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Review on film forming hydrogel for rheumatoid arthritis

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Abstract
Rheumatoid arthritis is a chronic, inflammatory autoimmune disease causing synovial proliferation and joint destruction. Topical preparations are generally used for the treatment of rheumatoid arthritis. Film forming hydrogels are the dosage form for the topical delivery of drugs and it can bypass the side effects related to the conventional system like gastric ulceration and bleeding. It will provide effective topical release of the drugs. These film forming gels are novel approach for providing sustained release with increased residence time, therapeutic effect and patient comfort.

Keywords: rheumatoid arthritis, film forming hydrogel, topical delivery

Introduction

Inflammation will occur by the release of certain chemicals from tissues and migrating cells. Prostaglandins (PGs), leukotrienes (LTs), bradykinin, histamine, interleukin-1 and platelet-activating factor are strongly implicated [1]. Inflammation of joints is termed as rheumatoid arthritis. The joints become swollen in these condition. Symptoms of rheumatoid arthritis are treated by anti-inflammatory drugs, which will reduce the synthesis of prostanoids by inhibiting the cyclo-oxygenase enzyme [2]. The formation of PGs and LTs are prevented by corticosteroids by releasing lipocortin. Lipocortin will inhibit phospholipase A2, which will reduces the release of arachidonic acid and there by inflammation will be suppressed [3].

The drugs such as NSAIDs will used for the treatment of inflammation. NSAIDs are responsible for the suppression of COX enzymes, which will resulting in reduction of the production of prostaglandins, thus controlling inflammation. Some anti-inflammatories that are selectively inhibit COX 1 or COX 2 enzymes. Only COX 1 inhibits the formation of thromboxane. COX 1 inhibition is associated with increased risk of gastrointestinal bleeding and damage [4]. The adverse effects of COX 1 inhibitors can be minimized by the use of COX 2 inhibitors. These inhibitors include piroxicam, naproxen, meloxicam and nimesulide, diclofenac (first-generation selective COX 2 inhibitors) [5], and celecoxib, etoricoxib, valdecoxib, parecoxib and lumiracoxib (second-generation, selective COX 2 inhibitors) [6, 7].

Drugs

The drugs used to treat rheumatoid arthritis can be classified mainly into 3 groups [8].

Drugs that decrease pain & inflammation	Disease-modifying anti-rheumatic drugs	Biologics
Ibuprofen	Methotrexate	Infliximab
Naproxen	Leflunomide	Anakinar
Ketoprofen	Sulfasalazine	Rituximab
Flurbiprofen	Azathioprine	Adalimumab

Film Forming Hydrogel

Fig 1: Transformation of gel in to film

The film forming hydrogel is placed on the skin to deliver a certain dose of medication through the skin and into the bloodstream. Film provides a controlled release of medication into the patient [9]. Film forming formulations are the non-solid dosage forms that produce a substantial film after application on the skin. These type of compositions can either be semisolids or liquids with a film forming polymer. The formed film is responsible providing a sustained drug release to the skin [10, 11]. Film forming gel will facilitate prolonged contact on skin with drug. The film formed after evaporation would improve its skin retention ability and improving the topical treatment of various diseases. This approach will enhance percutaneous absorption, but may even allow for drug targeting to the skin. It also enhances drug efficacy and improving patient compliance. Frequent application is not needed in case of film forming hydrogels [12, 13]. Hydrogel is a polymeric material and having the ability to swell and retain a certain fraction of water within its structure. Due to their large water content they will possess degree of flexibility very much similar to natural tissue. The hydrophilic functional groups are attached to the polymeric matrix, from this they will attain the ability of hydrogels to absorb water [14]. The natural Hydrogels were replaced by synthetic hydrogels. Synthetic hydrogels has long life, high

capacity of water absorption, and high gel strength compared to natural hydrogels. Synthetic polymers usually have well-defined structures that can be modified to yield better functionality and degradability [15]. From purely synthetic components, Hydrogels can be synthesized. It is stable in the various conditions of temperature. Hydrogels have been widely used as a drug carrier and the combination of natural and synthetic polymers will provide biological acceptability and mechanical stability. In practice, to achieve more swelling, it is common to use synthetic polymers that are water-soluble. Hydrogels may be synthesized by various ways. These include polymerization (one step procedure) and parallel cross-linking of multifunctional monomers, as well as synthesis of polymer molecules having reactive groups and their subsequent cross-linking, possibly also by reacting polymers with suitable cross-linking agents (multi step procedure) [16, 17, 18].

Film forming hydrogel in topical drug delivery

Topical therapy more effective for the treatment of inflammatory diseases due to its advantages such as targeting of drugs to the site of inflammation and reduction of the risk of systemic side effects. There are various types of formulations are available to treat the inflammatory diseases, but they have some problems. These problems necessitate the development of such system that can overcome problems associated with conventional system. Film forming Hydrogel could be a better option that avoids the complications of existing systems. They preserve the active drug for a long time, biocompatible in nature and can be easily modified. Different types of combinations of polymers are made into hydrogel formulations. The film-forming polymers used for topical administration, are polyvinyl pyrrolidone (PVP), polyvinyl alcohol (PVA), HydroxyPropyl cellulose (HPC), Hydroxy Propyl Methyl cellulose (HPMC), various grades of Methacrylates and Ethyl Cellulose etc []. The pharmaceutical industry has been developing hydrogel according to drug delivery system in an advanced manner [19]. Usually topical formulations are more convenient for treating the inflammatory diseases instead of using NSAIDs. But the applied medicament may wiped off, due to clothes or any other reason. Thus there is a need to develop to novel drug delivery system which is in a gel form in a tube or container, but when applied to skin surface converts or transform into a film. Initially, gels provide a drug release and after transformation into film prolonged drug release was maintained [20]. These film forming gels are helpful in providing sustained release with improving patient compliance. This new drug delivery system having a change over the conventional in terms of many biopharmaceutical parameters. Film forming hydrogels having the capacity to hold water and they are biocompatiable [21, 22].

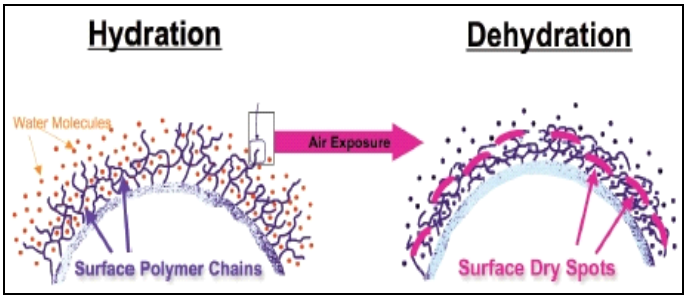

Fig 2: Formation of film on skin

Conclusion

The risk of rheumatoid arthritis will increasing day by day. The oral treatment of NSAIDs will cause gastric irritation and kidney damage. Film forming hydrogels are the most effective dosage form for the topical delivery of drugs. Also it remains adhered to the effected part for a longer period without getting rubbed off. Thus it can provide sustained drug release and frequent reapplication is not required. It will provide better patient compliance.

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