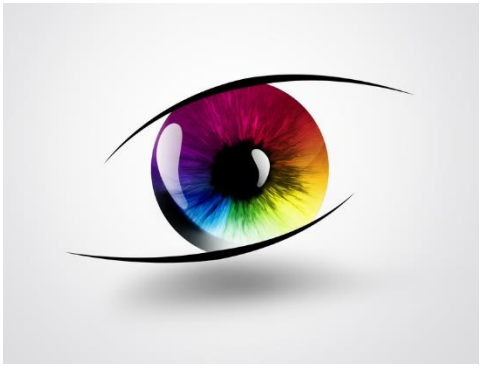
GP Lens Care and Patient Education

The material contained in this course is provided courtesy of
Edward S. Bennett O.D. and Vinita Allee Henry O.D.
Clinical Manuel of Contact Lenses



The ability to care for and handle rigid gas-permeable (GP) contact lenses properly depends on several factors. First, the patient must be provided with several methods of insertion and removal, and proficiency in these methods must be demonstrated before leaving the office. Second, the patient must be aware of the function of each solution in the recommended care regimen, the importance of performing each function properly and regularly, and the basis for which other solutions are not compatible with the particular material. Third, several methods should be provided to both educate the patient and reinforce the education. The patient must know the "do's and don'ts" of the newest GP lenses; in other words, the patient must recognize the limitations of the lenses and the problems that can occur through noncompliance. The purpose of this course is to provide an overview of the ways in which these important factors can be satisfied, thereby enhancing the probability of patient success.

Care Regimen

Wetting and Soaking

The majority of solutions used for wetting and soaking GP lenses combine several functions into one solution.
These solutions have four major functions:

1. To temporarily enhance the lens surface wettability
2. To maintain the lens in a hydrated state similar to that achieved on the eye
3. To disinfect the lens
4. To act as a mechanical buffer between the lens and cornea

The specific formulation of the ingredients in these solutions, especially the preservatives and wetting agents, is very important.

Preservatives

Preservatives are capable of either killing microorganisms (bactericidal agents) or inhibiting their growth (bacteriostatic agents). They are the active ingredients in these solutions (and all other GP care solutions) that should perform the following functions:

- Provide the necessary degree of disinfection
- Preclude toxic reactions
- Avoid adverse effects on lens surface wettability and parameters
- Enhance compatibility with the tear film

There are numerous preservatives currently in common use, all differing in their mode of action and effectiveness. The most common preservatives include benzalkonium chloride (BAK), chlorhexidine, thimerosal, ethylenediamine tetraacetate (EDTA), polyaminopropyl biguanide (PAPB), polyquarternium-1 (polyquad), and benzyl alcohol.

Benzalkonium Chloride:

Benzalkonium chloride is a quaternary ammonium compound that is effective against a wide spectrum of bacteria and fungi and normally is used at a concentration of 0.004%. It was first introduced as a preservative in the late 1940s and is currently used in the majority of ophthalmic preparations. The effectiveness of BAK is enhanced when it is used in combination with EDTA, allowing a lower concentration than otherwise necessary. It is not used as a preservative with soft lens solutions because the soft polymer will bind the preservative and actually concentrate it, thereby allowing it to potentially reach toxic levels and cause ocular injury.

Preservatives

Chlorhexidine is bactericidal in action and traditionally has been used in a concentration of 0.0005% in soft lens chemical disinfection solutions. However, unlike soft lenses, the binding capacity of chlorhexidine to GP lenses appears to be limited because of the wettability of GP lenses and chlorhexidine's large molecular structure. Though chlorhexidine has been reported to have an excellent spectrum of antimicrobial activity, it has limited effectiveness against yeast and fungi; therefore, it often has been combined with EDTA for greater effectiveness. In addition, chlorhexidine has been found to be relatively ineffective against Serratia marcescens.

Thimerosal is a bactericidal organic mercurial compound that at one time was a commonly used soft lens solution preservative. However, some patients are sensitive to organic mercurial compounds and experience a burning sensation and associated clinical signs of redness and superficial punctate keratitis.

In addition, it is slow-acting in nature and, in low concentrations, may be ineffective against Pseudomonas. Although thimerosal has been found to be compatible with GP lenses, exhibiting only rare sensitivity reactions, for optimal antimicrobial effectiveness it should be used in combination with another preservative such as chlorhexidine. It has largely been eliminated from contact lens care systems.

Ethylenediamine Tetraacetate: EDTA is a chelating agent and not a true preservative. However, it is commonly used in combination with BAK because of its synergistic ability to enhance the bacterial action of pure preservatives against Pseudomonas.

Polyaminopropyl Biguanide: PAPB has been used as a preservative in soft disinfection regimens because of its low sensitivity rate. It has supplemented chlorhexidine as a preservative in one of the GP care systems because it exhibits greater antimicrobial effectiveness, notably against Serratia. However, in the concentration used in GP lens solutions, which is 30 to 50 times the concentration used in soft lens solutions, the potential for toxicity reactions has been documented. However, when reduced in concentration by one-third, it has demonstrated excellent antimicrobial activity in comparison with other systems. It has also demonstrated effectiveness against Acanthamoeba.

