing a free carboxyl group or reactive hydrogen atom can be esterified to an amphiphilic prodrug. These amphipathic prodrugs are converted to drugs when diluted with water, thereby improving stability, facilitating transport across the cornea, and controlling the release profile. [13, 14].

OPHTHALMIC INSERTS:

The Ocusert system was first developed by the American company Alza in 1975. It is a flat, flexible, rigid and semi-rigid material with a chemical reservoir and a rate-control membrane, using various polymers [7, 15]. The main purpose of developing Ocuserts is the continuous administration of ophthalmically active drugs to the eye. The eye plug is placed in the dead space or upper part of the eye to release the drug at a predetermined rate. Thus, patient compliance is increased by reducing the frequency, better therapeutic results are obtained by reducing/lowering, local side effects/toxicity are reduced and bioavailability is increased by using more eye drops (16). It sounds like you're describing a drug delivery system for the eye, which typically consists of several main components that work together to provide controlled, long-term medication. [11].

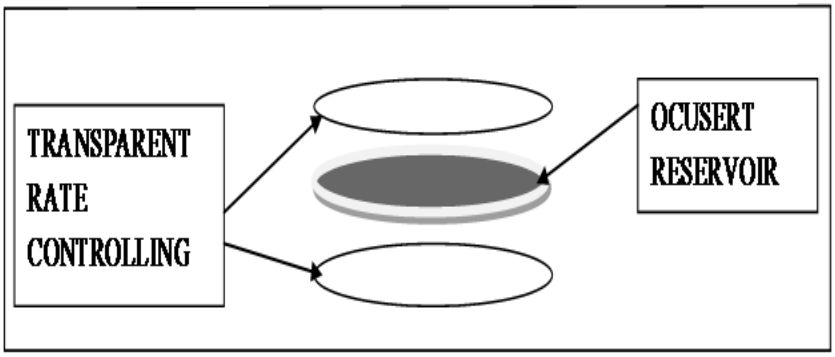

Fig-2: Schematic diagram of ocular insert

Advantages of ocusert:

Compared to many ophthalmic drugs, Ocusert has the following advantages:

- Increasing ocular contact time to enhance drug bioavailability [17].
- Increasing ocular permeation relative to standard formulations results in longer-lasting drug effects and, consequently, enhanced ocular bioavailability. [18].
- Administering an exact dose of medication to the eye leads to more effective therapy[19].
- Patient compliance improves by decreasing the frequency of doses needed[20].
- Improved efficacy is attained by delivering a consistent, controlled release of the drug[20].
- The likelihood of targeting internal ocular tissues is increased by using non-corneal penetration routes, such as the conjunctiva and sclera. [20].

Limitations of Ocusert

- There may be initial discomfort caused by their shifting movement within the eye. [14].
- Occasional accidental displacement can occur, especially during sleep or when rubbing the eye.
- The placement process can be difficult and may affect vision. [13].

