Ever since contact lenses were first fitted, some patients have either chosen to, or been advised by their practitioner to sleep in them.

Many of the first glass haptic lenses fitted by, for example, the Mullers in the 1880s, were worn for up to two years at a time, and the literature contains many reports of patients wearing both haptic and hard corneal lenses on an extended wear basis prior to 1974. It was John de Carle, working in London, who first popularised hydrogel overnight wear with the Permalens. In 1981 hydrogel extended wear was approved by the Food and Drug Administration (FDA) in the US for cosmetic correction and the aggressive advertising and popularity of this modality led to its widespread acceptance in the US. For the purpose of this article, extended wear (EW) refers to six nights of continuous wear followed by a night of no lens wear, and continuous wear (CW) as up to 30 nights followed by a night of no lens wear.

**Key Points**

- The risks and benefits of overnight wear should be discussed between the patient and practitioner to help enable an informed choice to be made.
- Although the absolute risk of developing a serious adverse reaction to overnight wear is small, the relative risk in comparison to daily wear is significant with all lens types including silicone hydrogel lenses.
- Patient selection and lens trial is more critical. Overnight wear lenses should only be considered for ideal contact lens patients.
- It is critical that extended and continuous wear patients are carefully and frequently monitored throughout their contact lens wearing life, with regular aftercare checks.
- All overnight wear patients should be instructed to self-monitor their eyes daily, and to understand the procedures to follow should any variations from the norm be observed.
Hydrogel overnight wear lenses were typically worn for up to 30 nights then removed, cleaned and reinserted. By 1985, an estimated 4 million US patients were wearing lenses in this way. Early overnight wear research was conducted in an intuitive clinical manner with patient success being judged by the ability to continue to wear the lenses. As the 1980s progressed, the scientific interest in the mechanics and physiology of overnight wear grew. In particular, there was an increased understanding of the oxygen needs of the cornea and the effect of oxygen depletion to its structure.

It is now well established that lack of oxygen to the eye leads to corneal swelling (oedema). During normal closed eye sleep the cornea swells by an average of up to 4 percent. It is capable, however, of recovering 8 percent of swelling during the day and this became the target for hydrogel lenses.

The landmark study by Holden and Mertz in 1984 defined the levels of oxygen needed to avoid corneal oedema (Table 1). Further studies have shown the inability of the EW hydrogel lenses fitted at that time to meet these needs. While hydrogel materials are unable to achieve the criteria of zero additional swelling with overnight wear, some come close to the 8 percent level (zero residual swell) and gained regulatory approval for overnight wear. More recent research by Harvitt and Bonanno define the Dk/t levels as 35 and 125 for daily and overnight wear respectively. More recent research by Harvitt and Bonanno define the Dk/t levels as 35 and 125 for daily and overnight wear respectively.

Modern rigid gas-permeable lenses (RGPs) and silicone hydrogels (Si-Hy) allow sufficient oxygen to the eye to meet the zero additional swelling criteria (Table 2). Nevertheless, it is important to remember the closed eye environment differs from the normal open eye in several key factors (Table 3). As well as the issue of corneal hypoxia, early non-disposable hydrogel CW was also associated with more inflammatory reactions due to long-term deposit build up, and toxic reactions due to the intensive cleaning procedures required after 30 nights of wear. The introduction of weekly replaced disposable lenses in 1987 resolved these two issues. These lenses were worn for six continuous nights of overnight wear and referred to as ‘extended wear’.

### Critical corneal oxygen requirements

<table>
<thead>
<tr>
<th>% DW ODEMA</th>
<th>4% OVERNIGHT ODEMA</th>
<th>8% OVERNIGHT WEAR RESIDUAL ODEMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Dk/t (avg) (x10^-9) @20°C</td>
<td>24.1</td>
<td>87.0</td>
</tr>
<tr>
<td>Critical EOP (% atmospheric O2)</td>
<td>9.9</td>
<td>17.9</td>
</tr>
</tbody>
</table>

Further increases in the size of the EW market followed, particularly in the US. Disposable EW shows fewer overall complications, fewer unscheduled appointments and fewer patient symptoms than conventional hydrogel CW lenses. This was primarily due to the increased replacement frequency, resulting in few allergy-based reactions. The incidence of corneal infection with disposable EW remained the same, although reports suggested the severity of the infection may be less than that with non-disposable EW.

