Top 10 complications of scleral lenses

It's funny how fashions always seem to come back around. Contact lenses started big, restricted as they were by manufacturing methods. They then became smaller as the ability to lathe cut plastic lenses came along, as well as a better understanding of the oxygen requirements of the cornea. Even when materials advanced and became close to 99 per cent permeability to oxygen, rigid lenses remained 'small', as this was what we became used to and adept at fitting. Larger scleral lenses became the domain of a few keen specialists, and developed a reputation for being very 'niche' and difficult to fit, only to be attempted by the very experienced. However in the last five or so years I have noticed a slow trickle of mini-scleral and scleral lenses come onto the market, some originating in the US and some designed here in the UK. They have slowly gained in popularity as practitioners' confidence in fitting such lenses has grown, and there is a clear benefit to both clinician and patient.

I will be discussing the classic complications related to the fitting of lenses which vault the cornea and rest entirely on the sclera. Eef van der Worp prepared an excellent table which neatly describes the types of RGP lenses we may come across nowadays, in terms of both size and the way they fit the eye (Table 1). This article will not cover how to fit scleral lenses; however, Eef van der Worp’s educational book, A Guide to Scleral Lens Fitting is an excellent resource and is available to download free from http://commons.pacificu.edu/mono/4/.

Indications for scleral lenses
Scleral lenses are generally indicated for those patients who require a rigid lens material, but who, due to a fragile epithelium, non-tolerance issues, or an extremely irregular corneal profile for example, are unable to wear a corneal lens. They are also a perfect option for those with ocular surface disease such as extreme dry eye, Sjögren’s syndrome, Stevens-Johnson syndrome, or graft-versus-host disease. Thanks to the very high Dk lens materials available otherwise we would be fitting scleral lenses on every patient. They are certainly easier to fit and more readily available now than, say, 10 years ago. However, there is still a learning curve for those who have not used large diameter lenses before and initially this will use more chair time, which needs to be charged for accordingly. They are more expensive to the patient, though due to the longer lifespan of larger lens types, they may actually end up costing no more than corneal RGP lenses. There are some unique complications than can occur with scleral lenses that you might not see with other lens types, indeed (in my experience) a regression of corneal neovascularisation can often be observed following the fitting of scleral contact lenses. Scleral lenses are also very comfortable to wear for most patients, and many attain an excellent visual acuity using these lenses, largely thanks to their centration, stability, rigid material and very large optic zones.

The benefit to us as practitioners are that it is appropriate for your professional role. Points for successful completion of CET are uploaded on a weekly basis. The deadline for responses to this exercise is March 7 2014.

Sophie Taylor-West shows what problems may arise with scleral contact lenses and how to manage them when they do. Module C35299, one distance-learning point for OOs, IP and CLOs

### TABLE 1
Types of RGP lenses, compiled by Eef van der Worp

<table>
<thead>
<tr>
<th>Alternative names</th>
<th>Diameter</th>
<th>Bearing</th>
<th>Tear reservoir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corneal</td>
<td>8.0 to 12.5mm</td>
<td>All lens bearing on the cornea</td>
<td>No tear reservoir</td>
</tr>
<tr>
<td>Corneoscleral</td>
<td>12.5 to 15mm</td>
<td>Lenses share bearing on the cornea and the sclera</td>
<td>Limited tear reservoir capacity</td>
</tr>
<tr>
<td>(Full) Scleral</td>
<td>15 to 25mm</td>
<td>All lens bearing is on the sclera</td>
<td>Somewhat limited tear reservoir capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Almost unlimited tear reservoir capacity</td>
</tr>
</tbody>
</table>

**Figure 1** Large air bubble under a scleral lens

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and I have compiled a list of my ‘top 10’ most commonly seen problems, and offer some insights in how to go about identifying, avoiding and remediing them.

10 Bubbles (Figure 1)
Getting a scleral lens in the eye without letting a pocket of air slip under is half the battle. It should be possible to get any sealed scleral lens onto an eye without a bubble with good technique, but sometimes it’s easier said than done!

To avoid insertion bubbles:

- Ensure the lens is filled to the brim with non-preserved saline, forming a meniscus
- Make sure the patient’s face is parallel to the floor, with their chin tucked towards their chest
- Try filling the lens with a more viscous solution in trickier cases, such as a non-preserved rewetting drop (or try a 50:50 dilution with saline?)
- Use a lens holder to keep lens parallel so as not to spill the saline (see number 3 ‘handling problems’)
- Remove fenestrations if they are present
- Practise!

