

## **Understanding Contemporary Contact Lens Care Products**

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Contributing Editors,  
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*Contact Lens Spectrum*

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### Disclosure Statement:

- Susan: Alcon/ CIBA Vision, Bausch + Lomb, Bioscience Communications, Blanchard , CooperVision, Danker, Focus Labs, Inspire, Westcon, and Vistakon
- Michael: Abbott Medical Optics, Alcon/ CIBA Vision, Bausch + Lomb
- No financial interest

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## **Understanding Contemporary Contact Lens Care Products**

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### History of Contact Lens Care

New Materials,  
New Technologies

HEMA vs. Silicone Hydrogels

Water Content and Oxygen  
Exchange

Surface Chemistry

Hydrogel Lens Care

Terminology

Understanding  
Lens Care Components

Multipurpose systems

## Solution components

- Surfactants/Cleaning agents
- Chelating/Sequestering agents
- Buffers
- Antimicrobials/Biocides/Disinfectants/Preservatives
- Salts
- Demulcents
- Lubricants/Wetting agents

## Other Care Modalities

- Radiation, UV
- Thermal

## New Products

### Biotrue (Bausch + Lomb)

- Matches the pH of healthy tears
  - sodium borate and boric acid (7.4-7.6)
- Utilizes lubricant naturally found in eye
  - hyaluronan/ hyaluronic acid
    - glycosaminoglycan (mucopolysaccharide)
- Keeps beneficial tear proteins (lysozyme and lactoferrin) active
  - Enhances antimicrobial activity
- Dual disinfection:
  - Polyhexamethylene biguanide (PHMB)
  - Polyquaternium-1 (PQ-1)



### RevitaLens OcuTec (Abbott Medical Optics)

- Dual disinfection:
  - Alexidine dihydrochloride (biguanide)
  - Polyquaternium-1 (PQ-1)
- Sodium borate (buffer)
- Tetronic 904 (block copolymer surfactant)→lubrication
- EDTA (chelant)→decreases deposit formation adds to antimicrobial properties



### OPTI-FREE PureMoist (Alcon)

- Same as RepleniSH:
  - Cleaning (Citrate/Tetronic 1304)
  - Disinfecting (POLYQUAD .001%)
- New:
  - Disinfecting (Aldox .0006% vs. .0005)
  - Chelating (added EDTA)
  - Wetting Agent (HydraGlyde Moisture Matrix vs. TearGlyde)



## HydraGlyde (EOBO)

- poly (oxyethylene)-poly (oxybutylene)
  - Di-block copolymer
  - ARVO 2010: reduced the surface and bulk hydrophobicity and improved the hydrophilic properties of SiHy lenses
  - Polyethylene oxide=hydrophilic: carries water to the hydrophobic lens sites not wetted by the tear film
  - BO chains target silicone; surround hydrophobic groups, leaving the surface wettable

## Menicon Deluxe Care System

- Menicon Unique pH (formerly Alcon Unique pH):
  - **daily** multipurpose solution for cleaning, conditioning, and disinfecting. Rub and rinse.
- Menicon PROAGENT
  - **biweekly** intensive cleaner, soaked w/o digital rub, to remove protein deposition and provide disinfection. Previously available in the US for in-office use only, now FDA-cleared for home use with practitioner approval.
- Menicon Rewetting Drops
  - **As needed**, either before or during lens wear; rebranded and available in a 10 ml bottle.

## Menicon Sales Model

- Not available through traditional drug, food or mass merchandisers
- WebStore: patients register online and receive their solutions through the mail
- Practitioners stock and sell the care system themselves



## Ocusoft Lens Care System (Ocusoft, Inc./ Essentia Pharma, LLC)

- 3% hydrogen peroxide
- Lubricating agent
- No added preservatives
- Limited retail availability:
  - dispensing from doctor's office
  - direct patient order: [www.ocusoft.com](http://www.ocusoft.com)

## GP Lens Care includes

- Surface cleaning/debulking of debris
- Disinfection
- Surface conditioning
- Cushioning
- Wetting/rewetting
- Lens storage & case care