The growth of the EW market in the US was curtailed in 1989 with the publication and popularisation of a landmark study by Poggio and Schien. This was sponsored by the Contact Lens Institution (CLI), an industry trade association. The study showed EW patients to have an incidence of keratitis of 20.9 per 10,000 patient years, compared to 4.1 per 10,000 for soft daily wear patients. The relative risk of developing microbial keratitis (MK) was shown to be increased by factors such as smoking and wearing lenses for more than six consecutive nights. The relative risks of hydrogel EW versus daily wear have been verified in several studies since the original CLI study (Table 4).

Despite the low incidence rates (about 0.2 percent), the Poggio and Schien study gained significant media coverage and reduced overall confidence in the modality. The study also led the FDA to recommend in 1989 that EW be limited to no more than seven days and six nights of continuous overnight wear without removal of lenses for cleaning and disinfection or lens disposal.
Overnight Wear

Incidence and relative risk of microbial keratitis: Extended wear hydrogel to daily wear hydrogel

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>DW RGP Hydrogel</th>
<th>EW RGP Hydrogel</th>
<th>DW RGP Hydrogel</th>
<th>EW RGP Hydrogel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peggio et al</td>
<td>1989</td>
<td>4.0</td>
<td>4.1</td>
<td>20.9</td>
<td>±5.09</td>
</tr>
<tr>
<td>MacRae et al</td>
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<td>6.8</td>
<td>5.2</td>
<td>18.2</td>
<td>23.9</td>
</tr>
<tr>
<td>Benjamin</td>
<td>1991</td>
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<td>2.1</td>
<td>4.2</td>
<td>8.8</td>
</tr>
<tr>
<td>Dart</td>
<td>1991</td>
<td>1.2</td>
<td>3.5</td>
<td>3.2</td>
<td>±5.78</td>
</tr>
<tr>
<td>Nilsson</td>
<td>1994</td>
<td>1.21</td>
<td>0.51</td>
<td>3.12</td>
<td>±6.72</td>
</tr>
<tr>
<td>Cheng et al</td>
<td>1999</td>
<td>1.1</td>
<td>3.5</td>
<td>20</td>
<td>±5.72</td>
</tr>
</tbody>
</table>

Current status

Disposable hydrogel EW has been shown to be beneficial over conventional non-disposable CW, with careful patient selection and close follow-up. However, they still result in significant hypoxia-related adverse events for many wearers and do not significantly reduce the incidence of MK compared to conventional non-disposable overnight wear.

High Dk RGP extended wear has several advantages over the use of soft hydrogel lenses. Notably, enhanced oxygen transmissibility and an active tear pump mechanism. These properties allow the issue of hypoxia to be addressed, with a resultant reduction in the risk of hypoxia-related complications. Several disadvantages, however, have limited the more widespread usage of this modality, with the main issue being comfort, lens binding resulting from changes in the tear film during sleep (Figure 1) and 3 and 9 o’clock staining.

Si-Hy lenses were initially developed to address the limitations of oxygen transmission of hydrogel lenses, and to make EW a safer and more successful wearing modality. Their introduction in 1999 resulted in a slow but steady increase in EW fitting, however new fits in the UK remain less than 10 percent.

Their development combines the oxygen benefits of silicone elastomers with the preferred hydrophilic aspects of hydrogel lenses. Increasing the silicone content may bring the benefit of increased oxygen permeability but will also decrease wettability and increase lipid interaction. Consequently Si-Hy lenses must be either surface treated or contain components to achieve a wettable and compatible lens following manufacture.

In general, Si-Hy materials deposit minimal protein although there is a tendency for greater lipid deposition when compared to hydrogel materials especially high water content, ionic hydrogel materials (FDA Group IV).

A range of Si-Hy lenses are now available, some with regulatory approval for up to 30 nights of continuous wear and others for six nights of extended wear.

