

Ocular Irritation and Contact Lenses

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Abstract

A number of causes of ocular irritation from the use of hydrogel lenses are examined in relation to the onset of G.P.C., keratoconjunctivitis, keratitis and infiltrative conjunctivitis.

Abrégé

L'irritation oculaire peut provenir de plusieurs sources. Ce travail examine certaines causes en fonction du début d'une kératite infiltrative, d'une kerato-conjonctivite, ou d'une conjonctivite papillaire géante.

Ocular irritation may be caused by lens deposits, by worn out lenses or damaged lenses, by chemicals employed in the cleaning and disinfection of lenses and microbial contamination of lenses. The purpose of this paper is to examine the relationship between these factors and Giant Papillary Conjunctivitis, (G.P.C.), keratoconjunctivitis or infiltrative keratitis, and immunology of the patient.

Lens deposits

Proteinaceous deposits are produced by the accessory lacrimal glands. These deposits are layered and lenses are 50% coated with mucus within the first 30 minutes of wear and by eight hours wear the lenses may be 90% coated¹. During the first three months about 10% of the patients would have accumulated enough debris to change the function and comfort of the lens². By the end of six months, 50% of the lenses would be showing significant debris. At the end of one year, more than 80% of lenses would be functioning at a less than satisfactory level because of surface coating. Convex surfaces and higher water content lenses seem to develop more deposits. The presence of deposits may necessitate the replacement of soft contact

lenses every 18 to 24 months.

Cleaning and disinfection of lenses

There are two procedures which may be used to clean lenses, surfactant cleaning of superficial deposits which accumulate daily and enzymatic cleaning to reduce chemically bound muco-protein deposits. Some cleaners emulsify the proteinaceous layer breaking them up into droplets on the surface of the lens which can be removed by rubbing the lens surface. No cleaner is effective in removing all the layers of deposits¹.

Disinfection is a procedure designed to kill bacteria and spores by means of either heat or chemical agents. The pores in soft lenses are impermeable to bacteria unless defects in the material are present due to poor quality control in manufacturing, and the effect of handling and aging of the lenses. There are also other ways in which lenses can become contaminated. Bacteria, including *Pseudomonas Aeruginosa*³ adhere to deposits on the lens surface.

Bacteria are unlikely to proliferate on a surface unless they can attach to the surface of the lens coating. It has been hypothesized that contact lenses may provide a surface on which bacteria can proliferate and provide antigenic mass³. Bacteria may come from the skin and is transferred to the lens or may even be present in the solutions used in cleaning and disinfecting lenses. For example, of 17 open bottles of Hydrocare solution tested, 10 were found to be contaminated with bacteria such as *Pseudomonas* and *Serratia liquefaciens*. Lens cases may contain contaminated solutions⁴. A lack of compliance on the part of the patient may also be a source of lens contamination and ocular irritation⁶.

A study of the chemical and microbiology assays on 29 hydrogel lenses from 20 patients was performed with three chemical systems and lenses made of three types of materials⁷. The chemical analyses revealed amounts of zinc, magnesium, silver, cadmium and, in one case, copper which had been absorbed through medication taken for colitis. These chemicals discoloured lenses and created G.P.C., infiltrative keratitis and intolerance to the lenses⁷. Bacteria were found in 18 lenses from 13 patients. In 6 out of 9 cases tested a new strain of *Pseudomonas* 11 K type 1 was found which is often present in distilled water. Other organisms present were *Pseudomonas Aeruginosa*, *Enterobacter Aerogenes* and *Cornybacterium pseudo dipthericum*. The chemicals absorbed in the lenses and bacterial contamination created 7 discoloured lenses within the first 12 months of use. Problems such as G.P.C. and or infiltrative Keratitis commenced in 15 patients within 24 months. It seems that soft contact lenses should be changed after a year due to lens contamination which may produce visual and ocular disturbances.

Immunological Response

Giant Papillary Conjunctivitis (G.P.C.) is a syndrome characterized by excess mucus, ocular itching, diminished or destroyed contact lens tolerance and giant papillae (0.3mm in diameter) in the upper tarsal conjunctiva. The syndrome develops in wearers of soft contact lenses after as few as three weeks and after as long as four years of daily successful wear. The cause of G.P.C. is probably immunologic because of the nature of the cellular infiltrate. It was hypothesized that "the antigen

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initiating the disease is in the deposit on the lens and not the lens material itself, because when the patient wears a new (clean) lens of the same material or an old lens from which deposits have been totally removed, the syndrome improves or disappears. No one particular type of lens seems to be responsible for the problem; it has been seen in all types of both soft and hard lenses. The occurrence of lymphocytes, plasma cells, basophils and eosinophils indicates that there may be a similarity between G.P.C. and a type of delayed basophilic cutaneous hypersensitive reaction."⁸

Some patients wearing contact lenses exhibit latent hypersensitivity reactions and are unable to tolerate any type of contact lens. The presence of a contact lens may create an antigen-antibody reaction, or the lens coating may attract antigens such as pollens and inhalants increasing the hypersensitivity reaction markedly. The resultant mucus discharge and antigen adhering to the contact lens surfaces may create blurred vision, discomfort and intolerance to the lenses.^{9,10}

Keratoconjunctivitis with G.P.C. has been observed in approximately 4% of the soft contact lens population¹¹. The cornea shows punctate staining and infiltrates around the superior and inferior limbi. This condition does not respond to medical treatment and resolves over a period of several months without treatment. It may be of bacterial, viral or immunologic origin. Excessive deposits on soft lenses are a

constant feature of G.P.C. and Infiltrative Keratitis. As symptoms continue to develop it may become more difficult to keep the lenses clean. A scanning electron microscope has been used to study the surfaces of coated soft lenses from patients with G.P.C.¹². All worn contact lenses differed strikingly from new, never-worn lenses. Thick coatings on lenses from patients with G.P.C. and asymptomatic wearers were similar. It seems that the capacity to develop G.P.C. may be influenced by individual differences more than by differences in the lens deposits and is probably created by a combination of mechanical, immunologic and inflammatory mechanisms¹³.

Conclusion

Several factors associated with the wearing of hydrogel lenses may produce an inflammatory response which reduced tolerance to the lenses. Deposits, chemicals used in cleaning and disinfection, bacterial contamination and allergies may affect lens wear. These factors may reduce the life of the lens; therefore, patients should be examined frequently and their lenses inspected with the biomicroscope for defects, deposits and discolouration. Problems usually commence in the second year of wearing lenses because of deterioration of the lenses. Patients should be advised that there is a limited life expectancy of soft lenses which varies with use, maintenance and the environment. A new material for soft contact lenses should be

developed which is just as comfortable, more durable, and easier to maintain than existing materials.

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