## Care for GPs and the Newest CL Designs and Materials

## Surface Cleaning

### Rub & Rinse to remove

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- Dirt and microbes
- Tear debris
- Eye area cosmetics
- Facial/hand creams
- Rub & Rinse prepares lens surface for disinfection and surface conditioning

## Inadequate Surface Cleaning

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- Inadequate cleaning results in
  - hydrophobic surfaces
  - irregular surfaces
  - debris attachment cycle
- Results in decreased vision, comfort and wearing time

## Surfactants

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- Surfactants are amphiphilic surface acting agents
  - Posses hydrophilic heads and hydrophobic tails components
  - Ability to attach and solubilize various debris

## HCL/GP Cleaners

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- Abrasive
  - Boston Cleaner
- Mildly Abrasive
  - Alcon Opti-Free
  - Boston Advance
- Non-Abrasive
  - Optimum by Lobob
  - Extra Strength Cleaner (Walgreens, Sereine)

## What should be used to rinse off daily cleaners?

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- Water
  - tap / filtered
  - bottled
  - distilled
- MPS
- Saline
  - multidose
  - unit dose
  - aerosol

## Rinse to remove detergents/cleaning agents and debris

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- Water
  - Inexpensive; promotes thorough rinsing
  - How clean is the water?
    - microbes
    - minerals
    - ? other contaminants

## Rinse to remove detergents/cleaning agents and debris

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- Saline/MPS
  - Expense
  - Tendency to under-rinse
  - Multi-dose salines - contamination concerns
  - MPS - additional preservatives and other chemicals

## Gas Permeable Lens Care Products

All-in-One MPS  
or  
Care System ?

## Multipurpose All-in-one Solutions

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Cleaning, disinfecting,  
soaking, wetting

- Simplus (B+L)
- Unique pH /
  - Opti Free GP (Alcon)

## Unique pH (Menicon) Opti-Free GP (Alcon)

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- Polyquaternium-1 preserved @ 0.0011% & EDTA
- Hydroxypropyl guar, PEG, PG, boric acid
- viscosity adjusts with pH
  - $\uparrow$ pH =  $\uparrow$ viscosity
  - $\downarrow$ pH =  $\downarrow$ viscosity
- Can add Opti-Free Suprac lens Daily Protein Remover if needed
- Rub & rinse lenses **prior** to application!

## Boston Simplus (B+L)

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- Contains poloxamine to remove dirt & repel deposits from lens surfaces
- Hydroxyalkylphosphate (HAP) for protein removal
- Chlorhexidine & PAPB for disinfection
- Glucam-20 & Hydroxypropylmethyl Cellulose (HPMC)
  - Cushioning on insertion
  - Uniform wetting
- No evening rub; + **Morning rub n rinse**

## GP Care *Systems*

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- Boston
- Boston Advance
- Optimum
  - ESC, CDS, WRW
- Menicon
  - CDS, WRW

## Optimum (Lobob)

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- 3 part system
- Separate:
  - Extra strength cleaner
  - Cleaning, soaking, disinfecting
  - Wetting/Rewetting

## Optimum (Lobob)

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- CDS solution must be rinsed from the lenses prior to lens application
- Water or saline is recommended by package insert

## Optimum (Lobob)

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- Cleaning/ Disinfecting/ Storage= CDS
  - benzyl alcohol 0.1%, disodium edetate 0.5%, surfactants
- Rewetting Drops= WRW
  - benzyl alcohol 0.1%
  - disodium edetate 0.5%
  - sorbic acid 0.05%
  - PVA, PVP, mc

## Boston Advance Conditioning Solution

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- PAPB 0.0005%
- Chlorhexidine 0.003%
- Polyquaternium 10
- PVA, EDTA, buffers, salts

## 'spare set' GP Lens Storage

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### Lens Storage

- If stored wet:
  - Re-clean and change solution at least weekly
- store dry for long term storage, and repeat disinfection cycle prior to lens wear (4 h)

