Health & Safety

Contact Lenses in the Lab – Are they Safe?

Contact lenses are generally banned in chemical laboratories due to concerns that chemicals might exacerbate eye damage. These restrictions, which are based on perceived hazards, are being lifted based on research showing that contacts do not increase the risk of injury, and that they can be safely worn with eye protection in a chemical laboratory environment.

In the United States, 45 million people wear contact lenses. About 13% of them wear rigid gas permeable (RGP) lenses and the remaining wear soft lenses made from either traditional methacrylate or siloxane hydrogel (CDC 2021; Lazarus 2021). A hydrogel is a gel-like water-containing plastic; the higher the water content, the higher the oxygen permeability. Advances in contact lenses over the years have focused on increasing oxygen permeability to create a more comfortable lens. Contacts vary in thickness from 0.04–0.9 mm depending on the prescription and length of use, with daily wear lenses being the thinnest (Musgrave and Fang 2019; Nicolson and Vogt 2001).

History of Contact Lens Materials

- 1887, blown glass
- 1939, poly(methyl methacrylate) (PMMA) hard lenses
- 1970s–90s, fluoro silicone or siloxane rigid gas permeable (RGP) polymers
- 1971, poly(hydroxyethyl methacrylate) (HEMA) hydrogel soft lenses
- 1998, polysiloxane hydrogel soft lenses

Contacts in the Chemical Lab

Although limited and primarily carried out in the lab or on anesthetized rabbits, research to date has shown that wearing contacts in a lab does not increase the risk of injury. Studies have focused on a narrow range of specific chemicals but include some used in conservation like acetone, xylene, and ammonia (Hejkal et al. 1992; LaMotte, Smith, and Chang-Smith 1995; Nilsson and Andersson 1982). In fact, studies have shown that all types of contacts can provide protection from damage in the following scenarios:

- **Solvent splashes:** Chemicals were not trapped behind contact lenses due to the eye's reflex to twitch, creating a barrier effect protecting the cornea (Guthrie and Seitz 1975; Nilsson and Andersson 1982).
- **Organic vapors:** Contacts decreased the eye's exposure by absorbing the vapor and releasing it primarily back into the air (Nilsson 1982; Hejkal et al. 1992).
- **Ammonia vapor:** Contacts absorbed the vapor and quickly released it into a saline solution within seconds. Presumably this indicates that the natural action of tears would flush ammonia away, shielding the cornea from direct exposure to the fumes (La Motte, Smith, and Chang-Smith 1995).
- **Particulates:** The normal adhesion force of the lens to the eye prevented particulates from getting underneath it. The few particles found on the lenses were easily removed from the surface by normal tearing, blinking, and cleaning and did not cause any eye damage (Nilsson, Lindh, and Andersson 1983).

Contacts did not perform as well with splashes of strong corrosives, which are known to be dangerous to the eye. If the eye is not immediately flushed with water when exposed to corrosives, severe and permanent damage will result. Eye exposure to acids tend to be self-recovering while alkalis can rapidly disrupt, soften, and penetrate the cornea affecting the lens, retina, and uvea (Cullen 2007). A study by Nilsson and Andersson showed that contact lenses did not protect against strong alkalis (20 and

40% sodium hydroxide) but did not exacerbate the condition either. Lenses did provide some protection against strong acid (20 and 40% hydrochloric) reducing corneal damage by about 75% (1982).

These findings do not suggest that contact lenses may be used as a substitute for protective eyewear, but they do emphasize that wearing contacts does not increase damage and as a result, has prompted a reversal of bans on lens wear by individuals working in chemical labs. The National Institute of Occupational Safety and Health (NIOSH) recommends that contact lenses be permitted, provided safety guidelines are followed and that contact lenses are not banned by regulation or contraindicated by medical or industrial recommendations (Schulte et al. 2005). The Occupational Safety and Health Agency (OSHA) still recommends against contact use when working with acrylonitrile, methylene chloride, 1,2 dibromo-3-chloropropane, ethylene oxide, and methylene dianiline. This recommendation regarding specific chemicals is presumably based on best professional judgment because there is no data to support it (Messana 2001).

Safety Guidelines for Contact Lens Use in a Laboratory

The following safety guidelines should be included in a laboratory contact lens policy (Randolph and Zaron 1987; Schulte 2005).

- Identify employees who wear contacts and ensure their supervisor and lab safety officer know. This is necessary in the event of an accident when lenses must be removed.
- Complete an eye hazard job evaluation with an industrial hygienist or safety professional to assure the use of contact lenses in your workplace is safe.
- Require eye protection when working with hazardous chemicals. Contact wearers do not require enhanced eye and face protection over non-wearers. For chemical vapor or liquid, corrosives or particulate hazards, the minimum protection consists of indirectly vented goggles or full facepiece respirators.
- Instruct contact wearers to remove lenses at the first signs of eye redness or irritation when working with chemicals and keep glasses and saline solution at work. Contacts should be removed and cleaned daily after working with volatile solvents or in an environment with particulates.
- Develop first aid procedures. In the event of a chemical splash, flush eyes immediately with water and remove contact lenses as soon as possible to allow thorough irrigation of the eyes. Do not delay irrigation while waiting for contact lens removal. If the employee is unable to remove the contacts themselves, a suction-type lens remover can be used, and staff should be trained in its use. This piece of equipment is inexpensive and should be part of the lab's first aid kit. Flush eye again for at least 10-15 min.

Conclusions

Studies have shown that contacts do not increase the risk of injury and can be worn in a chemical laboratory environment if safety guidelines are followed. However, this conclusion is based on very limited research involving only a few specific solvents. Research is needed on additional solvents and on how the thickness and water content of lenses affects the results. Contact lenses are not eye protective devices and wearing them does not reduce the requirement for eye and face protection, but they are generally safe for use in a chemical laboratory setting when appropriate precautions are taken.

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