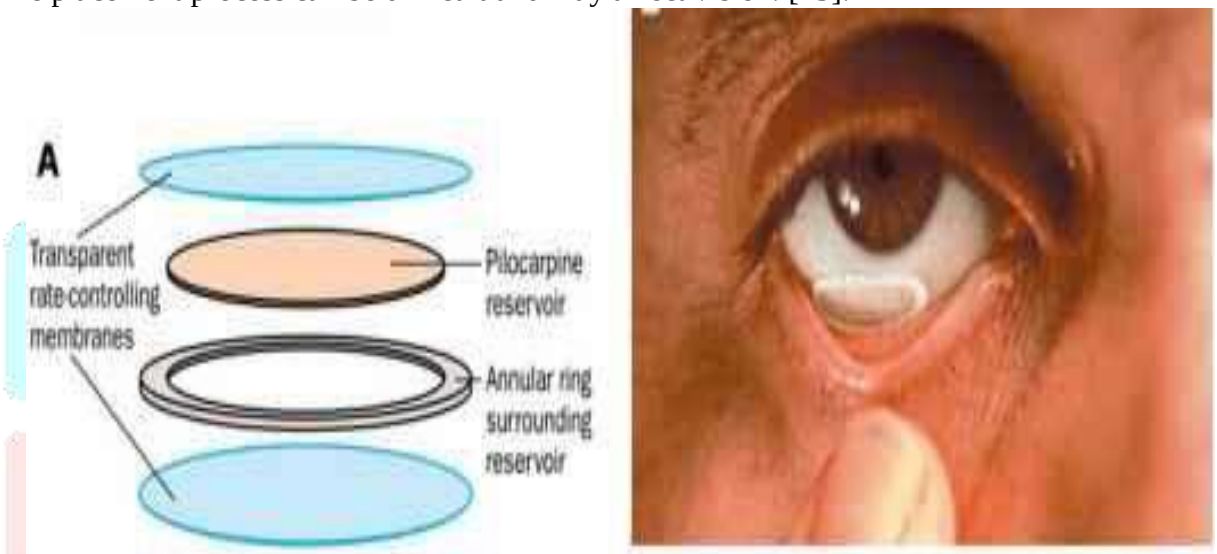

Fig-3: Delivery of drug via ocular insert

The mechanism by which drugs are released into the eye :

The method for delivering medication into the eye under control is as follows:

- Diffusion
- Osmosis
- Bio-erosion

Diffusion

The medicine is continuously and carefully released from the device into the tear fluid through the diffusion process. When the insert has a non-erodible structure with pores and dispersed drug substances [21].

Osmosis

In the permeable mechanism, the insert is structured with a transverse impermeable elastic membrane that divides it into two chambers: a first chamber and a second chamber. Here's how the system functions:

First Chamber Composition:

The first chamber is formed by a semipermeable membrane on one side and an impermeable membrane on the other, both of which are surrounded by an elastic membrane. The semipermeable membrane allows water to pass through, but the impermeable membrane prevents the drug from escaping. This chamber is filled with a solvent that cannot pass through the semipermeable membrane.

Second Chamber Composition:
An impermeable membrane encloses the second chamber, which is divided from the first by an elastic membrane. This chamber contains the drug, which is usually in a liquid or gel form. It also holds water or another medium necessary to help release the drug.

Impermeable Wall with Drug Release Opening:
The impermeable wall of the insert has a chemical discharge hole, which is the outlet through which the drug will be released into the eye. The purpose of this perforation is to control the drug's passage into the tear fluid.

Water Diffusion and Pressure Mechanism:
Water starts to diffuse into the first chamber as soon as the insert is positioned in the eye's aqueous environment. As water enters, it stretches and compresses the elastic membrane, which in turn exerts pressure on the second chamber. This pressure forces the drug to be released through the discharge hole in the impermeable wall, allowing it to enter the eye [22].

Bio-Erosion
In the bioerodible mechanism, the insert is made from a matrix of materials that can break down in the presence of tear fluid, into which the drug is distributed.The medicine is released in a regulated way when the insert comes into touch with the tears due to the material's bioerosion [23].

CLASSIFICATION OF OPHTHALMIC INSERTS/OCUSERTS

The ophthalmic inserts/ocuserts are classified on the basis of their solubility behavior.
1. Insoluble ophthalmic inserts/ocuserts
2. Soluble ophthalmic inserts/ocuserts
3. Bio-erodible ophthalmic inserts/ocuserts [13]

Insoluble ophthalmic inserts/ocuserts
The insoluble inserts are sub-classified into three groups.
a) Diffusional inserts/ocuserts
b) Osmotic inserts/ocuserts
c) Contact lenses [24]

Diffusional Inserts/Ocuserts
The Ocuserts system is a novel drug delivery system based on a porous system. The diffusion release mechanism determines how the medicine is released from the diffusion insert. Diffusion inserts/diffusers contain a central drug reservoir within a specially designed semi-permeable/microporous membrane, allowing the drug to diffuse from a precisely defined reservoir [21]. Tears control the release of drugs from such a system by penetrating the membrane until sufficient pressure is reached. The working method can be solved by Fick's diffusion equation.

$$\mathbf{J} = \frac{DA\,dc}{dx}$$

Where,
J = Solute flux
D = drug's difference coefficient inside the polymer membrane..
A = Area of membrane
$\frac{\mathbf{dc}}{\mathbf{dx}}$= Drug concentration gradient within the membrane along the direction of drug flow [13].