Poiyquaternium-1: Polyquaternium-1 is a large cationic (+) polymer that also is similar in molecular structure to chlorhexidine. The quaternary ammonium group has a lower cationic (+) charge than polyhexamethylene biguanide and, as a result, is used at higher concentrations. It is less likely to produce toxic or allergic reactions than previously developed preservatives such as benzalkonium chloride and thimerosal.

Benzyl Alcohol: Benzyl alcohol originally was considered for use as a solvent for contact lens materials; however, it was also found to have good disinfection capabilities. Pure benzyl alcohol possesses certain physicochemical characteristics that are regarded as ideal for an ophthalmic preservative, including low molecular weight, bipolarity, and water solubility. Benzyl alcohol exhibits negligible binding to the surface of GP lenses, especially fluoro-silicone/ acrylate (F-S/A) lens materials. In addition to its properties as a disinfectant, benzyl alcohol is effective in lipid removal.

Storage and Disinfecting Solutions

Storage and Disinfecting Solutions		
Manufacturer	**Name**	**Preservatives**
Bausch & Lomb	Boston Advance Comfort Formula Conditioning Solution	Chlorhexidine gluconate
Bausch & Lomb	Boston Conditioning Solution	Chlorhexidine gluconate

All commonly used preservatives in GP lens solutions appear to be safe and exhibit far fewer sensitivity reactions than soft lens disinfecting solutions. Certainly, it is possible for an occasional patient to exhibit a sensitivity reaction to any one of the aforementioned preservatives. This sensitivity is manifested, as with any allergic reaction, in the form of itching, burning, and redness. If this reaction occurs, it is often eliminated by switching to a care regimen using a different preservative.

Wetting Agents

Wetting/soaking solutions typically contain either polyvinyl alcohol or a methylcellulose derivative as a wetting agent. Polyvinyl alcohol has several properties that make it a beneficial additive to GP lens solutions. It is water soluble and is relatively nonviscous and nontoxic to ocular tissues. It has good viscosity-building properties and exhibits good spreading and wettability on the eye and lens surfaces. Also, unlike methylcellulose, polyvinyl alcohol does not retard regeneration of corneal epithelium. Methylcellulose derivatives have been used successfully as wetting agents in more viscous GP solutions.

Cleaning

Several types of cleaners are available for use by GP lens wearers, including nonabrasive surfactants, abrasive surfactants, and surfactant soaking solutions, enzymes, and laboratory cleaners.

Nonabrasive Surfactants

GP cleaners and traditional hard lens cleaners may contain nonabrasive surfactant (detergent) cleaning agents to remove contaminants (e.g., mucoproteins, lipids, and debris) from the lens surface. The use of digital pressure or friction during the cleaning process is important in removing deposits from rigid lenses. Optimum Extra Strength Cleaner (Lobob Laboratories, Inc.) is an example of a nonabrasive surfactant lens cleaner.

COMBINATION SOLUTIONS		
Manufacturer	**Name**	**Preservatives**
Menicon	Unique pH Multipurpose Solution	Polyquaternium-1
Lobob	Optimum by Lobob	Benzyl alcohol
Bausch & Lomb	Boston Simplus Multi-Action Solution	Chlorhexidine gluconate polyaminopropyl biguanide

Abrasive Surfactants

Abrasive particulate matter has been used in cleaners as an effective adjunct in removing adherent mucoproteinaceous deposits. The daily use of abrasive cleaning regimens can be more effective than the use of nonabrasive cleaners. However, two problems have been described with abrasive cleaners. First, small surface scratches have been observed under high magnication. Second, inducing minus lens power while reducing center thickness can result. These problems have been minimized by the introduction of small-particle abrasive cleaners; however, abrasive lens cleaners may be contraindicated for lens materials with hyper-oxygen permeability (Dk) as well as for lens materials that have been plasma treated.

Surfactant Soaking Solutions

GP lens care systems have traditionally embraced two-bottle regimens composed of separate cleaning and soaking solutions. One-bottle GP systems are a more recent innovation and combine these procedures. These solutions use surfactant soaking, intended to dissolve deposits during the overnight soaking cycle; therefore, little digital pressure is necessary and warpage is less likely. Optimum Soaking Solution (Lobob Laboratories, Inc.) contains nonabrasive surfactants; it is used for both cleaning and disinfection. It should be rinsed before insertion to remove the benzyl alcohol and to facilitate the mechanical removal of lens debris.

WETTING AND LUBRICATION SOLUTIONS	
Manufacturer	**Name**
Bausch & Lomb	Boston Rewetting Drops
Lobob	Optimum by Lobob Wetting & Rewetting drops (WRW)
Menicon	Menicon (WRW) drops

Enzymatic Cleaners

The use of a weekly enzymatic cleaning regimen for GP lens wearers has been proven to be a beneficial adjunct to surfactant cleaning in protein removal from the lens surface. In addition, enzyme use has not been reported to cause any adverse effects for GP lens wearers.

