



Contact lens infections – can they ever be eliminated?

New materials, modalities and care products have had little effect on preventing infection in contact lens wear. **Alison Ewbank** reports on the infection and compliance sessions in our final report from the British Contact Lens Association Clinical Conference

After decades of research into contact lens-related infection, it seems remarkable that answers to some of the most fundamental questions about the safety of contact lenses remain unclear.

A special session on pathology and safety at the BCLA conference saw leading researchers in this area, including husband and wife team **Professors Suzi Fleiszig** and **David Evans** of the University of California, Berkeley, seek answers to some of these questions (see panel).

Microbiologist **Professor Mark Willcox**, of the Institute for Eye Research in Sydney, summed up the situation. The incidence of microbial keratitis (MK), the most serious complication of contact lens wear, had not changed in 20 years and silicone hydrogel lenses might even have increased the rate. Microbial adhesion to and growth on lenses was thought to be an initiating factor in adverse events.

Small numbers of bacteria probably adhered to lenses then grew to become a pathological inoculum. In small numbers, bacteria did not initiate adverse responses and might even protect the eye. Killing bacteria or other microbes as a way of preventing the development of a pathological inoculum might be very useful and could benefit contact lens wearers.

Dead bugs could never cause infection so if we could kill all bacteria we could stop infections, observed Willcox. If we could kill most of them we would reduce the incidence of infection and inflammation. In fact the presence of dead bacteria did not necessarily produce an adverse event and could have a protective effect.

Strategies included making



Husband and wife team: Professors Suzi Fleiszig and David Evans

lenses or lens cases antimicrobial, either by killing the bugs or by preventing adhesion. Approaches under investigation for lenses were melimine attached to the surface and fimbrolide coatings (previously known as furanones).

Silver-containing or silver-coated antibacterial cases were now available from three manufacturers, were effective in reducing Gram-negative bacteria and even fungi, and showed clinical benefits.

The macro/micro picture

Presenting a keynote address on behalf of his wife, whose arrival in the UK was delayed, **Professor Evans** questioned why there were not more infections since *Pseudomonas* was everywhere. The intact cornea was resistant to infection but was the epithelial barrier all there was to the eye's defences?

New imaging techniques enabled us to see inside the living cornea to study these defences in the healthy eye and observe what bacteria did and how the cornea responded when it was compromised.

Summarising recent studies, Evans said that defences additional to the epithelial barrier included the basal lamina, which acted as a filter since its pores were smaller than bacteria, and tear fluid, which rendered cells more

KEY QUESTIONS ON INFECTION IN CONTACT LENS WEAR

- Do we need to kill bacteria to keep patients safe?
- Do we need to stop bacteria binding to contact lenses?
- Why is extended wear a risk factor?
- Does fluorescein staining predict risk of infection?
- Is stagnation under a lens a problem?
- Is hypoxia a risk factor?
- Why *Pseudomonas*?
- What is the relationship between infection and inflammation?
- And would it help if patients were more compliant?

resistant to bacteria. Intriguingly, he mentioned that new research funded by the Bill and Melinda Gates Foundation had identified a completely novel antimicrobial mechanism in the corneal epithelium, which he described as 'top secret'.

In his own presentation, Professor Evans said that progress in research had been hindered by the lack of an appropriate animal model for studying the eye's natural defences and how contact lenses cause infection. Infection models were previously limited to scratching the cornea to expose it before adding bacteria or injecting bacteria directly into the cornea.

Recently his group had developed a technique using custom-made lenses to introduce a single inoculum to the rat or mouse eye and different levels of bacteria to see whether this induced infection over time. Even with very virulent strains and large numbers of organisms, the eye cleared the infection.

The studies were repeated with the animal eye blotted with tissue paper to remove epithelial surface cells and introduce fluorescein staining. Blotting alone was not enough to initiate infection and the level of inoculum introduced via a contact lens made little difference to the disease onset or severity.



Looking at the lenses from infected eyes, there was a substantial biofilm on the back surface and bacteria within the lens but the anterior surface was clear. It seemed that biofilms were not just a mechanism of survival for bacteria but might also be a mechanism for initiating disease.

Adaptation to the *in-vivo* environment under a contact lens might allow bacteria to traverse the corneal epithelium and cause MK, at least in an animal model. Posterior lens surface biofilm formation could represent one form of contributing to *in-vivo* adaptation. Corneal changes induced by extended lens wear, with or without bacterial factors, might also have a role.

