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SHORT REVIEW - EMULGEL

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ABSTRACT:

Application of drug incorporated formulation to the skin to directly treat skin disorder is called topical delivery system. Topical application of therapeutic agents offers various advantages over the other route of administration. It is an attractive route for local and systemic application of drug to treat various complications. Gels are providing faster drug release compared with other topical drug delivery. The major limitation of gel is delivery of hydrophobic drugs. It can be overcome by Emulgels. Emulgels are emulsion either oil in water or water in oil type which are incorporated in to gelling agent. Emulgel can provide local concentration of drug in the affected area. Emulgel is more effective than regular gel in curative aspects, and permeation depth of drug in emulgel is more. It is used as a vehicle to deliver various drugs to the skin. Drug delivery can be enhanced by the use of permeation enhancers in emulgel. Emulgel allow dual control of the drug release from the formulation, i.e. emulsion and gel. They have advantages of both emulsion and gels; hence it has higher patient acceptability. Emulgels have properties like thixotropic, greaseless, easily spreadable, easily removable, emollient, non staining, long shelf life, bio-friendly, transparent and pleasing appearance. Hence it can be used as better topical drug delivery system over present systems.

KEY WORDS: Topical delivery, emulgel, gelling agent

INTRODUCTION:

Over the last decades the treatment of illness has been accomplished by administration of drug to human body via various routes namely oral, sublingual, rectal, parental [1]. Topical drug administration is a localized drug delivery system anywhere in the body through ophthalmic, rectal, vaginal and skin as topical routes. These are applying a wide spectrum of preparations for both cosmetic and dermatological, to their healthy or diseased skin [2]. Drugs are administered topically for their action at the site of application or for systemic effects. Drug absorption through the skin is enhanced if the drug substance is in solution, if it has a favorable lipid/water partition coefficient and if it is a non electrolyte. Drug applied to the skin for their local action include antiseptics, antifungal agent and skin emollients. The main advantages of topical delivery system are to bypass first pass metabolism. Avoidance of the risk and inconveniences of intravenous therapy and of the varied conditions of absorption like pH

changes, presence of enzymes, gastric emptying time are other advantages of topical preparations [3, 4].

Gels are a relatively newer class of dosage form created by entrapment of large amounts of aqueous or hydro-alcoholic liquid in a network of colloidal solid particles, which may consist of inorganic substances, such as aluminum salts or organic polymers of natural or synthetic origin. They have a higher aqueous component that permits greater dissolution of drugs, and also permit easy migration of the drug through a vehicle that is essentially a liquid, compared with the ointment or cream base [5]. These are superior in terms of use and patient acceptability. In spite of many advantages of gels a major limitation is in the delivery of hydrophobic drugs.

RATIONALE

Many widely used topical agents like ointment, cream, lotion have many disadvantages. They have very sticky causing uneasiness to the patient when applied.

Moreover they also have lesser spreading coefficient and need to apply with rubbing. And they exhibit the problem of stability also. Due to all these factors within the major group of semisolid preparations, the use of transparent gels has expanded both in cosmetics and in pharmaceutical preparations.

A gel is colloid that is typically 99% wt liquid, which is immobilized by surface tension between it and a macromolecular network of fibers built from a small amount of a gelling substance present. In spite of many advantages of gels a major limitation is in the delivery of hydrophobic drugs. So to overcome this limitation an emulsion based approach is being used so that even a hydrophobic therapeutic moiety can be successfully incorporated and delivered through gels [6].

In recent years, there has been great interest in the use of novel polymers with complex functions as emulsifiers and thickeners because the gelling capacity of these compounds allows the formulation of stable emulsions and creams by decreasing surface and interfacial tension and at the same time increasing the viscosity of the aqueous phase. In fact, the presence of a gelling agent in the water phase converts a classical emulsion into an emulgel. Both oil-in water and water-in-oil emulsions are used as vehicles to deliver various drugs to the skin.

Emulgels for dermatological use have several favorable properties such as being thixotropic, greaseless, easily spreadable, easily removable, emollient, nonstaining, water- soluble, longer shelf life, bio-friendly, transparent & pleasing appearance [7, 8].

DRUG DELIVERY ACROSS THE SKIN

There are three primary mechanisms of topical drug absorption are transcellular, intercellular, and follicular. The barrier resides in the outermost layer of the epidermis, the stratum corneum, as evidenced by approximately equal rates of penetration of chemicals through isolated stratum corneum or whole skin [9].

The surface of the stratum corneum presents more than 99% of the total skin surface available for percutaneous drug absorption. Passage through this outer most layer is the rate limiting step for percutaneous absorption [10].

Emulgel can provide local concentration of drug in the affected area. Emulgel is more effective than regular gel in curative aspects, and permeation depth of drug in emulgel is more. It is used as a vehicle to deliver various drugs to the skin. The permeation of drug and its absorption is enhanced by utilizing chemical enhancement physical enhancement, biochemical enhancement and super saturation enhancement [11].

Emulgel allows dual control of the drug release from the formulation, i.e. emulsion and gel.

FACTORS TO BE CONSIDERED WHEN CHOOSING A TOPICAL PREPARATION [12]

1. Effect of the vehicle e.g. an occlusive vehicle enhances penetration of the active ingredient and improves efficacy. The vehicle itself may have a cooling, drying, emollient or protective action.
2. Match the type of preparation with the type of lesions. For example, avoid greasy ointments for acute weepy dermatitis
3. Match the type of preparation with the site.(e.g., gel or lotion for hairy areas)
4. Irritation or sensitization potential. Generally, ointments and w/o creams are less irritating, while gels are irritating. Ointments do not contain preservatives or emulsifiers if allergy to these agents is a concern.