More recently developed protein removal products are in liquid, rather than tablet, form and may be used with the manufacturers' accompanying storage solution. Boston One-Step Liquid Enzymatic Cleaner (Bausch & Lomb) is added to the storage solution weekly, whereas SupraClens (Alcon Laboratories, Inc.) is added to the storage solution daily. Both products should be rinsed before insertion. Boston One-Step is composed of subtilisin; SupraClens is a pancreatin derivative. Both products are designed to promote patient compliance and meet the patient's desire for convenience.

Laboratory Cleaners and Solvents

Professional strength laboratory cleaners and solvents have largely been replaced by formulas that can also be used by the patient at home, such as Menicon PROJENT Protein remover, which was reformulated for at home use. GP lenses are now coated with a water soluble wax prior to shipping, which protects the lenses from minor scratches or other damage while in transit. The old wax coating was not water soluble and needed a laboratory strength cleaner with citrus. Still in use is Boston Laboratory Lens Cleaner which uses alcohol as an ingredient.

Plasma Treatment

Plasma treatment for GP lenses removes residue from the manufacturing process and imparts an ultra-clean lens surface. This can enhance lens wettability, patient comfort and vision, particularly upon initial dispensing and early lens wear. Plasma treatment is applied at the discretion of the laboratory or practitioner.

Rewetting and Relubricating

A solution that is used to rewet a GP lens surface while it is still on the eye should perform the following functions:

- Rewet the lens surface
- Stabilize the tear film
- Rinse away trapped debris
- Break up loosely attached deposits

Ideally, this solution should clean the lenses of any debris while rewetting them for an extended period. Because the key to rewetting a GP lens is contact time, polyvinyl alcohol (PVA) is often added to increase the length of contact time. Some solutions contain hydroxyethylcellulose, methylcellulose, or other cellulose derivatives to aid surface wetting by increasing viscosity. Several rewetting solutions also contain a mild, nonionic detergent to loosen and solubilize mucus and debris and keep it from adhering tenaciously to the lens surface. Some available rewetting/relubricating drops formulated specially for GP lenses are listed in the previous table.

Dispensing Visit

Procedures

Knowledge about the available care regimens and their respective functions, applications, and benefits becomes especially important at the dispensing visit. Before dispensing new lenses to a patient, it may be beneficial to apply fluorescein dye to the tear film to rule out any baseline staining with the biomicroscope. Once GP lenses have been inserted, an adaptation period is necessary before performing any test procedures. When the patient's awareness has decreased and he or she is able to gaze in the straight-ahead position with minimal difficulty (a variable period, typically 10 to 45 minutes), visual acuity and lens evaluation can be performed. The use of a topical anesthetic immediately before initial lens application may result in the ability to assess both vision and the lens-to-cornea fitting relationship much more readily.

Visual Acuity

The patient's vision should be assessed. Biomicroscopy should then be performed to evaluate lens position and surface wettability. If both good lens centration and surface wettability are present, an overrefraction can be performed to determine the necessary additional correction.

Over refraction

If the visual acuity is equal to the expected value, typically a spherical over-refraction only is indicated. If a reduction of one line or greater is present, a spherocylindrical over-refraction should be performed. Diagnostic fitting is imperative for obtaining a proper fitt. In turn, a proper fitt gives best visual acuity and enhances patient motivation.

If an uncorrected cylinder that is not residual in nature is causing reduced visual acuity, overkeratometry should be performed to determine if the lens is flexing. If the keratometry readings are not spherical, flexure is present. This induced flexure can be minimized by selecting a flatter base curve radius (e.g., 0.50 D minimum) or increasing center thickness by a minimum of 0.02 mm.

Patient Education / Handling

Slit-Lamp Biomicroscopy

The use of a biomicroscope is essential for evaluating lens centration, lag, fluorescein pattern, and surface wettability (although a Burton lamp would be a valuable adjunct for assessing fluorescein pattern). The lens-to-cornea fitting relationship initially should be evaluated using a wide beam with low-intensity white light and low magnification to scan the lens surface. In addition, the lens can be evaluated for regions of poor wettability or hazing.

If the patient experiences variable visual acuity in combination with poor initial wettability, this problem can be minimized by pre-soaking the lenses for at least 24 hours to precondition the surface before insertion. If poor wettability is present after presoaking the lenses, an in-office cleaner can be used or approved laboratory solvents should eliminate the problem. Polishing the front surface of the lens also may be beneficial; however, this should be performed after the lens is initially cleaned with an in-office cleaner and only if the lens has not been plasma treated.

Comprehensive evaluation of the fluorescein pattern is also important. Is the pattern similar to that observed at the diagnostic fitting visit? The use of high illumination, low magnification, and a moderate-to-wide beam width with cobalt filter should be beneficial when observation is by biomicroscope. If there is difficulty in observing the pattern, a Wratten No. 12 or similar filter can be used, especially if the lens material contains an ultraviolet inhibitor. In addition, if lower magnification is necessary to evaluate the pattern accurately, or to view both eyes simultaneously, a Burton lamp can be used.

Initial Patient Education / Handling

In addition to a great fit that provides excellent visual acuity, patients will remain motivated when taught how to handle and care for the GP lenses.

