

Contact Lens Care: More Than Disinfection

CLINICAL AREA	Multi-Purpose Solutions: Cleaning and disinfecting reusable soft contact lenses
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KEY TAKEAWAYS

- Reusable soft contact lens care requires cleaning, antimicrobial activity, lens conditioning, and adequate patient behavior working together with multi-purpose solutions.
- In a 3-month clinical study of Biotrue Hydration Plus MPS, lenses showed minimal deposit accumulation, sustained wettability and high subjective cleanliness ratings throughout 3 months of wear.
- In antimicrobial studies, the same formulation demonstrated activity statistically comparable to a hydrogen peroxide comparator across five compendial organisms and greater than 3-log reductions against three non-compendial Gram-negative organisms under tested conditions.
- Daily lens hygiene depends on following the labeled instructions for use, including rubbing, rinsing with fresh solution, soaking for the labeled time and maintaining the storage case appropriately.

Why reusable lens care requires both cleaning and disinfection

Reusable soft contact lenses require daily care because they are worn, removed, stored and reinserted over multiple wear cycles. Between wear periods, the care system must address both deposits on the lens surface and microorganisms introduced through handling, the ocular environment, water exposure or the storage case. Therefore, multi-purpose solutions (MPSs) integrate cleaning, rinsing, disinfection, conditioning and storage in a single product, and these functions are distinct and interdependent.^{1,2}

- Cleaning prepares the lens for reuse by reducing deposits, debris and residue that accumulate during wear.
- Disinfection reduces viable microbial populations to support hygienic reuse.
- Conditioning supports post-soak lens surface properties, including wettability and lubricity, through interactions between care-solution components and the lens material.

In this Science in Focus entry, we discuss how cleaning, disinfection and conditioning contribute to reusable soft contact lens care, review clinical and laboratory evidence on lens cleanliness, wettability and antimicrobial performance, and consider how care-regimen adherence influences daily lens hygiene.

What clinical evidence shows about cleanliness and wettability

During wear, tear-film components, debris and environmental material can accumulate on the lens surface. These deposits may affect wettability, optical quality, comfort and the way the lens interacts with the ocular surface. Contemporary MPS formulations use surfactants to help loosen deposits and debris so they can be rinsed away more effectively and to support lens wetting.¹ While the precise cleaning regimen should always follow the current product labeling and practitioner’s directions, a rub-and-rinse regimen is generally recommended with MPS and soft lenses, including silicone hydrogel lenses, to maximize lens cleanliness.^{3,4}

The care steps provide complementary mechanical and chemical actions:

- Rubbing provides mechanical action that helps loosen adherent deposits and microorganisms.
- Rinsing carries away material released from the lens surface.
- Soaking provides the labeled contact time needed for disinfection and allows conditioning agents to interact with the lens.

Clinical assessment of deposit accumulation, perceived cleanliness and lens wettability can help quantify cleaning-related performance under conditions that reflect daily lens wear and care. In a multicenter clinical study, habitual planned-replacement

soft lens wearers used Biotrue Hydration Plus MPS with five prespecified hydrogel or silicone hydrogel lens types. At the 3-month follow-up, investigators reported that:

- Only 1.3% of lenses exhibited more than light deposits during the entire study period.
- By the 3-month visit, all lenses had none or only light deposits.
- Subjects rated lens cleanliness on removal consistently in the “very good” to “excellent” range throughout the study.
- At the 3-month assessment, 97.6% of lenses required no or only mild additional cleaning.
- At 3 months, 99.6% of lenses met the study’s wettability criteria.⁵

These findings support the cleaning-related performance of the formulation under daily-use conditions.⁵

What disinfection testing means for everyday lens hygiene

MPS disinfection is achieved using antimicrobial agents that may be used alone or in combination, with frequently used examples including polyaminopropyl biguanide (PAPB), polyhexamethylene biguanide (PHMB), polyquaternium-1 (PQ-1), alexidine and myristamidopropyl dimethylamine (MAPD).