Osmotic Inserts/Ocuserts
Osmotic Inserts / Osmotic inserts are usually made from two different osmotic solutes. The osmotic solute and the drug are put in different chambers, with a semipermeable membrane enclosing the osmotic solute reservoir and an elastic impermeable membrane enclosing the drug reservoir[21]. Tear fluid diffuses into the osmotic chamber and osmotic pressure is created due to chemical diffusion [13].

Contact Lenses

Contact lenses are covalently cross-linked hydrophilic or hydrophobic polymers that form a three-dimensional network capable of retaining aqueous solutions or compounds [13]. Antibiotics are static formulations used to treat the eye. Antibiotics are widely used as potential medicinal products by first soaking in water. The main advantage of this system is the ability to focus and release drugs simultaneously. [14].

Soluble Ophthalmic Inserts/Ocuserts

Dissolvable ophthalmic inserts/ophthalmic inserts represent the oldest group of ophthalmic inserts/ophthalmic inserts. These soluble inserts/inserts have the advantage of being completely soluble, so they do not need to be removed from the application site, limiting the effect to the insert only. Preferably, the inserts are soaked in a solution containing the drug, dried and rehydrated before use in the eye to absorb the therapeutic agent. The drug load will depend on the amount of binding material, the concentration of the solution in which the components are soaked and the duration of soaking [24]. The drug is released from this type of insert due to the penetration of tears into the insert, which expand around the base of the insert and form a gel layer, enhancing the release of the drug [13].

Bio-Erodible Inserts/Ocuserts

Bioerodible inserts/additives consist of a homogeneous distribution of chemical substances, which may or may not be incorporated into a hydrophobic impermeable layer [24]. Bioerodible inserts/ocesters consist of bioerodible polymers (such as cross-linked gelatin derivatives, polyester derivatives) that undergo hydrolysis of chemical bonds and thus become degraded. The main advantage of bioerodible polymers is that their erosion can be modified by changing their final structure during mixing and addition of anionic or cationic surfactants [21]. The chemicals released by these systems are formed by contact with the tear fluid, which causes the device to migrate into the matrix[13].

CONCLUSION

Ocular implants represent a major advance in eye care. Ophthalmic implants are characterized by small pieces of clear, thin, multilayered, drug-impregnated material or similar material that are placed in the cul-de-sac or conjunctival sac, which appear to be large and specifically for ophthalmic use. They are made of polymer materials containing chemicals. This increases the exposure time and therefore bioavailability. It is believed that systemic absorption is reduced, thereby reducing systemic antagonistic effects. Reduces tissue recurrence, thereby reducing the incidence of visual impairment and improving patient compliance. In this research, we focus on advanced techniques for ocular drug delivery. The advantages of oxesters are: Accurate dosage Ability to deliver and maintain drug release at a constant rate, resulting in better results Increase contact time, thereby increasing bioavailability Can reduce systemic absorption, thereby reducing adverse reactions. Reduce dosing frequency to improve patient compliance and reduce the incidence of side effects.

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REFERENCES

1. Pandit JK, Bharathi D, Srinatha A, Ridhurkar DN and Singh S. Long acting ophthalmic formulation of indomethacin: Evaluation of alginate gel systems. Indian J Pharm Sci 2007;69(1);37-40.

2. Srividya B, Cardoza RM and Amin PD. Sustained ophthalmic delivery of ofloxacin from pH triggered in situ gelling system. J Controlled Release.2001;73(2-3):205-11.