The key to teaching patients to successfully handle GP lenses is reassurance. No matter how frustrating it might be to the ECP, that feeling of frustration must not be conveyed to the patient. The instructions must be provided slowly and one at a time. Performing group instruction is distracting and denies the patient the necessary one on one personal instruction. Feelings of failure and surrender may result, possibly leading to the attitude that contact lenses will never be worn. However, if the patient feels confident about handling the lenses, a perception of satisfaction and success is often present.

A minimum of three successful insertions and removals is recommended, although the number depends on how confident the patient feels. If it takes two or three visits for the patient to master lens handling, then be sure to schedule the visits closely together to maximize the patient’s remembrance of techniques and to minimize further anxiety.

Proficiency in application and handling is sometimes a problem with presbyopic patients, who not only are experiencing blurred vision at near, but also may have lived 40 or more years without having a foreign body placed on their eye, thereby increasing anxiety.

Insertion by the Patient: Insertion of lenses by the patient is a three-step procedure

Insertion of lenses by the patient is a three-step procedure. Patients should be instructed to insert and remove the lenses over a cloth or paper towel spread on a table (not over a sink drain). In addition, patients should be reminded to avoid oily substances such as hand creams, lotions, or cosmetics; and their hands should be washed and rinsed thoroughly prior to handling the lenses. It is important for both the practitioner and staff members to set a good example by washing hands before handling lenses in the office and requiring patients to do the same.

Positioning: The patient should be encouraged to use an adjustable mirror when inserting the lenses. This will help to ensure that the lens is positioned properly on the finger and to view the position of the lens; the latter is especially important because patients may consistently bring the lens in contact with the upper or lower lid.

Lid Retraction: For the right eye, the lens should be placed on the right index finger. The middle finger of the left hand should be placed over the upper lashes to lift up the upper lid. The middle finger of the right hand should be placed directly over the lower lashes to depress the lower lid. The ability to retract the lashes successfully is essential.

Placement: The patient should be looking straight ahead, typically at a mirror on a table or counter. Often, the new rigid lens patient will experience difficulty maintaining proper fixation as the lens approaches the eye; therefore, it is important to assure the patient that the lens will not damage the eye. Finally, once the lens has made contact with the eye, the patient should be instructed first to release the finger holding the lens, then the lower lid, and finally the upper lid. This procedure then can be performed in reverse for the other eye (i.e., use the index finger of the left hand for holding the lens, the middle finger of the right hand for holding the upper lid, and the middle finger of the left hand for holding the lower lid).

Insertion and Removal

Insertion by the Practitioner or Assistant:

The procedure is similar if performed by an office member. If the lens is to be placed on the right eye, the lens will be placed on the index finger of the right hand, with the left middle finger holding the upper lid and the right middle finger holding the lower lid. Because the patient may become especially apprehensive with someone else inserting the lens, it is very important to apply pressure underneath the lashes to ensure that they will not move during this process. In this case, the patient can be instructed to view a distant target, for example, a letter on the acuity chart.

Removal by the Patient: There are at least three methods of removing a GP lens. Which method is used depends on such factors as lid tension, lens design, and personal preference.

The easiest method is to use the index finger of the same hand as the eye from which the lens is to be removed to eject the lens. The finger is placed at the junction of the lateral edge of the lids. With the eye opened wide, the lids are pulled laterally; at the same time, the patient blinks and the lens should be ejected. This procedure can be performed with both the middle and index fingers of the same hand to enhance the possibility of lens ejection. The other hand can be positioned underneath the eye to catch the lens if it fails to adhere to the lower eyelashes.

For patients who experience difficulty with the first method because of such factors as loose lid tension, low edge lift, and large overall lens diameter, a more forceful method to remove the lens is to use both hands. The middle and index fingers of the same hand are positioned over the lower lid; the middle and index fingers of the opposite hand hold up the upper lid. As with the first method, the lids are pulled laterally and, while the patient blinks, the lens is ejected. As with all methods of removal, the most important factor is allowing the lid margins to eject the lens. If the lids are not retracted properly (i.e., if the finger is not placed over the lashes), the lid can evert and, therefore, apply very little pressure toward ejecting the lens.

Another forceful method of removing the lens is to eject the lens with a vertical (not lateral) motion. The fingers are positioned as in the second method (i.e., fingers of the opposite hand holding the upper lid, fingers of the same hand positioned on the lower lid). The lower lid is pushed superiorly and the lens is then ejected.

Removal by the Practitioner: The same methods for removal by the patient can be used by the practitioner. In the first method, the lids are pulled laterally. In the second method (i.e., fingers of one hand holding the upper lid, fingers of the other hand positioned on the lower lid), the lens is ejected with a vertical motion.

The fear of being unable to remove a GP lens is perhaps the greatest cause of anxiety with a new wearer. Every patient should be able to remove his or her lenses easily before leaving the office. Although the temptation exists to allow the patient to practice at home, this may eventually result in a frustrated and dissatisfied patient. Both practitioners and assistants should be skilled at all of these removal methods.