## Peroxide Disinfection of GP lenses



## Hydrogen Peroxide

### Mode of action

- $\text{H}_2\text{O}_2 \Rightarrow \text{H}_2\text{O} + \text{O}_2$ 
  - produces free radical superoxide, which is toxic to microbes;
  - damages DNA
- strong oxidant
- not affected by organic matter
- removes proteins & lipids from lens surfaces

## Hydrogen Peroxide Disinfection Systems

- Catalase enzyme neutralized (Oxysept)
  - full 3% strength for >20min; delayed neutralization
- Catalytic disc neutralized (AOSept, ClearCare, Sauflon)
  - decreasing peroxide concentration
  - age of disc determines if neutralization occurs in a few minutes or several hours

## Clear Care (Ciba)

- 3% hydrogen peroxide in saline
- platinum disc neutralization
- no rub; one step
- pluronic 17R4 as cleaning agent
- Potential for toxicity from un-neutralized peroxide
- Patients often prefer to rinse prior to lens insertion
- Use wetting agents in am

## Peroxides

- Very effective, and preservative free
- For daily use; not for occasional CL wearers
- Caution patients not to store 'spare lenses' in neutralized peroxides
- Most common problem is toxicity from non/insufficiently neutralized  $\text{H}_2\text{O}_2$

## $\text{H}_2\text{O}_2$ Case Care

- Always
  - Use fresh solution *Daily!*
  - Air dry
  - Do not store 'spare' lenses in wet case



## Boston® Laboratory Lens Cleaner

### Additional Cleaners

FEATURES	PROVIDES	CLINICAL ATTRIBUTES
Combination of powerful surfactants	◊ Quick, effective, cleaning of lens surfaces	◊ Clean, comfortable GP lenses ◊ Helps lens surfaces to wet fast and completely
2-propanol 10%	◊ Thorough removal of manufacturing residuals ◊ Removes stubborn deposits from difficult-to-clean lenses	◊ Ensures excellent initial wetting and good vision ◊ Helps to resolve heavy deposit and lens contamination problems

### Enzymatic Cleaners

- Papain (papaya)
  - no longer available
- Pancreatin (porcine protease)
  - Supracleans
- Subtilisin A (endopeptidase from *B.subtillis*)
  - Ultrazyme, Boston one-step liquid enzyme, Unizyme

### Progent (Menicon)

A= sodium hypochlorite

B= potassium bromide

- Mix A and B doses in the Progent vial
- Soak the lenses for 30 minutes (soaking over 30 minutes may discolor lenses)

### Plasma Treatment of GPs

- Plasma treatment is not a lens coating
- The treating of GP lenses with oxygen plasma is a very effective cleaning method to remove any remaining residues (e.g. oils, waxes) from the lens manufacturing process

### What is Plasma?

- Plasmas are the fourth state of matter, after solids, liquids and gases
- Plasmas are similar to gases, but their atoms are different as they are made up of free moving electrons and ions in neutral environment

## Tandem SCL + GP lenses combination (aka Piggyback)

## Contact Lens Care Piggyback

- For SCL/GP combined Tandem system:
  - Remove GP, clean with GP daily cleaner, rinse and store in MPS or peroxide
  - Do not use Boston Cleaner on Menicon or other surface treated materials
  - Remove SCL, clean, rinse and store in MPS or peroxide
  - In the morning, rinse & wet both lenses with MPS or PFAT prior to placing on eye
  - Do Not Allow GP Solutions to Come in Contact with SCL materials**



## Lens Wetting

Rewetting agents are surface-active chemical substances that increase the spreading and penetrating properties of a liquid by lowering its surface tension

