CONTACT LENS

Evaluation of Running Water Rinsing of Soft Contact Lenses

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Abstract

The safety of using running water to rinse soft contact lenses was evaluated. Twenty soft contact lenses were contaminated with viable micro-organisms in an organic load and were then rinsed under running water for 20-30 seconds. The results showed that the reduction of the contaminants by the running water rinsing alone was always more than 98%. To evaluate the contaminant level introduced to the lenses by the running water, 24 sterile lenses were also rinsed with running water. Our results indicated that these lenses were virtually not contaminated with running water rinsing. However, when 30 sterile lenses were handled by 15 soft contact lens wearers in the same manner as they would prior to inserting the lenses in their eyes, thousands of contaminants were recovered per lens in average. Furthermore, when lenses containing different water levels were rinsed in water, followed by soaking in a sterile isotonic saline solution, none of the lenses were adversely affected physically by the water rinse. From the results of this study, we believe that it is safe to use running water to rinse soft contact lenses in conjunction with a safe holding device and a proper disinfecting regimen.

Résumé

L'objectif de cette étude est de déterminer si l'eau courante est un moyen sûr pour rincer les lentilles cornéennes molles. Après avoir contaminé vingt lentilles cornéennes molles avec des micro-organismes viables dans une substance organique, on les a rincées à l'eau courante pendant 20 à 30 secondes. Les résultats ont démontré que le taux de réduction des contaminants par suite du rinçage à l'eau courante seulement dépassait toujours 98 %. Afin d'évaluer le nombre de contaminants introduits dans les lentilles par l'eau courante, on a également rincé 24 lentilles stériles à l'eau courante. Nos résultats n'ont indiqué aucune véritable contamination de ces lentilles par suite d'un rinçage à l'eau courante. Cependant, après que 15 utilisateurs de lentilles cornéennes molles eurent manipulé 30 lentilles stériles de la manière dont ils s'y prennent habituellement avant de les insérer dans leurs yeux, on a retrouvé des milliers de contaminants en moyenne par lentille. Par ailleurs, lorsqu'on a rincé des lentilles à teneur différente en eau et qu'on les a ensuite fait tremper dans une solution saline isotonique stérile, on a constaté qu'aucune des lentilles n'avait subi de dommages par suite du rinçage à l'eau. Les résultats de cette étude nous font conclure qu'il est possible de rincer les lentilles cornéennes molles à l'eau courante sans risque de contamination, à condition de les placer dans un endroit sécuritaire et d'utiliser un liquide désinfectant approprié.

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Background

Contact lens patients encounter many common problems — e.g., red eyes, GPC (giant papillary conjunctivitis), lens discoloration — which are due to inadequate removal of lens deposits.[1,2,3,4]. Despite clear recognition of the importance of cleaning lenses and the availability of good cleaning solutions, many patients are not adequately removing deposits. Careful observation of the cleaning procedures used by many contact lens wearers has indicated that a common weakness is *inadequate lens rinsing.*

For several years, the principal method of cleaning soft contact lenses has been to rub the lens between the fingers after adding a few drops of a cleaning solution. The loosened debris and cleaning solution are then rinsed off by directing a stream of saline solution from a squeezable plastic bottle to the hand-held lens. This rinsing method is sometimes not adequate in providing the thoroughness of rinsing needed for complete removal of lens deposits and cleaning solution residues.

A much more effective, efficient and economical rinsing method to remove deposits and cleaning solution is the use of the force of running water. Indeed, for all hard and gas-permeable contact lenses, the use of running water has been the standard rinsing method for decades.

Despite its wide acceptance for rigid lens rinsing, running water rinsing has run into some skepticism by some clinicians concerned about possible contamination of the lenses by microbes and/or minerals in the water. In addition, questions regarding lens parameter/integrity arise. With the availability of the Hydra-Mat II, it is possible to completely rinse all cleaners and deposits from the lenses in 20-30 seconds without any fear of damage or loss of the lenses. The purpose of the research reported in this article was to address these concerns.

Materials

Lenses: For microbiological experiments:

Hydrophilic soft contact lenses of 35%, 45% and 55% water content (Gelflex, Hydrocurve II_{45} and Hydrocurve II_{55}, respectively)

For lens parameter experiments:

Hydrophilic soft contact lenses of 38%, 45%, 55% and 70% water content (Bausch & Lomb, Hydrocurve II_{45}, Hydrocurve II_{55} and Sauflon 70, respectively).

Running Water: City of Sunnyvale, California

Lens Case: Barnes-Hind Hydra-Mat II Unit

Lens Solution: Barnes-Hind Soft Mate ps Daily Cleaner

Test Organisms: *Serratia marcescens* ATCC 14041, *Staphylococcus epidermidis* ATCC 17917, and FDA specified organic load.

Media: 0.1% peptone water with 1% polysorbate 80 to wash contaminants from the lenses and Trypticase Soy Agar (BBL) containing 1% polysorbate 80 for recovery of contaminants.