A suction cup should not be used as a crutch for patients unless the practitioner deems it essential. However, in an emergency situation in which a suction cup is unavailable, the patient’s head can be placed in sink filled with water and his or her eyes opened, allowing the lenses to dislodge from the eye.

Recentration: It is extremely important to demonstrate to new GP lens weare

Insertion and Removal

Cleaning

Patients should be told what specific brand of cleaning solution(s) should be used, when to use it, and how to clean the lens properly. Cleaning with a surfactant cleaner should be performed immediately upon removal at the end of the day, not before insertion the next morning. This is important in maintaining good surface wettability, because the lens is inserted directly from the wetting/soaking solution and debris is removed more easily after the lens has been in recent contact with the tear film. It is very difficult for any patient to exhibit compliance if the lenses are not cleaned upon removal and are placed in an empty case. Any mucoproteinaceous and other deposits may adhere to the lens surface if the lenses are stored dry; therefore, deposit removal will become more difficult to perform.

Cleaning should be performed carefully in the palm of the hand (not between the fingers). Excessive digital pressure can result in lens warpage or lens fracture, especially with the more flexible hyper-Dk lens materials. This has been shown to be a much greater problem in former polymethylmethacrylate (PMMA) wearers. These patients may be accustomed to lens care habits (i.e., cleaning between the fingers, storing in a dry state, carelessness in handling). An exception to the rule may, in fact, be the Menicon Z lens, which has been found not to exhibit greater warpage when cleaned digitally versus in the palm of the hand. Patients should also be advised to rub their lenses, with the recommended cleaner or multipurpose solution, for a minimum of 20 seconds after removal.

In general, patients should be warned about what can occur with noncompliance, and the proper cleaning techniques should be reviewed at the follow-up visits.

It is also important to note that patients should be told what not to use in cleaning the lenses and why. Former PMMA wearers may have used such products as baking soda, toothpaste, baby shampoo, or dishwashing liquid to clean their lenses. It should be emphasized that these products are not approved with GP lenses and may be both irritating and harmful to surface wettability.

Patients should also be warned of the so-called "left lens syndrome." This pertains to the problem of patients who clean the right lens first and more thoroughly than the left. Eventually, the left lens

becomes more deposit bound and problematic to the patient. Simply bringing this potential problem to the patient's attention should be sufficient to prevent its eventual occurrence.

In addition to a surfactant cleaner, the use of an enzymatic cleaner for one 2-hour cycle every week should be recommended with some patients. Both extended-wear and borderline dry-eye patients should be started with an enzyme cleaner. Other patients also may benefit from enzymatic cleaning, which can be provided once it has been established that surface deposits have become problematic.

Recommended Solutions

Every patient should know what solutions they can and cannot use with their lenses and why. For example, it must be emphasized that although other solutions may cost less and appear to have similar functions, changing to such a solution may cause redness, burning, and reduced surface wettability. The specific recommended solutions and any acceptable alternative solutions should be provided as part of the patient instruction materials. In addition, the progress evaluation forms should have a space for solutions such that patients can be asked to provide the brand names of their care regimens at each visit.

Every product in the care kit provided to a new GP lens patient should be explained to the patient as they pertain to everyday use (i.e., inserting, removing, cleaning and disinfection, etc.). The patient should then repeat the care instructions to ensure understanding and aid compliance. What the assistant and practitioner believe is common sense may be confusing to the patient. It cannot be assumed that every patient will carefully read and understand product labels and care instructions. If each product is explained and the patient still appears to be confused, the specific care instructions for each care product can be provided in written form. In addition, the function(s) of each bottle can be applied on a large label taped to the solution. The latter is especially beneficial for presbyopic patients who may experience difficulty with small print.

Rewetting or relubricating drops do provide some important functions with GP lenses. Specifically, these solutions can be used on an as-needed basis to rewet the lens surface while also rinsing loosely adherent debris off the lens surfaces.

Patients should be advised to always soak the lenses in the recommended disinfecting solution, not in the dry state. Soaking the lenses overnight has numerous benefits including the minimization of surface scratches, consistent and complete disinfection, good wettability and hydration.

If storing the lenses long term, disinfecting solution should not remain in the case for longer than 30 days without replacement. It has been found that contamination is an issue as solutions lose their effectiveness over time.

In addition, the patient should be advised against topping off their disinfecting solution. Instead of replacing the solution every night, the patient simply adds a small amount to top off what is already in the case. The resulting contaminated solution may cause potential sight-threatening ocular complications. Daily lens removal requires complete replacement of fresh solution every day.

Cases

A hard plastic, ribbed, and deep-welled case is recommended, both to allow sufficient solution in the wells and to minimize leakage. The more flexible, hyper-Dk lens materials can adhere to a smooth-welled case if placed improperly in the case (e.g., convex side up), possibly resulting in warpage caused by the force required to remove the lens from the case. In addition, lenses that adhere to the

bottom of a smooth-surface case may experience edge chipping from the excessive digital pressure needed to dislodge the lens. Both of these problems can be eliminated by using a case that has ridges or holes in the wells.