An insufficient seal will result in the accumulation of bubbles during wear – a ‘leaky lens’. This is a potential problem when fitting full sclerals. To rectify:

- Flatten the haptic portion of the lens to move the bearing surface closer to the limbus (the sclera is less toric here)
- Fit a mini-scleral lens.

9 Conjunctival blanching
This phenomenon (Figures 2 and 3) is caused by an excessively tight haptic zone. The haptic (scleral) part of the lens presses on conjunctival blood vessels, sealing them off and creating a white area. Vessels beyond the edge of the lens will often become more enlarged/engorged leading to unsightly redness. It is usually quite uncomfortable, but may be tolerated surprisingly well initially. If ignored, it leads to a rebound reaction on lens removal as vessels refill, and the eye becomes temporarily very red.

- OCT can be used to assess the peripheral fit of mini sclerals (Figure 4)
- If the edge of the lens is embedded more than 50 per cent into the conjunctiva, it may be too tight
- The bottom image shows a well aligned periphery

8 Conjunctival bunching/prolapse
This is when the conjunctiva gets sucked up under the limbal part of the lens and folds over the limbus, as shown in Figure 6. It can look quite alarming but in practice it rarely causes any symptoms.

- It can occur when there is excessive limbal clearance. If this is the case, reduce the clearance in this zone to try and rectify the issue
- This phenomenon can also be caused by the lens being pushed onto the eye with excessive force, causing a suction effect. Place the lens on the eye gently and let the lids settle the lens in place
- If it’s not causing a problem, it rarely seems to cause any long-term issues.

7 Pain/discomfort
Discomfort while wearing a scleral lens is genuinely a rarity, but will tell you a lot about the fit.

- Awareness under the top lid is almost always due to tight periphery, even if no blanching is observed. Rectify this by flattening the peripheral curves
- Awareness at the bottom lid usually
indicates a flat periphery, though this will be unusual. Tighten the peripheral curves to fix it.

● Ensure there is no corneal touch as this can cause discomfort (Figure 7).

● Stinging usually indicates solution sensitivity or not rinsing the cleaner off fully. Switch to a non-preserved/non-buffered saline and ensure thorough rinsing.

6 Setting back

The conjunctiva is spongy and boggy, and a scleral lens will settle back and ‘bed in’ to an extent on every patient.

● Allow the lens 60 minutes to settle before making final assessments, and before performing a final over-refraction.

● Assume over eight hours the lens will settle around 100 microns and allow for this when you assess the central and limbal clearance.

You can help reduce the degree of settling by increasing the diameter of the lens as this increases the baring surface.

5 Corneal staining

Because scleral lenses are designed to vault the cornea, corneal staining (Figure 8) should not be accepted and should be simple to resolve once you have identified the problem.

● There are two main possible causes:
  - Corneal touch. Increase the overall sagittal depth of the lens to resolve this
  - Solution allergy or toxicity will cause diffuse superficial punctate staining (Figure 9).
  - Switch to 100 per cent non-preserved solutions and saline (eg OxySept + Lens Plus saline) to fix this problem.

4 Surface deposits and non-wetting

As with any RGP lens, make-up, debris, lipids and proteins from the tear film are prone to depositing themselves onto the anterior lens surface and causing smeary vision (Figure 10).

● Numerous possible causes:
  - Make-up. Ensure the patient puts make-up on after inserting lenses, and advise them not to wear eyeliner on the inner rim of the lid
  - Face/eye creams. Use non-oily product; wash off hands before touching lens; don’t get product too close to eye; switch brands?
  - Soap. Use non-moisturising soaps
  - Underlying lid disease. Start treating as early as possible using wipes, warm compresses and massage
  - History of allergy. Treat the allergy and reduce exposure to allergens where possible. If necessary refer to the GP or an ophthalmologist for treatment with Opatanol or steroids.

Sometimes despite best efforts this problem cannot be eliminated entirely, eg severe dry eye, allergy or excessive protein production. In these cases, the following methods can help:

● Plasma or re-plasma treat lens
● Remove lens at intervals, clean and re-insert
● Wipe front of lens on-eye with moistened cotton-bud or lens sucker (like a squeegee)
● Use lubricating drops throughout the day
● Treat allergy
● Regularly deep-clean lenses with a protein-removing product such as Progent.

