



APPLICATION OF PMMA AND PHEMA IN EYE PROTECTING CONTACT LENSES

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ABSTRACT

Contact lenses are manufactured by sophisticated polymer, are usually worn during the day time and taken out every night for cleaning. Recently, contact lenses are gaining popularity among lens wearers. Basically, they are three types-soft, hard and gas permeable. Hard contact lenses are made of some variant of polymethyl methacrylate (PMMA) and soft contact lenses are made of poly hydroxyl ethyl methacrylate(PHEMA) which has hydrophilic qualities. For the improvement of soft contact lenses permeability silicon based polymer use is started like poly methylsiloxane (PDMS). Biocompatibility is also very important factor for the use of contact lens.

INTRODUCTION

Contact lenses are high grade plastic polymers which are placed on cornea of the eye. They are applicable as eye glasses. They play role as to bent light rays so that images are properly focused on the retina side. The majority of contact lenses users wear them for vision to correct myopia. In addition, contact lenses can also be worn to change or increase the colour of eye for aesthetic reasons. Contact lenses can be worn by the people with eye disorders because many form of the eye disease and vision are better corrected by the contact lenses than conventional spectacles. In 1948, a first plastic corneal lens was made from Poly (methyl methacrylate) i.e. PMMA.

Hard contact lenses are made of some variant of polymethyl methacrylate (PMMA) and soft contact lenses are made of poly hydroxyl ethyl methacrylate which has hydrophilic qualities. The Rigid Gas-Permeable (RGP) lenses are made from combination of PMMA, Silicones and Fluoropolymer. This combination allows exchange of gases directly through the lens which provides easiness and comfortableness to wearer.

Hard contact lenses

Polymethyl methacrylate (PMMA) is an ideal polymer which is used for the preparation of hard lenses because it is cheaper and easily prepared. It is moderately hydrophobic which also have protein repelling property, having typical oxygen permeability. Recently TRIS (Tri methyl siloxy silane) with MMA (methyl acrylic acid) are polymerized. The PMMATRIS Lens was first RPG lens but it was problematic because TRIS is hydrophobic and lipophilic Recent research has shown that MMA-

TRIS lenses with Fluoromethacrylates are more useful and it gives oxygen and carbon dioxide more room to penetrate the lens. They repel more effectively protein and lipids. They are durable and their strength helps them resists scratching and protect cornea.

Soft Contact Lenses

They are made of thermo-set polymer hydrogel, these gels are made up of a three dimensional amorphous network with cross-links. These lenses are soft because the polymer is above its glass transition temperature. Soft contact lenses are typically formed by cast moulding or the spin cast method. In this lens permeability is proportional to the amount of water present in the lens. Permeability is linear; it means that as water percentage of water in the lens increases, its permeability increases. Whenever water content increases the polymer lose their strength. Hence softer lens is not more effective for the protection of cornea in eye. The first hydrogel was used in soft contact lens, that was HEMA (Hydroxy ethyl methacrylate) cross-linked with Ethylene dimethacrylate (EDMA) or ethylene glycol monogethacrylate (EGDMA). Later on surfactant were added, methyl acrylic acid (MAA) and N-Vinyl pyrrolidone (NVP) to increase water content. For the improvement of soft contact lenses permeability silicon based polymer use is started like poly methylsiloxane (PDMS).

Surface chemistry of soft contact lenses is of great importance. While the soft contact lenses typically have acceptable diffusion rates, all meth acrylic and acrylic hydrogels are hydrophobic to a certain extent. It has been shown that water content of a hydrogel helps its permeability. In siloxan lenses, siloxane migrates to the

surface of the lens during polymerisation because of its desire of air. While siloxane is successful in repelling proteins, but it is highly hydrophobic which results in lipid and protein deposition on the lens. Recently it has been shown that by grafting polyethylene to the surface, the lens effectively repel protein and lipids, and increased wettability. Improved surfactant consisting of random copolymer of lauryl-, hexyl-, and methyl-methacrylate and polyethylene glycol methacrylate, have also been used. The surfactants are bound to the surface during the actual making of the lens. The surfactant monomers are added to the contact lens monomers, and the surfactants moved to the surface during formation of lens because they have a higher desire for air than siloxane. Covalent bonds are then formed as the silicones of the gel matrix appear. Research has shown that by polymerizing the contact in polar molds effectively increased the wettability of the lens. This is because of the charge distribution on the mold attracts charges to the surface of the lens while it is forming. Once the charges are at the surface of the lens, they are polymerized, and consequently forced to stay at the surface.

Working of Contact Lenses

A soft contact lens molds to the shape of the eye covering both cornea and limbus. Due to the lens is soft and flexible. The lens floats in the layer of tear that is present on top of the eye. The eyelid and attraction between the polymer and tear film hold the lens in place. Hard contact lenses are not flexible, and this means that they must be ground to precisely fit the eye. They only cover the cornea, and not the limbus. If hard contacts are not fit precisely to the eye they will move and not work correctly. Hard and soft contacts work similarly in that as light is refracted as it passes through the polymer. By varying the thickness and the shape of the lens the amount of refraction can be corrected.

CONCLUSION

Contact lenses are constantly in contact with the fluid of the eye. When the contact is placed in the eye, a layer of tear separates it from eye. This is commonly known as the tear film. If a polymer is hydrophobic, it will repel the water that makes up a majority of tear surface. This disrupts the tear flow, and results in the deposition of an albumin film on the lens. This reduces the effectiveness of the contact, and can cause infection or irritation. Protein and lipid deposition create biofilm which produces different amounts of visual correction the lens. This can result in the lens losing its ocular properties, and turns into yellow colour. This yellow colour results in lens spoilage, a outcome of the diffusion of proteins and lipids into the lens. A big requirement of the lens is that it must be light weight. This allows it to be placed on the eye comfortably for extended periods of time without causing ocular strain.

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