Overview to Ophthalmic Products

Dr. D. S. Ghotekar
N. V. P Arts Commerce, Science College, Lasalgaon, Nashik, Maharashtra, India

ABSTRACT

Ophthalmic are specialized dosage forms designed to be instilled onto the external surface of the eye (topical), administered inside (intraocular) or adjacent (periocular) to the eye or used in conjunction with an ophthalmic device. Ophthalmic preparations are sterile product (free from foreign particles, Ocular inserts are defined as sterile preparations, with a thin, multi-layered, drug-impregnated, solid or semisolid consistency devices placed into cul-de-sac or conjunctival sac and whose size and shape are especially designed for ophthalmic application.

Keywords: Ophthalmic preparations, sterile product, Ocular inserts.

INTRODUCTION

They are specialized dosage forms designed to be instilled onto the external surface of the eye (topical), administered inside (intraocular) or adjacent (periocular) to the eye or used in conjunction with an ophthalmic device.

The most commonly employed ophthalmic dosage forms are solution, suspension, & ointments. But these preparations when instilled into the eye are rapidly drained away from the ocular cavity due to tear flow and lachrymal nasal drainage.

Newest dosage forms for ophthalmic drug delivery are – Gels, Gels forming solution, Ocular inserts, Intravitreal injections & implants. (1)

OPHTHALMIC DOSAGE FORM

Ophthalmic preparations are sterile product (free from foreign particles.) that is intended to be applied topically to cornea or instilled in the space between the eyeball and lower eyelid (CUL-DE-SAC CAVITY). (11)

CONVENTIONAL PRODUCTS

- Aqueous Solutions
- Suspensions

Copyright: © the author(s), publisher and licensee Technoscience Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.
• Ointments
• Gels
• Contact Lens
• Eye Drops

NON-CONVENTIONAL PRODUCTS
• Non-Erodible Ocular Inserts.
  a. Prodrugs
  b. Insoluble Inserts
  c. Soluble Inserts
• Ocular Inserts

CONVENTIONAL PRODUCTS

Aqueous Solutions
• Nearly all the major ophthalmic therapeutic agents are water-soluble salts.
• Widely administered drugs as liquid dosage form.
• Only 5% of the dose is absorbed.
• Mostly absorbed through systemic circulation.

Manufacturing techniques (Aqueous Solutions)
• Dissolution of the active ingredient & all or a portion of the excipients into all or a portion of the water.
• Sterilization by heat or by sterilizing filtration.
• Additional required sterile components, such as viscosity-imparting agent, preservatives.
• Final volume with additional sterile water.

Ophthalmic Suspensions
• Drug is not sufficiently soluble; it can be formulated as a suspension.
• A suspension may also be desired to improve stability, bioavailability, or efficacy.
• Water-soluble salts, (prednisolone phosphate & dexamethasone phosphate); they have a lower steroid potency & are poorly absorbed.
• An ophthalmic suspension should use the drug in a micro fine form; usually 95% or more of the particles have a diameter of 10µm or less.(5,9)

Manufacturing techniques (suspension)
• Are prepared in same manner, except that before bringing to final volume with addition sterile water, the solid that is to be suspended is previously rendered sterile by: Heat, Exposure to ethylene oxide or Ionizing radiation (gamma or electrons), sterile filtration, & aseptic crystallization.
• Particle size should be monitored

OINTMENT
• Prolongation of drug contact time.
• Blurring of vision & matting of eyelids can limit its use.
• Chlorobutanol and methyl and propyl paraben are the most commonly used preservatives in ophthalmic ointment.
• Ophthalmic ointment must be free from large particles and must meet the requirements for “leakage” and for “metal particles”.

Manufacturing techniques (ointment)
• The ointment base is sterilized by heat and appropriately filtered while molten to remove foreign particulate matter.
• placed into a sterile steam-jacketed kettle to maintain the aseptic conditions and added the active ingredient(s) & excipients
• Entire ointment passed through a previously sterilized colloid mill for adequate dispersion of the insoluble components.
• Filled into sterilized container.

GELS
• Gels on contact with the tear fluid and provide increased contact time with the possibility of improved drug absorption and increased duration of therapeutic effect.
• Liquid-gel phase transition-dependent delivery system varies according to the particular polymer(s) and their mechanism for triggering the transition to a gel phase in the eye.
• Disadvantage is blurring of vision and matting of eyelids.(5)

CONVENTIONAL PRODUCTS
• Aqueous Solutions
• Suspensions
• Ointments
• Gels
• Contact Lens
• Eye Drops

NON-CONVENTIONAL PRODUCTS
• Non-Erodible Ocular Inserts.
  a. Prodrugs
  b. Insoluble Inserts
  c. Soluble Inserts
• Ocular Inserts

CONVENTIONAL PRODUCTS
Aqueous Solutions
• Nearly all the major ophthalmic therapeutic agents are water-soluble salts.
• Widely administered drugs as liquid dosage form.
• Only 5% of the dose is absorbed.
• Mostly absorbed through systemic circulation.

Manufacturing techniques (Aqueous Solutions)
• Dissolution of the active ingredient & all or a portion of the excipients into all or a portion of the water.
• Sterilization by heat or by sterilizing filtration.
• Additional required sterile components, such as viscosity-imparting agent, preservatives.
• Final volume with additional sterile water.

Ophthalmic Suspensions
• Drug is not sufficiently soluble; it can be formulated as a suspension.
• A suspension may also be desired to improve stability, bioavailability, or efficacy.