To evaluate antimicrobial activity consistently, the internationally recognized ISO 14729 standard provides a common framework for characterizing disinfection efficacy under controlled conditions. It specifies two complementary methods, which can be applied with or without organic soil:

- **The stand-alone test** evaluates the antimicrobial activity of the solution itself. The solution is challenged with three bacteria (*Staphylococcus aureus*, *Pseudomonas aeruginosa* and *Serratia marcescens*) and two fungi (*Candida albicans* and *Fusarium solani*). To meet the primary acceptance criteria, the solution must achieve at least a 3-log reduction for each bacterium and a 1-log reduction for each fungus at the manufacturer-recommended minimum disinfection time.^{3,6}
- **The regimen test** evaluates antimicrobial performance as part of the complete lens-care process. The solution is tested in combination with a contact lens and the prescribed cleaning and disinfection steps, such as rubbing, rinsing and soaking, to assess performance under the labeled regimen.⁶
- **Organic soil** may be added to the microbial challenge suspension. It is a standardized mixture of biological material used to simulate organic material that may be encountered during lens handling and wear, creating a more demanding test condition because proteins and other organic components can hinder antimicrobial activity.⁶

Against this standardized framework, comparative studies can show whether formulations meet established antimicrobial performance criteria and can also reveal differences in the magnitude of microbial reduction across solutions and organisms. Two recent studies applied the ISO 14729 stand-alone method, with organic soil, to characterize the disinfection performance of commercially available lens-care systems.

A 2024 study compared Biotrue Hydration Plus MPS with four other MPS formulations and a hydrogen peroxide system under ISO 14729 stand-alone test conditions in the presence of organic soil.

- At the labeled 4- or 6-hour soak times, all products met the primary criteria for all five compendial organisms except one MPS, which produced a 0.4 ± 0.1 log reduction against *C. albicans*.
- Average reduction across all five organisms was 4.6 ± 0.1 logs for Biotrue Hydration Plus MPS and 4.3 ± 0.1 logs for the hydrogen peroxide comparator; these two results were statistically comparable.
- Biotrue Hydration Plus achieved a 4.2 ± 0.7 log reduction against *C. albicans*, which was greater than the results for the other tested solutions.³

A separate 2025 study compared Biotrue Hydration Plus MPS with five other MPS formulations and a hydrogen peroxide system against three Gram-negative organisms associated with contaminated lens cases and corneal infiltrative events.

- MPSs containing PAPB/alexidine/PQ-1 (Biotrue Hydration Plus), alexidine/PQ-1 or PHMB, and the hydrogen peroxide system, produced greater than 3-log reductions for all three organisms.
- The three MAPD/PQ-1 solutions produced 0.6- to 1.7-log reductions across solution-organism combinations.
- The PAPB/alexidine/PQ-1 (Biotrue Hydration Plus) and alexidine/PQ-1 formulations were statistically comparable to the hydrogen peroxide comparator for overall efficacy.⁷

These in vitro findings demonstrate that antimicrobial efficacy is solution- and organism-dependent. They should not be interpreted as direct estimates of infection risk or as a substitute for clinical outcomes. Formulation interactions, lens material, organic soil, case conditions and wearer behavior can all influence performance.^{3,7}

Why following the care regimen matters

Controlled laboratory testing can demonstrate disinfection capability, but consistent daily hygiene depends on following the complete care regimen.

- Handwashing, use of fresh solution, avoiding “topping off,” completing the labeled soak time, replacing lenses and cases as directed, and avoiding overnight wear when not prescribed are central to hygienic reuse.
- Poor hand hygiene is an independent risk factor for microbial keratitis, and lens cases can act as reservoirs that transfer organisms or their products to the lens and ocular surface.^{3,7,8}

For eye care practitioners, solution selection and behavior counseling are therefore inseparable. A practical recommendation should account for the lens material, patient handling habits, ocular surface findings, comfort needs, prior care-system experience and the patient’s ability to follow the complete regimen.

Putting the evidence into practice

The evidence supports discussing reusable lens care as a system rather than as a bottle alone.

- Cleaning reduces deposits and prepares the lens surface.
- Disinfection reduces viable microorganisms.
- Conditioning supports the post-soak lens surface.

The clinical value of an MPS is therefore best understood as the combined effect of finished-formulation performance, lens compatibility and regimen adherence.

Patient counseling should reinforce four behaviors that are easy to remember and clinically important:

- Rub the lens.
- Rinse with fresh solution.
- Soak for the labeled time.
- Maintain the storage case with fresh solution and no water exposure.

This behavior-focused framing helps translate solution performance into consistent daily lens hygiene, including deposit removal, wettability support and microbial reduction.^{3,6,8}

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Author disclosures

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