First-generation materials tend to have a higher modulus than more recently available materials and this can have an impact on lens fit, initial comfort and mechanically-related adverse events.

Oxygen supply to the cornea is such that incremental overnight corneal swelling with lens wear should be eliminated or significantly reduced. This was the primary design goal of Si-Hy lenses and studies confirm that overnight swelling is typically no greater than that measured with no lens wear, regardless of the different oxygen transmissibilities of the Si-Hy materials tested (Table 2).

This may be explained by the minimal differences in equivalent oxygen percentage (EOP) or oxygen flux during closed eye between the Si-Hy materials tested.

These materials represent a significant breakthrough in design, with the direct result that complications associated with lens-induced hypoxia — such as epithelial and stromal oedema, limbal hyperaemia, corneal vascularisation, endothelial polymegathism and myopic shifts — are now rarely observed.

Indeed, blood vessels that have extended into the clear cornea as a result of chronic hypoxia are often seen to empty following refitting with these lenses (Figure 2). Si-Hy lens overnight wear is not, however, complication free.

Adverse events

First generation Si-Hy materials are approximately two to three times stiffer than hydrogel materials and can result in more negative pressure under the lens during blinks than more flexible materials such as HEMA or etafilcon A. This may increase the incidence of mechanical arcuate lesions (Figure 3) with these materials, as well as a more mechanically-related local papillary conjunctivitis (CLPC) typically observed in zones two and three (Figure 4). ‘Mucin balls’ (Figure 5) are more frequently observed with Si-Hy lenses. Frequency of mucin balls increases the longer the period of overnight wear and these are more likely to present in eyes with steeper corneal curvature. They are not detrimental to contact lens wear, with no intervention required if vision is not compromised. More recent lens and edge designs, as well as materials with lower modulus (less stiff), have resulted in less mechanically-related adverse events during overnight and daily wear.
Inflammatory responses can manifest as different adverse events. Contact lens acute red eye (CLARE), contact lens peripheral ulcer (CLPU) (Figure 6) and other infiltrative events can occur. Literature reviews have shown that there are twice as many corneal infiltrative events with Si-Hy lenses worn overnight up to 30 days when compared with disposable hydrogel six nights’ extended wear. Increased risk cannot be definitively linked to Si-Hy lenses alone since the effect of material on outcome is confounded by the differences in length of wear (30 nights versus six nights). It will be interesting to observe from future studies whether the availability of newer Si-Hy materials approved and used for six nights of EW followed by disposal will result in a lower incidence of inflammatory events. Regardless, inflammatory events will occur more frequently during overnight wear and practitioners must be confident in their detection and diagnosis. Helpful grading scales have been designed to support the management of the full range of infiltrative events (Figure 7).

**Infection risk**

Studies have shown that *Pseudomonas aeruginosa*, a microorganism often associated with MK, showed a significant reduction in binding to the epithelium of corneas wearing lenses with higher oxygen transmissibility and it was hypothesised that Si-Hy lenses would result in a lower incidence of MK. However, recent prospective epidemiological studies published9,10 and presented at scientific congresses suggest that Si-Hy when used as CW have a similar incidence of MK compared to six nights of hydrogel EW. Both have a higher incidence compared to daily wear re-usable hydrogel lenses (Table 3). Si-Hy CW can, however, result in less severe infection, with faster recovery rates.

Other factors such as tear film stagnation, entrapment of pathogens and debris underneath the lens, compromised corneal epithelial integrity and reduced epithelial cell turnover may play a more significant role in the development of corneal infection than corneal hypoxia. Risk factors for microbial keratitis in soft contact lens wearers are shown in Table 6.15

---

**TABLE 5**

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>YEAR</th>
<th>ANNUALISED INCIDENCE PER 10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morgan et al</td>
<td>2005</td>
<td>2.9, 6.4, 96.4, 19.8</td>
</tr>
<tr>
<td>Schien et al</td>
<td>2005</td>
<td>–, –, –, 18.2</td>
</tr>
<tr>
<td>Stapleton et al</td>
<td>2008</td>
<td>1.2, 1.9, 19.5, 25.4</td>
</tr>
</tbody>
</table>