## GP Wetting Drops

TABLE 1 Wetting Drops Approved for GP Lenses

Product Name	Manufacturer	Ingredients	Preservatives
Aquify Long Lasting Comfort Drops	Ciba Vision	Sodium hyaluronate, sodium chloride, sodium phosphate	Sodium perborate, stabilized with phosphoric acid
Blink Contacts	Abbott Medical Optics	Purified water, sodium hyaluronate, sodium chloride, potassium chloride, calcium chloride, magnesium chloride, boric acid	Stabilized oxychloro complex 0.005%
Boston Rewetting Drops	Bausch + Lomb	Cationic cellulose derivative polymer, polyvinyl alcohol, hydroxyethylcellulose	Chlorhexidine gluconate (0.0006%), edetate disodium (0.05%)
Cleer Plus lens drops	Alcon	Citrate and sodium chloride, Cles-100 (PEG-11 lauryl ether carboxylic acid), and Tetronic 1304	Edetate disodium 0.05% and Polyquad (polyquaternium-1) 0.001%
Complete Blink-N-Clean Lens Drops	Abbott Medical Optics	Purified water, sodium chloride, bromethamine as an emulsifier and buffer, hydroxypropyl methylcellulose, tylosin	Polyhexanethylene biguanide 0.0001%, and edetate disodium
Optimum WRW Wetting and Rewetting MeniCare GP WRW	Lobdell/Menicon	Polyvinyl alcohol, polyvinyl pyrrolidone, hydroxyethyl cellulose, sodium and potassium chloride, sodium carbonate, and sodium bisulfite 0.02%	Benzyl alcohol 0.1%, disodium edetate 0.1% and sorbic acid 0.05%
Refrak Contacts	Allergan	Carboxymethylcellulose sodium, sodium chloride, boric acid, sodium borate decahydrate, potassium chloride, calcium chloride, magnesium chloride, purified water	Stabilized oxychloro complex
TheraTears Contact Lens Comfort Drops	Advanced Vision Research	Carmellose sodium in purified water, hypotonic, borate buffer, sodium chloride, potassium chloride, sodium bicarbonate, calcium chloride, magnesium chloride, sodium phosphate	Sodium perborate

## In Office GP Lens Reprocessing

- surfactant cleaning / rinse
- $\geq 2$  hour soak in  $H_2O_2$ , followed by neutralization
- dry storage
- clean / rinse / wet prior to reuse

## Deposits

- Tear debris
- Make up
- Facial/hand creams
- Inadequate cleaning
  - Hydrophobic
  - Irregular surface
  - Debris attachment cycle

## Eyelid Disease

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Blepharitis and meibomian gland disease are more commonly a complication for contact lens wear than aqueous tear deficiency

## Scleral Lenses

### Scleral Lens Care

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- Cleaners
  - Optimum ESC (Lobob)
  - Boston Advance Daily Cleaner (B+L)
  - Instruct patients to rinse their lenses thoroughly so that no chemical residue remains on the lens surface

### Scleral Lens Care

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- Disinfection
  - Peroxides: ClearCare (Ciba), Oxysept (AMO)
  - Boston Advance Conditioner (B&L)
  - Optimum CDS (Lobob)
- morning saline rinse

### Scleral Lens Care

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- Filling Fluid Reservoir
  - Unit dose sterile saline (Addipak)
  - PFAT
  - No Preservatives, buffers, or ANYTHING else

### Surface Wetting

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Lens surface wetting may be enhanced and delay deposit formations by gently rubbing wetting agents (e.g. WRW, Simplus, Blink contacts) on anterior (outside) lens surfaces

## Hybrid Contact Lenses

### Duette™ (SynergEyes)

SynergEyes "highly recommends":

- Clear Care®

Duette™ also approved for use with:

- Aquify
- Express/Replenish
- Complete
- Renu



Patients must digitally clean their lenses daily.

- GP cleaners and solutions contraindicated
- Replace lenses q 6 mos.

### ClearKone™ (SynergEyes):

- Disinfection:
  - Clear Care® (Alcon)
  - Oxysept® Ultracare® Formula (AMO)
- Rinsing: only preservative-free saline, e.g. Unisol® 4 (Alcon)



### Hybrid Daily Cleaning

- Place the lens bowl-side up in the palm of the hand and apply a few drops of solution.
- With the pad of the finger, gently rub the entire lens in a circular motion against the palm of the hand.
- Rinse well in a steady stream of solution.