ADVANTAGES [13]

Incorporation of hydrophobic drugs: Hydrophobic drugs can be easily incorporated into gels using o/w emulsions. Most of the hydrophobic drugs cannot be incorporated directly into gel base because solubility act as a barrier and problem arises during the release of the drug. Emulgel helps in the incorporation of hydrophobic drugs. This may be proving better stability and release of drug than gel base directly.

1. Better stability: Other transdermal preparations are comparatively less stable than emulgels. Like powders are hygroscopic, creams shows phase inversion or breaking and ointment shows rancidity due to oily base.
2. Better loading capacity: Other novel approaches like niosomes and liposomes are of nano size and due to vesicular structures may result in leakage and result in lesser entrapment efficiency. But gels due to vast network have comparatively better loading capacity.
3. Production feasibility and low preparation cost: Preparation of emulgels comprises of simpler and short steps which increases the feasibility of the production. There are no specialized instruments needed for the production of emulgels. Moreover materials used are easily available and cheaper. Hence, decreases the production cost of emulgels.
4. No intensive sonication: Production of vesicular molecules needs intensive sonication which may result in drug degradation and leakage. But this problem is not seen during the production of emulgels as no sonication is needed.

5. Controlled release: Emulgels can be used to prolong the effect of drugs having shorter $t_{1/2}$.

FORMULATION CONSIDERATIONS

The challenges in formulating topical emulgel are [14]

1. Determining systems that are non-toxic, non-irritating, non-comedogenic and non-sensitizing.
2. Formulating cosmetically elegant emulgel.
3. The emulgel formulation must have low allergenic potential, good physiological compatibility and high biocompatibility.

COMPONENT OF EMULGEL:

Drug: [9]

Physicochemical and biological properties of drugs prescribed for topical or transdermal delivery is applicable for selection of drug for emulgel.

Vehicle: [15]

The vehicle must have following properties.

1. Efficiently deposit the drug on the skin with even distribution.
2. Release the drug so it can migrate freely to the site of action.
3. Deliver the drug to the target site.
4. Sustain a therapeutic drug level in the target tissue for a sufficient duration to provide a pharmacological effect
5. Cosmetically acceptable to the patient.

Aqueous Material:

This forms the aqueous phase of the emulsion. Commonly used agents are water, alcohols [6].

2. Oils:

These agents form the oily phase of the emulsion. For externally applied emulsions, mineral oils, either alone or combined with soft or hard paraffin's, are widely used both as the vehicle for the drug and for their occlusive and sensory characteristics. Widely used oils in oral preparations are non biodegradable mineral and castor oils that provide a local laxative effect, and fish liver oils or various fixed oils of vegetable origin (e.g., arachis, cottonseed, and maize oils) as nutritional supplements [16, 17].

Emulsifiers

Emulsifying agents are used both to promote emulsification at the time of manufacture and to control stability during a shelf life that can vary from days for extemporaneously prepared emulsions to months or years for commercial preparations e.g.

Polyethylene glycol 40stearate,[18] Sorbitan monooleate (Span 80) [19], Polyoxyethylene sorbitan monooleate (Tween80) [20], Stearic acid and Sodium stearate [21].

Penetration Enhancers

In order to promote absorption of drugs, vehicles often include penetration enhancing ingredients that temporarily disrupts the skin barrier, fluidize the lipid channels between coenocytes, alter the partitioning of the drug into skin structures, or otherwise enhance delivery into skin. E.g. Clove oil 8%, Menthol 5%.

EMULGEL PREPARATION

Step 1: Formulation of emulsion either O/W or W/O
Step 2: Formulation of gel base

Step 3: Incorporation of emulsion into gel base with continuous stirring.

Emulgel was prepared by the method reported by Mohammad et al (2004) with minor modification. The Gel in formulations were prepared by dispersing Carbopol 934 in purified water with constant stirring at a moderate speed and Carbopol 940 in purified water with constant stirring at a moderate speed then the pH are adjusted to 6 to 6.5 using Tri ethanol amine (TEA). The oil phase of the emulsion were prepared by dissolving Span 20 in light liquid paraffin while the aqueous phase was prepared by dissolving Tween 20 in purified water.

Methyl and Propyl paraben was dissolved in propylene glycol whereas drug was dissolved in ethanol and both solutions were mixed with the aqueous phase. Both the oily and aqueous phases were separately heated to 70° to 80°C; then the oily phase were added to the aqueous phase with continuous stirring until cooled to room temperature. And add Glutaraldehyde in during of mixing of gel and emulsion in ratio 1:1 to obtain the emulgel [22].

CHARACTERIZATION

Characterization of emulgels are physical appearance, stability of emulsion, microscopic evaluation, pH determination, spreading coefficient, extrudability, drug content, swelling index, viscosity, phase separation, *in vitro* and *ex vivo* permeation studies. These are elaborately discussed earlier reviews [9].

CONCLUSION:

Emulgel is alternative approach of hydrophobic drugs to delivery topically with advantages of emulsion and gel to improve patient acceptability. Emulgel helps in enhancing spread ability, adhesion, viscosity, and extrusion. It is used both pharmaceutical and cosmetic applications as well as it allow to incorporate herbal formulations.

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