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Review Article

A Systemic Review on Ophthalmic Hydrogel in Contact Lenses

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ABSTRACT

There has been a recent advances in the field of microbiology where hydrogels contact lenses can be extend as the new ophthalmic drug delivery. Rather than the conventional eye drops, these hydrogels can minimize the side effect also prolonged the residence time of drug. Hydrogels are three-dimensional, hydrophilic, and polymeric networks capable of absorbing great volume of water and biological fluid. Hydrogel becomes the leading material for contact lenses because its biocompatibility and transparent characteristic. The purpose of this article is to review on few types of ophthalmic hydrogel in contact lenses and its application.

Keyword: hydrogel, contact lense, drug delivery, ophthalmic

INTRODUCTION

There has been an uncountable medical disease and problems, which becoming a great challenge to numerous scientists, researchers and doctors. A lot of studies have been conducted in finding the cure. Pharmaceutical industry has becoming the major contributor to the solution of medical problems where treatment such asthma, diabetes and other diseases can no longer depend on conventional pharmaceutical formulation. In the world of Pharmaceutical Sciences, advanced drug delivery formulations has been seen to have a significant future. These formulations are designed by the pharmaceutical scientist and molecular designer to meet in such manner. There have been numerous studies where hydrogels contact lenses may demonstrated to be the next drug delivery system. Hydrogels are three-dimensional, hydrophilic, and polymeric networks capable of absorbing great volume of water and biological fluid[1,2]. Hydrogel can be classified into three groups, which are according to the nature of the side groups (neutral or ionic), mechanical and structural characteristics (affine or phantom networks), and physical structure of the networks (amorphous, semicrystalline, hydrocolloidal aggregates, supermolecular-structure, and hydrogen-bonded structure)[1]. Hydrogels can be made from virtually any water-soluble polymer, including an extensive range of chemical compositions and physical bulk attribute. Other than that it can be formulated in slabs, nanoparticles, microparticles, coating and films. Hence it is conventional used in clinical practice and experimental medicine for wide range of applications[3]. Hydrogels unique properties have lead to the attention of its use in drug delivery system for oral, rectal, ophthalmic, epidermal and subcutaneous application[4]. Therefore, this review will be focusing more on ophthalmic hydrogel in contact lenses. In ophthalmic drug delivery, the physiological limitation applied by the protective mechanism of the eye forces to the low absorption of drugs result in short period of action[4]. Saettone (1987) stated that after the drug is administered to the eye cavity, within 4-20 minutes, the effective tear drainage and blinking action of the eye in the drug concentration is reduced to 10 times[5]. Unabsorbed drug by the cornea is either absorbed by the conjunctiva or flows through the upper and the lower canaliculi into the lacrimal sac[6]. Therefore, most administered dose passes via nasolacrimal duct into gastrointestinal tract (GI), causing to side-effects[5]. Semi-solid formulations like ointment and suspensions can be retained in the eye eventhough gives uncomfortable feeling to patients. However hydrogels has elastic properties that act as an ocular drainage-resistant device in conjunction offering better feeling with slight gritty sensation to the patients[4]. For example, due to their facility in dosing as liquid, in-situ-forming hydrogels are more appealing as an ocular drug delivery. Furthermore it has long period retention property as a gel after dosing as observes by Cohen *et al*. (1997) in his in-situ-gelling system of alginate with high guluronic acid content for ophthalmic delivery of pilocarpine. The duration of the pressure-reducing effect of pilocarpine is up to 10 hours compared to 3 hours when pilocarpine nitrate was dosed as a solution. An evaluation of Gelrite® in-situ gels by Carlfors *et al*. (1998) suggested that when administered in the eye there is a high rate of long precorneal contact times[7,8].

Types of Hydrogel Formulation

There are a number of formulations for a hydrogel delivery. Each has its own specific application and function. While different from the conventional delivery system, each has its own advantages over the other, and can be used to simplify for certain types of ocular diseases. Therefore, modification has been made from the conventional one (e.g. extending drug delivery system) so that it can ease the compliance of patients to drug therapy. The following are the types of hydrogel formulation and

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