**TABLE 6**

<table>
<thead>
<tr>
<th>Risk factors for microbial keratitis in soft contact lens wearers</th>
<th>DAILY WEAR</th>
<th>EXTENDED WEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAILY WEAR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrequent lens disinfection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chlorine disinfection</td>
<td></td>
<td></td>
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<tr>
<td>Heat disinfection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No or infrequent disinfection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No surfactant or rub and rinse step</td>
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<td></td>
</tr>
<tr>
<td>Case cleaning (reduction)</td>
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<td></td>
</tr>
<tr>
<td>Compliance with hygiene regimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EXTENDED WEAR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Younger age group (12-19 years)</td>
<td></td>
</tr>
<tr>
<td>Infrequent lens disinfection</td>
<td>Longer duration of extended wear</td>
<td></td>
</tr>
<tr>
<td>Chlorine disinfection</td>
<td>Lower socio-economic class</td>
<td></td>
</tr>
<tr>
<td>Heat disinfection</td>
<td>Smoking</td>
<td></td>
</tr>
<tr>
<td>No or infrequent disinfection</td>
<td>Overnight use of daily wear lenses</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>Topical steroid therapy</td>
<td></td>
</tr>
<tr>
<td>No surfactant or rub and rinse step</td>
<td>Warm climate</td>
<td></td>
</tr>
<tr>
<td>Case cleaning (reduction)</td>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Compliance with hygiene regimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
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<td></td>
</tr>
</tbody>
</table>

*From Stapleton et al 43*

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**TABLE 6**

<table>
<thead>
<tr>
<th>Incidence and relative risk of microbial keratitis: Continuous wear silicone hydrogels to daily wear hydrogels</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTHOR</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Morgan et al</td>
</tr>
<tr>
<td>Schien et al</td>
</tr>
<tr>
<td>Stapleton et al</td>
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<th>EXTENDED WEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAILY WEAR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
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<tr>
<td>Infrequent lens disinfection</td>
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<tr>
<td>Chlorine disinfection</td>
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<tr>
<td>Heat disinfection</td>
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<tr>
<td>No or infrequent disinfection</td>
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<tr>
<td>Diabetes</td>
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<td></td>
</tr>
<tr>
<td>Case cleaning (reduction)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance with hygiene regimen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
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</tr>
<tr>
<td><strong>EXTENDED WEAR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>Younger age group (12-19 years)</td>
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<td>Smoking</td>
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</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*From Stapleton et al 43*
Patient selection

Overnight wear contact lenses are beneficial for many patients and there is no doubt that patients are interested in the convenience of this option, especially if endorsed by their eye care professional. The benefits are particularly evident, with many occupations such as doctors and nurses on night duty and those in the armed forces, in addition to certain hobbies, which make the management of daily wear lenses impractical. Infant or elderly aphakes are further examples of those who may also benefit from overnight wear lenses, by overcoming handling and vision limitations.

However, this lens modality needs to be treated with respect in view of the greater incidence of overall complications compared to when contact lenses are worn as daily wear, as well as the increased risk of MK resulting from overnight use.

It is important, therefore, that a full explanation of the risks and benefits of overnight wear are provided objectively, allowing the patient to make an informed choice. This discussion should include risk comparison with other lens types and wearing modalities, as well as a comparison to refractive surgery — a procedure that results in a significantly greater risk of loss of best corrected vision compared to EW or CW contact lenses. If the patient accepts this increased risk then the practitioner has to decide on the best course of action. There are three possibilities:

- Refuse to fit any overnight wear regardless of physiological suitability. In this case the patient might go to another practitioner and who might not take the care required to manage the modality.
- Refer the patient to a colleague who is more experienced in fitting and managing this modality or fit under supervision until more confident.
- Proceed with the evaluation of suitability and, if the patient is suitable, fit. This course of action maintains the relationship between practitioner and patient and allows the practitioner to offer a total contact lens service.