As the lens case can be a place for microorganisms to hide, it should be washed every morning and allowed to air dry, using a clean toothbrush in combination with soap or surfactant cleaner and water. The soap can be rinsed off with fresh saline and the case allowed to air dry.

Weekly cleaning, to include rinsing out the case with boiling hot water and allowing the case to air dry without replacing the tops, is also recommended. Patients should be encouraged to replace their case on a regular basis (i.e., every 1-3 months). To reinforce the importance of a clean case, a new one can be p

Infection

Bacterial infection is also a problem. A patient may transfer infectious organisms from the lashes to the mascara wand and then to the mascara tube, where they colonize. In addition, eyeliner should not be applied to the inner lid margin because it may clog the meibomian glands, possibly resulting in blepharitis, hordeolum, or chalazion.

Numerous cosmetic products on the market are recommended for contact lens wearers. They are water soluble and contain little, if any, fragrances or fillers. It is important to note again that cosmetics should be applied after lenses have been inserted.

Any cream or oil that is used on the face or hands can be transferred to the contact lenses, resulting in discomfort and blurred vision; therefore, these substances should be applied after the lenses have been inserted. Any contaminant or residual oils on the hands can be transferred to the lens and possibly be absorbed into the lens matrix. Hand soaps contain additives such as oils, perfumes, dyes, deodorants, and abrasives that can complicate the problem. The use of an optical-compatible hand cleaner developed specifically for contact lens wearers will minimize discoloration and deposit build-up on contact lenses.

Swimming

GP lens patients should be advised not to swim with their contact lenses unless they wear goggles. If a patient swims with the GP lenses but without goggles, he or she should know about the likelihood of lens ejection. Swimming in contact lenses may also place the patient at risk for infection. Likewise, with the recent concerns about Acanthamoeba keratitis, patients should be advised to insert their contact lenses after showering. It is due to the potential for contamination that the NCLE recommends the removal of contact lenses prior to swimming, showering, bathing and the use of a hot tub.

Education

Adaptation

Patients should be told that adaptation varies from person to person with an average of 10 to 14 days before the achievement of no lens awareness. This period can be estimated by how much tearing and discomfort is experienced at the dispensing visit. However, the patient should also know that it could last as long as 4 weeks in some patients. The patient should be reassured that comfort typically will improve on a daily basis. Avoiding the use of sensitizing words like pain and discomfort is helpful in reassuring the patient.

In addition, the patient should be told that, if lens wear must temporarily be discontinued (e.g., because of irritation or a lost lens), wearing time will need to be rebuilt gradually. A typical wearing schedule is below:

Day 1–4 hours
Day 2– 4 hours
Day 3– 6 hours
Day 4– 6 hours
Day 5– 8 hours
Day 6– 8 hours
Day 7– 10 hours
Day 8– 10 hours

Current all-day rigid lens wearers should be able to go immediately into a full 12-hour wearing schedule after receiving their new GP lenses. Some practitioners prefer to have daily-wear patients wear their lenses a minimum of 4 hours prior to their scheduled progress evaluation; therefore, it is important to schedule these visits in the afternoon or evening. Exceptions to this are GP extended-wear patients, who should be seen in the morning. Typically, orthokeratology patients are evaluated in the morning after the first night of wear and then later in the day for subsequent visits to monitor residual refractive error at the end of the day.

Progress visits for a new daily-wear patient should be scheduled as follows:

Visit one - 1 week after dispensing
Visit two - 1 month after visit one
Visit three - 3 months after visit two
Visit four - 6 months after visit three

After the 6-month visit, patients should be scheduled at regular 6-month intervals. For continuous-wear patients, visits should be scheduled as follows:

Visit one - 1 week after dispensing (daily wear)
Visit two - 24 hours after initiating extended wear
Visit three - 1 week after initiating extended wear
Visit four - 1 month after visit four
Visit five - 3 months after visit five

After the initial five visits, progress evaluations should be scheduled every 3 months for the extended-wear patient.

Patience Compliance

Several recent studies have found a low patient compliance rate with contact lenses in general. In fact, when over 1,400 lens wearers were asked to complete a 14-question compliance questionnaire, only 0.3% admitted compliance with all steps. Ocular complications associated with noncompliance are more common with soft lens wearers. However, GP lens wearers who do not comply with the recommended care guidelines may experience problems as well. Some of the more frequent causes of noncompliance problems with GP lens wearers include the following:

GUIDELINES TO MINIMIZE RISK OF ACANTHAMOEBA KERATITIS	
Solution Use	Use fresh disinfecting solution every day. Do not reuse or top off solution. Use only products recommended by your eye care practitioner. The use of saline solution (not intended for disinfection) and rewetting drops should not be used for soaking the lenses. Tap water should not be used in the wetting, rewetting, or soaking of contact lenses.
Care and Compliance	Always wash your hands before handling contact lenses. Always clean the lenses or at a minimum utilize a rub-and-rinse action upon removal.
The Lens Case	Replace the lens case, at minimum, every 3 months, although preferably every month. Rinse the case every day with sterile disinfecting solution, and allow to air. The lens case should be sterilized on a regular basis (weekly recommended), either via boiling the case in hot water or microwaving the case (in dry form) for 3 mins.
The Environment	Generally, do not swim while wearing your contact lenses if so, wear airtight goggles over the lenses if they are to be worn during swimming. Do not wear contact lenses while showering, while in a hot tub, or during exposure to well water.