• Water-soluble salts, (prednisolone phosphate & dexamethasone phosphate); they have a lower steroid potency & are poorly absorbed.
• An ophthalmic suspension should use the drug in a micro fine form; usually 95% or more of the particles have a diameter of 10µm or less.(5,9)

Manufacturing techniques (suspension)
• Are prepared in same manner, except that before bringing to final volume with addition sterile water, the solid that is to be suspended is previously rendered sterile by: Heat, Exposure to ethylene oxide or Ionizing radiation (gamma or electrons), sterile filtration, & aseptic crystallization.
• Particle size should be monitored

OINTMENT
• Prolongation of drug contact time.
• Blurring of vision & matting of eyelids can limit its use.
• Chlorobutanol and methyl and propyl paraben are the most commonly used preservatives in ophthalmic ointment.
• Ophthalmic ointment must be free from large particles and must meet the requirements for “leakage” and for “metal particles”.

Manufacturing techniques (ointment)
• The ointment base is sterilized by heat and appropriately filtered while molten to remove foreign particulate matter.
• placed into a sterile steam-jacketed kettle to maintain the aseptic conditions and added the active ingredient(s) & excipients
• Entire ointment passed through a previously sterilized colloid mill for adequate dispersion of the insoluble components.
• Filled into sterilized container.

GELS
• Gels on contact with the tear fluid and provide increased contact time with the
possibility of improved drug absorption and increased duration of therapeutic effect.

- Liquid-gel phase transition-dependent delivery system varies according to the particular polymer(s) and their mechanism for triggering the transition to a gel phase in the eye.
- Disadvantage is blurring of vision and matting of eyelids.

EYE DROPS

- Eye Drops are sterile solutions, essentially free from foreign particles, suitably compounded and packaged for instillation into the eye.
- Widely administered drugs as liquid dosage form.
- Only 5% of the dose is absorbed.
- Mostly absorbed through systemic circulation.

Manufacturing techniques (Eye drops)

- Using purified water USP.
- Obtained by – distillation, deionization or reverse osmosis.
- Oils have been used as vehicles for several topical eye drops.
- Oils as vehicle in ophthalmic fluids, they must be of the highest purity. Vegetable oil such as olive oil, castor oil & sesame oil.

Contact lens

- Contact lens are considered medicinal device and can be worn to correct vision or for cosmetic or therapeutic reasons.
strength durability resistant to absorption of medications and environmental contaminants visual accuracy

**Soft lens**

worn for longer periods do not dislodge easily

**Disadvantages**

**Hard lens**

- require adjustment period of the wearer
- more easily dislodged from the eye

**Soft lens**

have a shorter life span and the wearer must ensure that the lenses do not dry out.\(^{(7,8)}\)

**NON-CONVENTIONAL PRODUCTS** \(^{(2,3)}\)

**Non-Erodible Ocular Inserts**

**Prodrug**

- Prodrugs are simple, chemical or enzymatically derivatives of drugs which are converted to their active form as a result of hydrolysis within the eye.
- Prodrugs technology is usually considered as a useful technique in improving corneal permeability & poor solubility.
- Prodrug is available is dipivaloyl epinephrine.

**Insoluble Ocular Insert**

It is a multi-layered structure consisting of a drug containing core surrounded on each side by a layer of copolymer membranes through which the drug diffuses at a constant rate.

The rate of drug diffusion is controlled by:

- The polymer composition
- The membrane thickness
- The solubility of the drug

E.g. The Ocusert Pilo-20 and Pilo-40 Ocular system designed to be placed in the inferior cul-de-sac between the sclera and the eyelid and to release pilocarpine continuously at a steady rate for 7 days for treatment of glaucoma.\(^{(10)}\)

![Photograph of patient with Ocusert (pilocarpine) in place in lower cul-de-sac of right eye](image_url)

**Soluble Ocular Inserts**

Soluble inserts consists of all monolytic polymeric devices that at the end of their release, the device dissolve or erode.

**Types:**

- Based natural polymers e.g. collagen.
- Based on synthetic or semi synthetic polymers e.g. Cellulose derivatives – Hydroxypropyl cellulose.
- The system soften in 10-15 sec after introduction into the upper conjunctival sac, gradually dissolves within 1 h, while releasing the drug.

**OCULAR INSERTS**

Ocular inserts are defined as sterile preparations, with a thin, multi-layered, drug-impregnated, solid or semisolid consistency devices placed into cul-de-sac or conjunctival sac and whose size and shape are especially designed for ophthalmic application.\(^{(2,11)}\)

We can classify the insert on the basis of their solubility as insoluble, soluble and bio erodible inserts. The drug release from the inserts would take place by following three procedures

- **diffusion**
- **osmosis**
• bioerosion

The technology used in this is an insoluble delicate sandwich technology. In Ocusert the drug reservoir is a thin disc of pilocarpine-alginate complex sandwich between two transparent disc of micro porous membrane fabricated from ethylene-vinyl acetate copolymer.\(^8\)

**CHARACTERISTICS OF OCULAR INSERT**

• Bio stable and nontoxic
• Biocompatible with tissue of eye
• Retrievable
• Release at a constant rate
• Good mechanical strength
• Free from drug leakage
• Easily sterilizable
• Easy and inexpensive to manufacture

**Advantages of ocular insert**

• Increased ocular residence
• Sustained & controlled release
• Accurate dosing
• Reduction of systemic absorption
• Better patient compliance

**Disadvantages of ocular insert**

• Felt by the patients as an extraneous body in the eye
• Loss during sleep or while rubbing the eyes
• Their interference with vision
• Difficult placement of the ocular inserts \(^5,^6,^7\)

**REFERENCES**


**Cite this article as :**