So could contact lens infection ever be eradicated? For Evans, with appropriate models and funding to support the latest technology, this would be possible. But multiple factors were involved, and among these were 'user contamination' and compliance.

Continuous wear: a crazy idea?

Contact lens safety was also the subject for *The Sunday Debate*, a newly revived feature at the BCLA conference, with the motion 'With modern silicone hydrogel contact lenses continuous wear is not a crazy idea'. Overnight wear has been shown to be the most important risk factor for contact lens-associated microbial keratitis but is still capable of stimulating fierce debate.

Setting the scene, chairman **Suzi Fleiszig** posed the question, 'If I wore contact lenses would I sleep in them?' She described recent studies into infection and extended wear, including the finding that contact lens wear inhibited important defence mechanisms in the corneal epithelium and this could take up to 72 hours of lens wear. If inflammation preceded infection, then it was likely the process would take time to unfold, so extended wear increased the chance of that happening.

Her latest work with cytotoxic strains showed that infection could occur in 24 hours in an intact cornea, without any scratching, blotting or superficial damage, in mice that slept with a lens on the eye for four hours. But infection did not occur with one hour's sleep. It seemed that stagnation on the cornea over time was needed to allow bacteria to penetrate. 'And none of this has much to do with oxygen,' she observed.

It was no surprise that Fleiszig



Professor Mark Willcox

concluded she would not sleep in contact lenses, which may well have coloured the debate that followed. Arguments for the motion could be summed up as 'Continuous wear is not a crazy idea, we just haven't done it right yet' (**Brien Holden**) and 'We're already in the risk game and infections are rare' (**Dr Philip Morgan**).

Against the motion, was that 'Some patients will fail physiologically with continuous wear' (**Professor Lyndon Jones**) and 'Adverse events still occur, even with second-generation SiHs' (**Mark Willcox**). But the final vote showed that the audience, representing all disciplines and more than 40 countries, was evenly split between the two camps.

Preventing disease transmission

Infection control in contact lens and general optometric practice was the subject of another special session at the conference, chaired by **Professor Roger Buckley** of Anglia Ruskin University.

After outlining the revised UK guidance on decontamination of trial contact lenses and other contact devices, he introduced dentist **Dr Michael Martin** who warned that the government had overridden previous professional guidance and all dental practices had to have best practice plans in place for infection control by December this year.

Separation of clinical areas from decontamination areas, specialist washing equipment and even a separate room for dressing were among the requirements, which Martin described as 'a major, major crackdown'.

His advice to the eye care professions was not to ignore what was happening in dentistry, to formulate their own policy quickly and to ensure that the professional

bodies endorsed it.

Scottish optometrist **Donald Cameron** said that every year the General Optical Council received complaints that a patient had caught an eye infection from a practitioner. Accusations involved not just infections from tonometer heads and trial contact lenses but also dirty premises and lack of hand washing.

Defence was easy if the practice had a clear policy on infection control. Washing hands between each patient, no clothing or jewellery below the elbow, no neckties and using alcohol swabs to clean all equipment and surfaces were just some of the simple measures recommended.

Jane Veys, education director of The Vision Care Institute, described hand hygiene as the single most important measure to avoid transmission and infection in practice. Data were collected from more than 200 practitioners attending eye health-related courses at the institute to find out how well they rated their own hygiene practice. The practitioners then used UV disclosing gel to demonstrate the effectiveness of their hand-washing technique, after which they re-evaluated their ratings.

Results showed a significant shift in self-rating scores once awareness of correct hand hygiene had been raised. More than two in three rated themselves excellent or very good initially compared to just one in four after the demonstration. The data supported the need for more engagement and ongoing education on the importance of effective hand washing, said Veys.

Elsewhere on the programme there were several other presentations on compliance and care procedures.

Reviewing current thinking on case care and hygiene, Willcox's colleague **Professor Fiona Stapleton** said that replacing cases at least three monthly, rinsing with solution then air drying face down was the most consistently offered advice, although studies were still needed to verify the impact of each step on case contamination and biofilm formation.

The impression from this conference was that, as **Professor Fleiszig** suggested, researchers were entering a new era in understanding infection and contact lens wear that would eventually lead to new methods of disease prevention. ●

● A selection of lectures from the conference is available at www.bcla.org.uk