Noncompliance Problems

Some of the more frequent causes of noncompliance problems with GP lens wear

1. Patient does not clean the lenses as often or as comprehensively as desired (if at all)
2. Patient does not adhere to the prescribed wearing schedule
3. Patient does not use disinfection solution or, if used, does not replace it regularly
4. Patient does not wash hands before handling the lenses
5. An inappropriate wetting solution such as saliva or tap water is used
6. Expired solutions are used
7. Case is not cleaned regularly
8. Patient substitutes originally recommended solution with another brand

One study found that approximately 50% of rigid lens care solutions were contaminated. In addition, a much higher percentage of patients who admitted noncompliance were found to have contaminated care regimens than compliant patients. It is important to note that all solutions that were <21 days old were uncontaminated.

Certainly, by optimizing patient compliance, the probability of ocular complications and liability problems will be minimized. A three-step approach has been recommended:

1. Inspect the lens care products that you use in your office or sell - look for contamination, tampering, and expired bottles
2. Assume patients know nothing; document your instructions and warnings in patient files

3. Inspect patients' solutions at follow-up visits, and question patients about any solution substitutions while reinforcing proper care procedures

A patient who is unable to remember the name of their care regime might have what is known as “solution confusion.” Reinforcing patient compliance will help to avoid this confusion.

One important problem resulting from poor compliance is the development of a microbial biofilm within the case, attached to the lenses and/or the solutions. Bacteria in a nutrient-deprived environment, such as the contact lens case, initiate a survival strategy to make them more resistant to disinfectants. The principal strategy is the development of a bacteria biofilm, which is a collection of bacterial cells in an exopolysaccharide glycocalyx slime secreted by the bacterial cell.

This glycocalyx slime can serve as protection for the bacteria against certain preservatives. A notable example is the resistance of Serratia marcescens against chlorhexidine. It has been found that PAPB's performance is superior to that of chlorhexidine- and benzalkonium-preserved solutions with respect to preservative efficacy and prevention of biofilm formation in contact lens cases. In addition, the combination of benzyl alcohol and a surfactant mixture should provide good effectiveness against biofilm formation. To minimize biofilm formation, cases should be designed with minimal hard-to-clean areas and replaced on an every 1- to 3-month basis as noted before. Disposing of cases on a regular basis may be as - or more - important than disposing of lenses as recommended. Microbial keratitis associated with a contaminated case is certainly possible.

Appropriate cleaning and disinfection practices should also be executed on a daily basis.

Summary

Gas Permeable (GP) lenses are viable and safe lenses provided that they are given proper care. An attention to detailed instruction and demonstration by the ECP at the time of dispense should lead to good patient compliance. In turn, good patient compliance will result in a happy, motivated and safe GP wearer.

Test Questions

1. _____ temporarily enhance the lens surface wettability.

- Wetting and soaking solutions
- Preservatives
- Benzalkonium chloride
- none of the above

2. _____ are capable of killing microrganisms.

- Wetting and soaking solutions
- Preservatives

- Non-preserved saline solution
- Non-abrasive surfactants

3. _____ was first used as a preservative in the late 1940s and is currently used in the majority of ophthalmic preparations.

- Benzalkonium chloride
- Thimerosal
- Benzyl alcohol
- Ethylenediamine Tetraacetate

4. _____ has several properties that make it a beneficial additive to GP lens solutions.

- Benzalkonium chloride
- Thimerosal
- Polyvinyl alcohol
- Ethylenediamine Tetraacetate

5. Unique pH Multiprupose Solution, Optimum by Lobob and Boston Simplus Multi-Action Solution are all:_____.

- combination solutions
- disinfecting solutions
- preservative solutions
- wetting solutions

6. Boston Advance Comfort Formula Conditioning Solution and Original Formula Boston Conditioning Solution are examples of:

- combination solutions
- disinfecting solutions
- preservative solutions
- storage and disinfection solutions

7. Opti-free Daily Cleaner, Original Boston Formula Cleaner, and Boston Advance are examples of:

- combination solutions
- disinfecting solutions
- preservative solutions

- daily cleaners

8. The use of a _____ for GP lens wearers has been proven to be a beneficial adjunct to surfactant cleaning contact lens.