## Thick Soft CL for Irregular Corneas

### KeraSoft IC (UltraVision CLPL, Bausch + Lomb, Art Optical)

- Digitally rub \*between fingers\*
- If chemically disinfected, rinse thoroughly with fresh, sterile rinsing solution prior to placement on the eye
- Recommended products:
  - Daily Cleaner: Opti-Free Daily Cleaner (Alcon)
  - Rinsing Solution: Opti-Free PureMoist (Alcon)
  - Disinfecting Solution: Opti-Free PureMoist (Alcon)
  - Lubricant/Rewetting Drops: Opti-Free Express (Alcon)
  - Enzymatic/Protein Cleaner: Opti-Free Supracleans (Alcon)
  - Oxidation Systems: 3% H<sub>2</sub>O<sub>2</sub> with neutralizing disc

## NovaKone (Alden Optical)

- “compatible with any of the soft contact lens solutions on the market”
- Recommendations:
  - peroxide system
    - ClearCare
    - Oxysept
    - Sauflon
  - daily cleaner
  - enzymatic cleaner

## Industry News and Information

## International Prescribing and the U.S. Market

## Private Label Contact Lens Solutions

## What’s in the Bottle?

## Recent History of the Alcohol-based daily cleaner

- MiraFlow (CIBA) d/c January 2010
- CVS brand d/c 2011
- Walgreens Extra Strength Daily Cleaner (Optikem International, Sereine)
  - Same ingredients as MiraFlow:
    - isopropyl alcohol, purified water, poloxamer-407, and amphoteric-10
  - CIBA: NOT a private label MiraFlow
  - no data on whether it has the same or similar efficacy profile as MiraFlow

## Industry impact on CL care products

- CIBA-Alcon merger
  - April 11, 2011: Swiss drugmaker Novartis and Alcon (Nestlé) completed their merger
  - Novartis ("CIBA") has become Alcon's majority owner with a 77% stake
  - Will spend \$4 billion on R&D in the next 5 years
  - Good-bye to ???

## Bacterial Contamination and Infectious Keratitis

## Lessons from the Keratitis Outbreaks

- As reported by The Ophthalmic Devices Panel of the Medical Devices Advisory Committee, 2008
  - Gromacki SJ. FDA Begins to Take Action Regarding Lens Care—Part 3. *Contact Lens Spectrum*, p. 27, Vol. 23, No. 2, February 2008.
  - Gromacki SJ. FDA Begins to Take Action Regarding Lens Care—Part 2. *Contact Lens Spectrum*, p. 22, Vol. 22, No. 12, December 2008.
  - Gromacki SJ. FDA Begins to Take Action Regarding Lens Care—Part 1. *Contact Lens Spectrum*, p. 29, Vol. 22, No. 10, October 2008.

## Limitations of the current regulatory testing methods:

- Stand Alone: no lens or case
- Regimen: only 2 lens types:
  - One Group I
  - One Group IV

## New Testing Methods should include:

- silicone hydrogel CL
- more diverse and representative set of infectious organisms, including *Acanthamoeba*
- "real world" scenarios
  - noncompliant care/ solution evaporation
  - clinical isolates
  - contact lens and case

## Strategies to prevent microbial keratitis

## Contact Lens Wear

- Contact lens wear is not a sterile event, but it should be a clean one
- Consider:
  - Our eyes are not sterile
  - Our fingers are not sterile
  - Only new lenses are sterile – until they are touched

## Prevention

- However, just killing microbes is not the answer
- Proper handling and personal hygienic practices remain important aspects of prevention

## Recommendations

### Lens Care

- Wash hands
- Replace lenses as prescribed
- Do not store opened, old ‘spare’ lenses; spare lenses should be in unopened original containers
- Rub-n-rinse daily
- Use fresh solutions daily
- Do NOT top-off

## Recommendations

### Case Care

- Empty/rinse daily
- Clean case with mild detergent and hot water; alternatively H<sub>2</sub>O<sub>2</sub>
- Rub / Air dry daily
- Scald with freshly boiled water weekly
- Replace often

## United States Food and Drug Administration (FDA) Activities

- Guidance document regarding “no-rub”
- The International Organization for Standardization (ISO) “ring test” of a new methodology to augment the current testing for contact lens care products
- Results of *Acanthamoeba* growing, harvesting, and cyst-forming experiments (to eventually incorporate it as a test organism)
- Established a Group 5 classification for silicone hydrogel materials—and its further subdivision based on ionicity, water content and surface tx