Methods

Reduction of Microbial Contamination by Rinsing with Running Water

Each lens was contaminated with approximately 1 x 10^6 viable cells with organic load. After 3-10 minutes' contact time, the lenses were each placed in a basket of a Hydra-Mat II unit and rinsed under running water for 20-30 seconds. The lenses were then transferred to peptone water for evaluation of the remaining contaminants.

Contamination of Lenses by Running Water Rinsing and By Finger Handling

In running water rinsing studies, lenses were each placed in a Hydra-Mat II basket and rinsed under running water for 20-30 seconds. For hand cleaning experiments, all subjects washed their hands first before cleaning the lenses with Soft Mate ps Daily Cleaner. The lenses were then rinsed or not rinsed with running water in Hydra-Mat II units. To study the contamination levels by finger handling, sterile lenses were handled by 15 soft contact lens wearers in the same manner as they would prior to inserting the lenses in their eyes. All the lenses were transferred to peptone water for evaluation of microbial contamination. The contaminants were identified by the Analytical Profile Index Systems of Analytical Products.

Determination of Effect of Water on Lens Parameters

Lenses were soaked in water for thirty seconds followed by soaking in Soft Mate preservative-free saline solution for ten minutes. Each lens' base curve, diameter, central thickness, optical power and optical quality were measured before and after the test procedure.

Results

The reduction of the contaminants by the running water rinsing alone was always more than 98% (see Table I). The data in Table II shows that sterile lenses

Table I

Reduction of Microbial Contamination on Soft Contact Lenses by Rinsing with Running Water

Test Organism	Contaminants Recovered: Control Lens Without Rinsing	Lenses Rinsed With Running Water*	Percentage Reduction After Rinsing
Serratia marcescens ATCC 14041	1.4×10^5 organisms/lens	1,567** organisms/lens	98.88%
Staphylococcus epidermidis ATCC 17917	1.8×10^5 organisms/lens	1,464** organisms/lens	99.19%

* Water microbial plate count = 100 organisms/ml
** Average of 10 lenses — Hydrocurve II_{45}

Table II

Contamination of Lenses by Running Water Rinsing and by Finger Handling

	Sterile Lenses Rinsed With Running Water* in Hydra-Mat II	Sterile Lenses With Soft Mate ps: Not Rinsed	Cleaned by Hand Daily Cleaner Rinsed with Running Water in Hydra-Mat II	Sterile Lenses Handled by Fingers Prior To Insertion In the Eyes
No. of lenses tested	24	14	14	30
Av. of viable organisms/lens	1+	4,445	73	4,172

* Water microbial plate counts = 1 to 40 organisms/ml
\+ Only three lenses were contaminated with 1 or 2 organisms.

Table III

Classification of the Major Microbial Contaminants Recovered from Contact Lenses by Finger Handling

Treatment	No. of Different Species or Strains	Microbial Contaminants
Finger handling prior to insertion in the eyes	14	*Staphylococcus epidermidis*
	3	*S. warneri*
	3	*S. hominis*
	2	*S. xylosus*
	1	*S. capitis*
	10	*S.* non-*aureus* species
	2	*Micrococcus*
	3	*Branhamella*
	1	*Mycobacterium*
	1	*Penicillium*
	1	gram positive bacilli

Table IV

Lens Parameter Measurements Before and After Water/Saline Rinsing (typical results)

Lenses Tested (Water Content)		B & L (38%)	Hydrocurve II_{45} (45%)	Hydrocurve II_{55} (55%)	Sauflon 70 (70%)
Base Curve (mm)	Before	8.2	7.8	8.2	8.6
	After	8.2	7.8	8.2	8.6
Diameter (mm)	Before	14.1	13.7	14.5	12.3
	After	14.1	13.8	14.5	12.3
Central Thickness (mm)	Before	0.07	0.10	0.11	0.17
	After	0.07	0.10	0.11	0.17
Optical Power (diopters)	Before	-3.00	+1.50	+4.00	+2.25
	After	-3.00	+1.50	+4.00	+2.25
Optical Quality	Before	Good	Good	Good	Good
	After	NC*	NC	NC	NC

*No change

were virtually not contaminated with running water rinsing. Indeed, finger handling of the lenses contributed contamination levels greater than 4,000 organisms per lens. Table III presents identification of the major microbial contaminants found on the lenses after finger handling.

Table IV presents typical results of the lens parameter measurements before and after a 30-second water rinse of 38%, 45%, 55% and 70% water-content hydrophilic lenses. Four lenses of each water content were tested and in all tests no lenses were adversely affected by the 30-second water rinsing.

Discussion

The data collected in this study demonstrate that running water rinsing did not contribute microbiological contamination to soft contact lenses. Quite the contrary, high levels of organisms placed on soft lenses, together with an organic load, were significantly reduced by running water rinsing.