- weekly enzymatic cleaning regimen
- surfactant soaking solution
- daily cleaner
- combination solution

9. A solution that is used to rewet a GP lens surface while it is still on the eye should perform the following functions:

- stabilize the tear film
- rinse away trapped debris
- break up loosely attached deposits
- all of the above

10. The use of a _____is essential for evaluating lens centration, lag, fluorescein pattern, and surface wettability.

- radiuscope
- biomicroscope
- keratometer
- lensometer

11. The following should be performed during the initial dispensing visit:

- visual acuity exam
- slit lamp biomicroscopy
- overrefraction
- all of the of the above

12. The key to teaching patients to handle GP lenses successfully is:

- reassurance
- repetition
- patience
- frustration

13. If the patient feels confident about handling the lenses:

- a perception of satisfaction and success of often present
- a feeling of frustration is often present
- they may leave the office with the lenses before they have demonstrated competence in insertion & removal techniques
- no further training is necessary

14. The patient should be reminded to:

- insert and remove the lenses over a cloth or paper towel spread on a table
- not work with lenses over a sink drain
- avoid oily substances such as hand creams, lotions, or cosmetics
- all of the above

15. The patient should be encouraged to use _____when inserting the lenses.

- a suction cup
- an adjustable mirror
- fluorescein
- disinfecting solution

16. Lens insertion by the patient is a three step procedure which includes:

- positioning the lens on the right index finger prior to insertion
- lid retraction
- placement on the eye
- all of the above

17. The easiest method used to remove a lens is:

- to irrigate the cornea with soaking solution
- to eject the lens with a vertical not lateral motion
- to use the index finger of the same hand as the eye from which the lens is to be removed to eject the lens.
- touse a suction cup

18. The fear of being unable to remove the lens is:

- perhaps the greatest cause of anxiety with a new wearer

- is never a cause of anxiety
- is unfounded
- can be alleviated by using a suction cup

19. It is very important for the new GP lens wearer to recognize:

- when a lens has been decentered off the cornea and how to reposition it
- when they should consider silicone hydrogel lenses
- fluorescein staining patterns
- when reading glasses become necessary

20. Cleaning with a surfactant cleaner should be performed:

- immediately upon removal at the end of the day
- prior to lens insertion first thing in the morning
- as a replacement to a weekly enzymatic cleaner regimen
- never

21. Cleaning should be performed:

- carefully in the palm of you hand
- between the fingers
- with excessive digital pressure
- after storing in a dry state

22. Which of the following should not be used when cleaning GP lenses?

- baking soda
- toothpaste
- baby shampoo
- all of the above

23. _____ can be used on an as-needed basis to rewet the lens surface while also rinsing loosely adulterant debris off the lens surfaces.

- soaking solution
- disinfecting solution

- rewetting drops
- cleaning solution

24. Patients should not allow their disinfecting solution to remain in the case for longer than _____days.

- 10
- 20
- 30
- 40

25. GP lens wearers should be warned about the softness of these materials. If not handled properly they can be subject to:

- scratches
- foreign body particles becoming trapped under the lens
- cosmetics which can cause discoloration and damage to the lens surface
- All of the above

26. Swimming with gas permeable lenses can result in:

- an increased likelihood of lens loss
- an increased likelihood of lens adherence
- nothing to be concerned with
- a decrease of gas permeability

27. Adaptation averages _____days before the achievement of no lens awareness.

- 1-2
- 2-10
- 10-14
- 15-30

28. The educational process should include _____instructions.

- written
- verbal
- audio-visual

- all of the above

29. Patient compliance is often reduced when the patient can't remember the name of the solution they need to purchase. This has been referred to as:

- solution confusion
- combination solution
- enzyme syndrome
- selection solution

30. All of the following are compliance issues which can cause problems with GP lens wear except.

- lenses are not cleaned as often or as comprehensively as desired
- patient does not adhere to the prescribed wearing schedule
- patient is given verbal, written, and audio visual instructions on care and maintenance of their lenses as well as insert and removal techniques
- expired solutions are used

31. What mercurial compound has largely been eliminated from contact lens care systems

- PAPB
- thimerosal
- polyquaternium-1
- benzyl alcohol

32. Which of these is not a benefit of using polyvinyl alcohol in a wetting solution

- it is non toxic
- it is water soluble
- it is non-viscous
- it does not exhibit good wettability

33. What laboratory cleaner was reformulated so that it can be used by patients at home

- Boston Laboratory lens cleaner
- PROJENT protein remover
- thimerosal
- Menicare (WRW) drops

34. What is one benefit of applying fluorescein dye to the tear film:

- to assess the lens rotation
- to look for lens damage
- to rule out baseline staining
- to evaluate visual acuity

35. Which biomicroscope filter can be used with a lens that contains an ultraviolet inhibitor in the material

- a cobalt blue filter
- a low magnification filter
- a Wratten #12 filter
- a green filter

36. Which of these can be used on a PMMA lens, but not on a GP lens

- salt
- baby shampoo
- acetone
- saliva

37. When should a GP lens patient apply cosmetics

- before putting on the contact lenses
- never
- after putting on contact lenses
- before or after makes no difference

38. Which of these is a noncompliance problem

- cleaning the case routinely
- using an expired solution
- washing hands before handling contact lenses
- cleaning the lenses immediately after removal

39. What is another good reason to clean and replace contact lens cases routinely

- to prevent contamination

- to minimize biofilm formation
- to prevent microbial keratitis
- all of the above are good reasons

40. Ocular complications associated with noncompliance are:

- eliminated due to multiple purpose solutions
- more common with soft lens wearers
- unseen in GP lens wearers
- always blinding events