Instrumentation

The instrumentation required for fitting contact lenses for overnight wear is essentially the same as for all basic contact lens fitting. It is vital that the slit-lamp biomicroscope has good optics and high magnification for viewing subtle corneal changes, in particular, corneal infiltrative events, which can be subtle in appearance. As with any form of contact lens practice, grading scales will allow more objective observation and recording of baseline tissue appearance prior to lens fitting. It is important to monitor corneal distortion secondary to hypoxia in both RGP and soft contact lens wearers. The keratometer provides some, but rather limited, information in this regard. Keratoscopy can also play a useful role in monitoring corneal distortion. As for any contact lens, the presence of a normal, stable, tear film is important. The practitioner must, therefore, have access to instrumentation that permits tear assessment for both initial assessment and monitoring.

Since the overnight wear of a contact lens can result in greater significant adverse events, it is incumbent upon the practitioner to carefully select candidates for overnight wear. This involves thorough pre-assessment, but ultimately a lens trial, which allows optimal fit and frequent monitoring to establish physiological response.

History and symptoms

The first stage in overnight wear fitting, as in any contact lens fitting, is to elicit a full history and symptoms from the patient. In overnight wear fitting it is important to fully understand and explore the reasons the patient wants overnight lens wear. Is it because the patient truly needs to sleep in lenses (for example, occupational need)? Or has interest been generated by consumer advertising? Has the patient failed in other lens modalities and thinks this may be a more appropriate modality? Is there a history of inflammatory events? General laziness or failure to return for aftercare would be considered as contraindications to overnight wear. High standards of patient hygiene are required, and consideration must also be given to the home or work environment.

Ocular and general health must be questioned; for example diabetes would be considered by many as a contraindication for EW but acceptable for daily wear.

Open questioning techniques should be used to identify the patient needs. It is the obligation of the practitioner to ensure that the patient fully understands the risks and benefits of their chosen modality. The patient must also understand the

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**Table 7**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Contraindication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor handling ability</td>
<td>Non-compliant/Poor hygiene</td>
</tr>
<tr>
<td>Lifestyle</td>
<td>Smokers</td>
</tr>
<tr>
<td>Occupation</td>
<td>Poor general health</td>
</tr>
<tr>
<td>New parents</td>
<td>Blepharitis/MGD</td>
</tr>
<tr>
<td>Therapeutic lens fitting</td>
<td>Signs of dryness</td>
</tr>
<tr>
<td></td>
<td>History of inflammatory response</td>
</tr>
</tbody>
</table>

Adapted from Woods™
importance of self-monitoring and of calling their practitioner if there are any unusual findings or changes.

Although the absolute risk of developing a serious adverse reaction to overnight wear is small, the relative risk in comparison to daily wear is significant with all lens types including Si-Hy lenses. The patient must understand this, and the use of a written and signed acknowledgement form is recommended. As in all contact lens practice, the practitioner should fully record the outcome of the discussion. Reasons for considering and avoiding overnight wear modality are summarised in Table 7.14

**Initial examination**

Once the history and symptoms have been completed, the next stage is to conduct a detailed examination of the anterior segment to assess the suitability of the patient for contact lens wear.

Overnight wear of contact lenses puts the cornea in a more stressful environment when compared to daily wear. It is, therefore, important to assess all potential contraindications to the wearer. It is possible that patients who may be borderline cases in terms of suitability, could be successful in daily wear lenses, but these patients should not be fitted with EW.

Particular aspects to be considered are: a stable tear film, no corneal staining, full blinking, minimal conjunctival hyperaemia, and minimal follicles or papillae on the tarsal plate. A recommended ‘pre-health’ checklist is shown in Table 8.15

Keratometric assessment, should be taken to provide baseline data in the cornea of the soft EW patient, and fitting information for the RGP EW patient. The keratometer reflex should be regular and if keratoscopy is to be carried out, the cornea should show a regular contour with no distortion or warpage.

The practitioner’s next responsibility is then to ensure that the patient is physiologically suitable for EW, which can be achieved from lens trial.

**Lens fitting**

The basic principles of EW lens fitting are the same as for daily wear. Maximising oxygen supply to the eye in addition to adequate tear exchange to remove post-lens debris should be prime considerations.