When one realizes that the finger-handling step in all contact lens wearers' regimen prior to returning lenses to the eyes contributes thousands of organisms, concern for running water rinsing should be minimal. Our own natural defense system can take care of contaminants introduced to the eye most of the time. A study conducted by Peterson[5] showed that microorganisms introduced to normal, healthy eyes did not survive over 24 hours!

In Canada and the United States, the law requires that the public be provided with safe drinking water.[6,7] The maximum microbial contaminant levels of public water systems are regulated and enforced by the individual provinces and states.[8,9] The total microbial counts in tap water from different faucets in different households can be variable, depending on the temperature, the frequency of use of the outlets, the plumbing line, etc. During the period of this study (March 29, 1984 to January 21, 1985), the Sunnyvale, California tap water contaminant levels varied from 0 to 103 organisms/ml.

The chemical and physical quality of the drinking water is also regulated and monitored by the states. The total hardness, the calcium and magnesium, the total soluble solids and other inorganic and organic chemicals are routinely monitored. Early studies have shown that the pore sizes of all the soft contact lens materials are less than 5 nanometers in diameter. During 20-30 seconds of rinsing under the force of running water, it is very unlikely that calcium and magnesium residues could be collected in the lenses. Moreover, if a small amount of calcium and magnesium were trapped in the surface area of the lenses, the chelating agent, disodium edetate (EDTA), in most commercial contact lens solutions would remove them effectively.

Conclusion

From the test results of this study, we believe that it is safe to use running water to rinse soft contact lenses in conjunction with a safe holding device and a proper disinfecting regimen.

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References

1. Tripathi, R.C. and B.J. Tripathi, "Lens Spoilage," *Contact Lenses* pp. 45. 1-45.25, Grune & Stratton, 1984.
2. Tripathi, R.C. and B.J. Tripathi, "The Pathology of Soft Contact Lens Spoilage," *Ophthalmology* 87:365, 1980.
3. Allansmith, M.R., et al, "Giant Papillary Conjunctivitis on Contact Lens Wearers," *Am. J. Ophth.* 83:697, 1977.
4. Sibley, M.J. and Chu, V., "Understanding Sorbic Acid-Preserved Contact Lens Solutions," *Int. Contact Lens Clinic J.*, Vol. 11, No. 9, Sept. 1984.
5. Peterson, A.F., "Microflora of the Normal Eye and Effects on Contact Lenses, *Developments in Industrial Microbiology*, 17:17-21, 1976.
6. Canadian National Water Guidelines for Drinking Water Quality, Dept. of Nat. Health and Welfare, 1978.
7. Title XIV, Safety of Public Water Systems, Public Law 93-523, 93rd Congress, S.443, Dec. 16, 1974.
8. Ontario Water Resources Act, Revised Statutes of Ont., 1981, Sections 15, 16 & 21, Pub. Jan. 1982.
9. California Domestic Water Quality and Monitoring Regulations. California Health and Safety Code and the California Administrative Code, Title 22, State of California, Dept. of Health, Sanitary Engineering Section, Berkeley, California 94704.

CAO 19th Biennial Congress Photo Contest and Exhibit Hall Prize Draw Winners

Following is a list of winners and donors of the prizes offered at the CAO 19th Biennial Congress in Regina. CAO and the Regina Local Arrangements Committee, under co-Chairpersons Dr. Len Koltun and his wife, Betty Lou, are sincerely grateful to the following companies for their support, and offer our sincere congratulations to all the winners.

1985 Biennial Congress Photo Contest

Category	Winner	Prize Donor
"Personality Plus"		
1st Prize — $300.00	Dr. H. Smit	Pioneer Optical
2nd Prize — $100.00	Dr. MW Stefanuk	Imperial Optical
3rd Prize — $100.00	Dr. L. Koltun	Western Optical
"Season to Taste"		
1st Prize — $200.00	Dr. H. Smit	CIBA Vision Care
2nd Prize — $100.00	Dr. MW Stefanuk	CAO 19th Biennial Congress
3rd Prize — $50.00	Dr. T. Winslade	Plastic Contact Lens
"Noah's Ark"		
1st Prize — $100.00	Dr. MW Stefanuk	Superlite Optical
2nd Prize — $100.00	Dr. T. Winslade	Optique Perfect
3rd Prize — $50.00	Dr. R. Rosere	Carl Zeiss Canada

Exhibit Hall Prize Draws

Prize	Winner	Prize Donor
$500.00 cash	Dr. G. King	Bausch and Lomb
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$200.00 cash	Dr. D. Wassell	Centennial Optical
Autofoc II Specialist Ophthalmoscope	Dr. P. Padfield	Heine Instruments
7 Power Bushnell Binoculars	Dr. M. McMorris	Imperial Optical
Case Display/Cases	Dr. S. Craig-Paul	Shilling Optical Case
Mini-Stirrer	Dr. V. Kuraitis	White Ophthalmic Services
2 Suspension Eyewear Fitting Kits	Dr. S. Craig-Paul	Suspension Eyewear