3 Handling problems

Scleral lenses need to be filled before insertion, which makes them hard to balance. When inserting the lens, the patient needs to hold it with one hand and retract both lids with the other hand, which can be awkward. Those with shaky hands (due to essential tremor or Parkinson’s for example), small eyes or tight lids, and those with very poor uncorrected vision may struggle.

● One possible solution is to fit with large sclerals (ie 22mm+), which many patients find easier to handle as they can simply be gripped at the edges and slotted under first the top lid, then the bottom.
There are various implements available to help with inserting scleral lenses, which you and your patients may find helpful (Figures 11-15). I also recommended issuing patients with a lens remover/sucker, for simple removal (Figure 16).

2 Conjunctival redness
This is a very common issue with scleral lens wear, particularly with new wearers (Figure 17). Luckily there are usually only two main causes (once you have excluded infection and other inflammatory conditions). Two main causes are: a tight periphery and a reaction to preservatives in the solution.

- Assuming you have ensured the periphery is not too tight, the first thing to try before adjusting the fit is changing the care regime
- Switch to a 100 per cent non-preserved cleaning regime
- Store in hydrogen peroxide system eg Oxysept or AOSept, or if it is a large diameter thicker lens, store them clean and dry
- Some patients are sensitive to the borate buffer in non-preserved saline such as Sauflon and Lens Plus
- In such cases, fill with non-preserved, non-buffered saline eg Amidose, or 5ml saline pods (Figure 18).

1 Misting under the lens
This is not the most common problem I encounter when fitting scleral lenses, but it is the most annoying and probably the hardest to remedy. It is caused by a build-up of mucus and lipids under the lens which then tends to congeal or froth, causing hazy/milky vision (Figures 19 and 20). It often happens in the first few months of wear but can get better with time as the eye adapts, and is more common in atopic and severe dry eye patients.

Potential causes and how to fix it:

- Excessive tear exchange
  - Sometimes tear flow lets mucus accumulate
  - Use fluorescein to find flatter area and tighten scleral curves to remedy
- Allergy and lid disease
  - If the eye is already prone to mucus it will inevitably accumulate under the lens
  - Treat MGD with compresses and lid massage and treat allergy as necessary
- Preservative sensitivity
  - Switch to non-preserved solutions and fill with non-preserved, non-buffered saline.

Other tips to avoid mucus build-up:

- Wash eye with an eyebath in the morning prior to inserting, or insert, remove and reinsert (to rid eye of morning ‘gunk’)
- Fill with a more viscous solution such as preservative-free eye drops, or 50:50 drops plus saline
- You may not be able to eliminate it entirely. The patient should remove the lens during the day, rinse and re-insert it periodically
- Reduce any excessive clearance
- Discuss probability of lens misting before fitting, so the patient is prepared for it! It often resolves itself after a month or so.

Summary of hints and tips

- Pick one or two scleral designs and get to know them inside out
- Keep solution preservatives to an absolute minimum from the start, rather than waiting until signs of solution toxicity occur. If you already know your patient is allergy-prone, go non-preserved from the beginning. Drum the importance of this into your patient and explain to them exactly which solutions they should and should not use. Give this information to them in writing and ask them about it at every aftercare appointment.
- Don’t rush the lesson, make sure the patient is really confident with
insertion and removal before they take the lenses away and are clear on which solutions they should be using.

- Don’t over-vault. They don’t need to clear by miles, just enough so that there is no corneal touch after settling back.
- On first follow-up, you need to assess the clearance without taking the lens out. You can use OCT but it is much quicker and easier to use an optic section.
- Full beam, very thin slit, beam at around 60 degrees. Swing beam across the lens to assess clearance over whole lens (Figure 21).
- Compare clearance to known thickness of the lens.
- Once you have a lens on the eye which looks good, let it settle for 30-60 minutes before making final assessments.
- When assessing clearance, allow for approximately 100 microns settling back.
- If you find unexpected residual astigmatism, perform topography over the lens to check for lens flexure. If the lens is flexing, either try a toric periphery, or increase the lens thickness.
- Consider not showing the patient the lens before putting it in their eye the first time. Sometimes they develop preconceptions of what the lens will feel like (usually negative) which makes it more difficult to get it on the eye, and makes them more aware of the lens once it goes in. Put the lens in, let them tell you how comfortable it is, then show them when you take it out.
- Discuss all common potential complications with the patient before ordering so they are prepared.

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