Si-Hy fitting is more critical due to the relative stiffness of some materials compared to hydrogels. Primary gaze post-blink movement should be 0.2–0.3mm and is required for flushing toxins and debris from underneath lenses. However, excessive movement can result in discomfort and tarsal plate changes. Careful observation of edge alignment of the lens to the bulbar conjunctiva should be made during biomicroscopic examination, as ‘edge-fluting’ can be a significant reason for poor comfort and an unsuccessful fit. A lens which is centrally steep may lead to fluctuating vision, which can be solved with a flatter base curve. High molecular weight sodium fluorescein can be useful when assessing the fit of stiffer materials. More recent lower modulus Si-Hy materials exhibit fitting characteristics more similar to hydrogel materials.

RGP lenses should be fitted to achieve an optimum fit to avoid 3 and 9 o’clock staining and lens binding. Fitting as close as possible to alignment to achieve equal lens bearing across the cornea reduces the risk of lens binding. In particular, if the lens is too tight in the mid periphery this will increase the risk of lens binding. Lack of tear exchange will cause an increase in tear viscosity. Other design considerations differentiating RGP EW from daily wear include increasing lens diameter to help stabilise the fit and increasing peripheral clearance to help avoid lens binding.

It is critical with overnight wear fitting that lenses be thoroughly cleaned and disinfected on removal, if they are to be reinserted.
With disposable systems, whether weekly or monthly, this need can be overcome. However, the latter necessitates the need for a longer period of continuous wear (up to one month) if lens care solutions are to be avoided.

**Lens adaptation**

In the authors' opinion, it is important that neophyte patients adapt fully to their lenses on a daily wear basis before starting to sleep in them.

Typically, at least one week of daily wear should be completed for soft lenses with the wearing time being gradually increased each day in the normal manner. Of course, the build-up will be more gradual for the novice RGP wearer. This period of daily wear use also helps in practicing lens handling technique.

It is particularly important that the patient understands the need to clean and disinfect the lenses during this adaptation period and that they are given full instruction in lens maintenance, even though they will not require to do this once they are wearing the lenses on single-use EW or CW basis (namely, disposal on removal).

Once the patient has built up to all-day wear they should, ideally, attend an aftercare appointment before commencing overnight wear. At this appointment, the practitioner should evaluate the extent to which the patient has adapted to lens wear and assess their end of day comfort.

Practitioners should be cautious about overnight wear if there are any visible signs of lack of adaptation during daily wear. In particular, signs of oedema, conjunctival hyperaemia, palpebral changes, corneal infiltrates or corneal staining, whether resulting from desiccation or mechanical insult as well as lens binding.

If the eye is clear and the patient appears to have fully adapted to daily lens wear then they may proceed with the first night of overnight wear. The practitioner should instruct their patient to remove the lens if there is any pain or significant redness in the eye, either during the night or upon waking. They should be told to check for lens movement on eye opening and ocular lubricants can be recommended for morning use to encourage movement and debris flushing from beneath the lens. It is also important to schedule a follow-up appointment for the morning after the first overnight wear. ‘Stress’ testing to determine what level of corneal oedema is acceptable is now less critical with the introduction of Si-Hy lenses.

When refitting hydrogel lens wearers, they may initially find silicone hydrogel lenses less comfortable due to the different surface properties of silicone hydrogel lenses as well as the higher lens modulus of some products. This adaptation period can take three to four weeks.

It must be stressed that the ability of any patient to wear lenses overnight, whether for one week to one month, does not assure continued success indefinitely. Regular and ongoing aftercare visits are essential for patients wearing overnight wear lenses.

**First aftercare appointment**

The appointment after the first overnight wear should be made as early as possible in the morning. This is more critical with hydrogel lens fitting to ensure that signs of corneal oedema are not missed. More importantly, this is when the cornea will have its most stressed appearance and is therefore the optimal time for slit-lamp examination. The examination routine should follow the normal aftercare pattern. Particular attention should be paid in the history and symptoms section to the comfort and vision of the lens upon eye opening and then the speed of resolution of any symptoms, which ought to be quite rapid.