3. Bharath S. Sustained ophthalmic delivery of ofloxacin from an ion-activated in situ gelling system. Pak J Pharm.2009;22(2):175-9.

[4]. Sachdeva, D., & Bhandari, A. (2011). Design, formulation, evaluation of levobunolol HCl ocular inserts. *Journal of Pharmaceutical Sciences and Research*, *3*(12), 1625-1631.

[5]. Paswan, S. K., Verma, P., & Yadav, M. S. (2015). Review-Advance Technique in Ocular drug delivery system. *World journal of Pharmacy and Pharmaceutical sciences*, *4*, 346-365.

[6]. Sreenivas, S. A., Hiremath, S. P., & Godbole, A. M. (2006). Ofloxacin ocular inserts: Design, formulation and evaluation. *Iranian Journal of Pharmacology and Therapeutics*, *5*(2), 159-162.

[7]. Jain, N. K. (2009). Controlled and novel drug delivery", First Edition 1997, Reprint 2009, CBS publishers and distributors, 11 Darya Ganj, New Delhi-110002 (India), 82-89.

[8]. Beringer, P. (2009). "Remington the science and practice of pharmacy", 21st edition 2005, third Indian reprint 2009, Wolter kulwer publication (India) Pvt. Ltd., New Delhi, 850-862.

[9]. Vishal, P., & Agrawal, Y. K. (2011). Current status and advanced approaches in ocular drug delivery system. *Journal of global trends in pharmaceutical sciences*, *2*(2), 131-148.

[10]. 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, 269-270.

[11]. Thakur, R., & Swami, G. (2012). Promising implication of ocuserts in ocular disease. *Journal of Drug Delivery and Therapeutics*, *2*(2):18-19.

[12]. El Gamal, S. S., Naggar, V. F., & Allam, A. N. (2008). Formulation and evaluation of acyclovir ophthalmic inserts. *Asian J Pharm Sci*, *3*(2), 58-67.

[13]. Imam, S., Bansal, A., Bushetti, S. S., Singh, A., & Chopra, H. (2009). Novel ocular dosage form in the treatment of glaucoma. *The Pharma Research, Sudarshan Publication*, *1*, 72-81.

[14]. Patel, J. K., & Gevariya, M. H. B. (2013). Formulation and evaluation of sustained release ocular drug delivery system for an anti-glaucoma drug. Saurashtra University, 1-21.

[15]. Bankar, G. S., & 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, 573-574.

[16]. Brahmankar, D. M., & Jaiswal, S. B. (2010). Biopharmaceutics and pharmacokinetics a treatise, second edition, reprint 2010, Vallabh prakashan New Delhi-110088; 473.

[17]. Imam Sarim., *et al*. "Novel ocular dosage form in the treatment of glaucoma". *The Pharma Research* 1 (2009): 76-78.

[18]. Gevariya Hitesh B. "Formulation and evaluation of sustained release ocular drug delivery system for an anti-glaucoma drug". Saurashtra University (2013): 1-21.

[19]. Bankar GS and Rhodes CT. "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.

[20]. Brahmankar DM and Jaiswal S.B. "Biopharmaceutics and pharmacokinetics a treatise, second edition, reprint 2010, Vallabh prakashan New Delhi-110088. 473.

[21]. Kumar, B. P., Harish, G., & Bhowmik, D. (2013). Ocular inserts: A novel controlled drug delivery system. *The Pharma Innovation*, *1*(12):1-14.

[22]. Karthikeyam, D. (2008). The concept of ocular inserts as drug delivery systems: An overview, *AJP*. 194-196.

[23]. Dabhi, V., Yogi, J., Bhimani, B., Patel, U., & Patel, G. (2014). Ocular inserts as controlled drug delivery systems. *International Journal of Pharmaceutical Research and Bio-Science*, *3*(5), 468-480.

[24]. Rajesh, A., Poonam, D., & Sangeeta, A. (2012). Ocular Drug Delivery System: Ocular Insert. *International Journal of Universal Pharmacy and Bio Sciences*, *1*(2):30-38.