## New Research in Contact Lens Care and Compliance

- “Research from the 2011 American Academy of Optometry Annual Meeting.” *Contact Lens Spectrum*, Vol. 25, No. 12, December 2011. (upcoming)
- “New Research on Compliance.” *Contact Lens Spectrum*, p. 21, Vol. 24, No. 12, December 2010.
- “Make Case Care a Priority in Your Practice.” *Contact Lens Spectrum*, p. 23, Vol. 24, No. 8, August 2010.
- “Standards of Contact Lens and Case Hygiene.” *Review of Cornea and Contact Lenses*, pp. 20-22, Vol. 147, No. 4, May 2010.

## From Academy 2012

## Global Contact Lens Care Summit

- Seattle, Washington; November 2011
- History, present and future of lens care research, standards and formulations
  - didactic presentations, debates and interactive panel discussions
- Participants:
  - Representatives from all the major lens and lens care companies
  - FDA staff
  - Leading optometric researchers and clinicians from around the world
- Primary outcomes of the meeting will be published via a peer-reviewed manuscript in *Contact Lens and Anterior Eye* (CLAE)

Gromacki SJ. A Lens Care Summit Overview. *CL Spectrum* 2012;28(3):25.

## Biofilms

- “a microbial community” that can aid in bacterial adhesion and colonization by secreting substances that act as a scaffold
- May contain multiple species of organisms and can render resistance to the biocide properties of lens care products
- Relevance for CL wearers:
  - Case contamination
  - CL surface contamination

## The Contact Lens Case



Gromacki SJ. Making a Case for Clean Cases. *Contact Lens Spectrum*, 2006;21(SI):12-13.

Gromacki SJ. Protecting Your Patients from *Acanthamoeba* Infection. *Contact Lens Spectrum*, 2008;22(2):23.

## The Contact Lens Case

- Antimicrobial case
  - Pro-Guard (MicroBlock, CIBA)- polypropylene infused with silver ions
    - silver is gradually released as the case is exposed to moisture
    - interferes with DNA cellular respiration, and enzyme conformation of pathogens
  - I-Clean cases (Amcon Laboratories)
  - In progress: antimicrobial material to coat CL cases
    - \$300,000 Australian Research Council Linkage Grant, Brien Holden Vision Institute and the University of New South Wales, Sydney

## Five steps to cleaner cases:

- Always wash your hands before applying or removing CL, incl. open or close storage case
- Discard used solution immediately
- Rinse case thoroughly, incl. lids with disinfecting solution
- Air dry case with lids open
- Replace lens case at least four times/year.

Source: American Optometric Association



## Cases

- LensAlert (Watch Dog Group LC)
  - # days replace lenses
  - # days replace case
- 2 cases included
- Alarm



## Compliance Rates and Consequences

## Predicting Noncompliance

- The only independent significant factor predicting noncompliance with CL compliance:
  - risk taking propensity

Carnt N, Keay L, Willcox M, et al. Higher risk taking propensity of contact lens wearers is associated with less compliance. *Cont Lens Anterior Eye*. 2010 Nov. [Epub ahead of print]

## Strategies to Improve Compliance

Gromacki SJ. Promoting Adherence to Your Prescribed Care Regimen, Part 2. *Contact Lens Spectrum* 2010;24(2):21.

Gromacki SJ. Solution Confusion. *Review of Cornea and Contact Lenses* 2010;147(1):22-25.

"Promoting Adherence to Your Prescribed Care Regimen, Part 1." *Contact Lens Spectrum* 2009;23(12):19.

## The Healthy Soft Contact Lens Habits Guide (AOCLE)



## Prescribe a Solution

- "Prescribe," not recommend
- Dispense a complimentary care kit
- Write your prescription on an Rx pad
- Provide a detailed written handout with the solution name
- Review the advantages of prescribed product
- "If you deviate from this solution, you run the risk of compromising comfortable, long-term wear."
- Communication is the key!



The Future is Bright!



Thank you!