The assessment of lens fit should show free-moving lenses with no sign of lens binding. Visual acuity in the lenses should not show any difference from that obtained before the first night of overnight wear. When refitting hydrogel EW lens wearers with Si-Hy lenses, greater lipid deposition may be observed in some patients. This may necessitate advice on the need to remove and clean the lens with a surfactant cleaner followed by disinfection before insertion again or increase frequency of lens replacement (namely, from monthly replacement to weekly replacement). A whiter eye is likely to be observed due to the significantly improved oxygen supply to the cornea resulting in less limbal redness. Over-refraction may also show a small refractive shift (less minus) due to the re-oxygenation of the cornea and more microcysts may be observed initially before reducing in number and eventual elimination.

All overnight wear patients should be instructed to respond to any signs or symptoms quickly and appropriately. Patients should be advised to remove the lenses immediately if they experience any pain, red eye or blurred vision, and call their practitioner for advice. This availability of immediate advice should be supported further by supplying patients with an after-hours emergency contact. Remember, early symptoms of potentially serious problems can be subtle; foreign body sensation is frequently the earliest symptom of MK.

Educating the patient as to appropriate self-management can enhance the success and safety of contact lens wear.

It is important that all practice staff who may receive calls from contact lens patients understand the appropriate action.
Management guidelines of overnight wear complications

<table>
<thead>
<tr>
<th>OBSERVATION</th>
<th>POSSIBLE CAUSE</th>
<th>ACTION REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 striae</td>
<td>Mild stromal oedema due to closed eye</td>
<td>Monitor for persistence later in day</td>
</tr>
<tr>
<td></td>
<td>Excessive oedema</td>
<td>Increase oxygen supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change to daily wear</td>
</tr>
<tr>
<td>≥4 striae and/or folds</td>
<td>Excessive oedema</td>
<td>Increase oxygen supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change to daily wear</td>
</tr>
<tr>
<td>10-30 microcysts</td>
<td>Mild corneal hypoxia and/or hypercapnia</td>
<td>Increase oxygen supply*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitor more frequently</td>
</tr>
<tr>
<td>&gt;30 microcysts</td>
<td>Excessive corneal hypoxia and/or hypercapnia</td>
<td>Increase oxygen supply*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change to daily wear</td>
</tr>
<tr>
<td>Vascularisation (note: most commonly seen in superior cornea initially)</td>
<td>Long-term hypoxia with hydrogel contact lens wear</td>
<td>Increase oxygen supply*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitor more frequently</td>
</tr>
<tr>
<td>General CLPC</td>
<td>Denatured protein build-up on lenses</td>
<td>Replace lenses and consider frequent replacement thereafter</td>
</tr>
<tr>
<td>Local CLPC</td>
<td>Lens stiffness, lens or edge design</td>
<td>Fit lower modulus Si-Hy lens</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change lens design</td>
</tr>
<tr>
<td>Corneal staining</td>
<td>Pervaporation of tears</td>
<td>Increase replacement frequency</td>
</tr>
<tr>
<td>* Desiccation</td>
<td>Compromised RGP fit</td>
<td>Try alternative material</td>
</tr>
<tr>
<td>* arcade lesions (eg SEAL)</td>
<td>Incomplete blinking</td>
<td>Use ocular lubricants</td>
</tr>
<tr>
<td></td>
<td>Poor surface wetting</td>
<td>Modify fit</td>
</tr>
<tr>
<td></td>
<td>Hypoxia under upper lid</td>
<td>Blinking exercises</td>
</tr>
<tr>
<td></td>
<td>Mechanical</td>
<td>New RGP lenses</td>
</tr>
<tr>
<td></td>
<td>Poor lens fit</td>
<td>Increase oxygen supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use material with lower modulus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve fit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change lens design</td>
</tr>
<tr>
<td>CLARE (contact lens acute red eye)</td>
<td>Poor tear exchange</td>
<td>Loose fit. Try alternative lens design</td>
</tr>
<tr>
<td></td>
<td>Tight lens fit</td>
<td>Loose fit</td>
</tr>
<tr>
<td></td>
<td>Bound lens</td>
<td>Improve fit, try ocular lubricants, change lens design</td>
</tr>
<tr>
<td></td>
<td>Exotoxins from bacteria</td>
<td>Improve lens hygiene, increase lens replacement frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corneal infiltrate (non-staining)</td>
<td>Hypoxia</td>
<td>Remove lens and allow to resolve</td>
</tr>
<tr>
<td></td>
<td>Poor tear exchange</td>
<td>Increase oxygen supply</td>
</tr>
<tr>
<td></td>
<td>Tight lens fit</td>
<td>Loose fit</td>
</tr>
<tr>
<td></td>
<td>Solution reaction</td>
<td>Try alternative lens design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change solution regimen</td>
</tr>
<tr>
<td>CLPU (contact lens peripheral ulcer)</td>
<td>Exotoxins from bacteria</td>
<td>Remove lens and monitor over 24hrs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If symptoms and signs increase: Immediate referral</td>
</tr>
<tr>
<td>Infectious ulcer</td>
<td>Microbial invasion of cornea</td>
<td>Remove lens and immediate referral</td>
</tr>
</tbody>
</table>

* Note: when refitting with higher Dk/t lens, the number of microcysts may initially increase prior to being reduced or eliminated

On lens removal, if the patient’s signs or symptoms persist, an urgent appointment with the practitioner should be made. It has to be remembered that serious adverse responses can develop within 24 hours.

Patients should be instructed to bring their lenses, their case and any solutions used to the appointment. As with daily wear contact lens users, all overnight lens wearers should be advised to have an up-to-date pair of spectacles for use as necessary.

On awakening each morning the lens wearer should carry out a self-assessment:

- Do my eyes look good?
- Do my eyes feel good?
- Do my eyes see good?

If any of these questions are answered in the negative, then lenses should immediately be removed and the decision tree followed as outlined in the Aftercare article of this series.

Ongoing aftercare

Following a successful fitting and first overnight wear the patient should be monitored after one week, and thereafter every three months or more frequently as required. All appointments should be made as early as possible in the morning.

As with all contact lens wearers, a full eye examination including ophthalmoscopy should be undertaken at least every two years or sooner if symptoms suggest a non-contact lens-related problem.

Interpretation of findings

Results from patient discussion, measurement and observation all need to be taken into account in deciding the course of action to be taken.

Table 9 summarises the complications seen in overnight wear patients and recommends management options.

Many conditions are rarely observed during daily wear follow-up and all forms of continuing education on overnight wear are to be encouraged to ensure appropriate recognition and management when prescribing this modality.
Overnight Wear

regardless of lens type prescribed, the importance of patient selection and education, optimal lens fitting and comprehensive/regular follow-up remains the same.

Summary
It is important to view the issues of overnight wear in perspective. Although there may be an increased risk of MK compared to daily wear, there is significantly less risk of loss of best corrected visual acuity when compared to Laskik.

extended or continuous wear is not a suitable modality for everybody, but recent material developments have increased success rates as well as improved wearing comfort. It can be the best choice for some patients – especially those with specific vocational or recreational demands and medical indications. If the need for overnight wear is established, it is better for the practitioner to manage responsibly rather than merely to say ‘no’. Informed choice and continuous careful monitoring are of the utmost importance.

New lens materials, in the form of SiHy, have resulted in significant improvements in satisfying the physiological requirements of the cornea during eye closure in that hypoxic-related complications should no longer be a feature of overnight wear for the majority of patients.

Many patients also report improved comfort and less dryness after a period of adaptation. They should therefore be the lens of choice when offering this modality to new wearers.

Regardless of lens type prescribed, the importance of patient selection and education, optimal lens fitting and comprehensive/regular follow-up remains the same.

References

Table 10

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>Increased risk of corneal infection</td>
</tr>
<tr>
<td>Continuous vision correction</td>
<td>Potentially for mechanical induced adverse events</td>
</tr>
<tr>
<td>Less maintenance</td>
<td>Increased risk of inflammatory events</td>
</tr>
<tr>
<td>Reduced or no care products</td>
<td>Increased chair-time costs</td>
</tr>
</tbody>
</table>

Less handling

Adapted from Woods**

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