Power Profiles and Lens Designs of Soft Contact Lenses for Myopia Management (and beyond)
CE06

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Course description

Potentially millions of children around the world may be fitted with soft contact lenses for myopia management purposes, given the latest insights into myopia progression. But what do we know about the lens BACK surface design and fit of soft lenses for myopia management, ánd about standard soft lenses for that matter. When it comes to soft lens fitting in general, we see that despite all material, replacement frequency and contact lens care developments in recent years, we are still facing high dropout rates in soft lens wear. It may therefore be time to see whether we can do things differently.

Furthermore – what do we know about the FRONT surface design of soft lenses, specifically for myopia management. In myopia management practice, we should know the differences in profiles – and potentially we may be off to a new beginning, changing, or altering our approach in the way we that we fit soft lenses going forward. The future of soft lens fitting is discussed in this session, and power profiles for soft lenses for myopia management specifically are explored, categorized, and made applicable for daily contact lens practice.

Course Objectives

- Understanding soft contact lens parameters and fitting characteristics
- Understand the differences in power profiles for myopia management soft lenses.
- How to improve soft lens fit in standard and in myopia management practice.

Course outline

INTRODUCITON

Despite all material, replacement frequency and contact lens care developments in recent years, we are still facing high dropout rates in soft lens wear. It may therefore be time to see whether we can do things differently. Potentially we may be off to a new beginning, changing, or altering our approach in the way we that we fit and evaluate soft lenses going forward. The future of soft lens fitting is discussed in this panel, amongst a group of experts that has experience in manufacturing, education, clinical practice, and research.

Drop-out rates and the reasons for that are complex, with tear film components and dry eyes as just one factor, and lens material, lens surface friction and edge design as other important components – as well as environmental factors. Many of these factors we as ECP have no say over, and no control over. What we do have control over is the lens fit. This presentation first focuses on that topic: how can we get control over the fitting of soft lenses – and optimize lens fit, in order to best respect and follow the shape of the ocular surface. Moving from back to front surface of the lens: what do we know about the power profiles of soft lenses for myopia management? Are there differences? Can they be categorized, and what does this mean for application of these lenses by ECPs in practice?

1. **SOFT LENS FITTING – <u>THE BACK SURFACE</u>**

- CURRENT APPROACH IS INSUFFICIENT
    - The way soft lenses are fitted today is, whether we like it or not, not evidence based. Central keratometry values do not predict the way soft lenses behave on the eye. We must conclude that the current approach is not sufficient.
- 'ONE-FITS-ALL'
    - Soft lens fitting has evolved from trial lens fitting, as with corneal RGP lenses, to an oftentimes 'one-fits-all' approach.
- DROP-OUTS
    - After years of investment in better lens materials and replacement frequency of soft lenses, it now may be time to get back to use lens design and respecting the shape of the ocular surface better with soft lenses as the starting point in lens selection.
- LIMITED RANGE OF SOFT LENS PARAMETERS AVAILABLE
    - About 75% of eyes can be fit successfully, with the currently available arsenal of frequent replacement lenses
- SOFT LENS GEOMETRIES
    - What do we know about soft lens geometry, and what is the role of base curve radius and diameter in soft lens fitting?

- SAGITTAL HEIGHT SOFT LENS FITTING
    - Substantial differences in sagittal height exist between different commercially available lenses, but the total range of the lenses available is limited.
    - Recent studies also show substantial differences between sagittal height values of myopia management lenses available on the market (Montani et al GSLS 2023).
    - The average sagittal height of a soft lens is somewhat higher than that of the ocular surface, to generate 'grip' and an acceptable lens fit.
    - Lens decentration on eye can be detrimental to myopia management efficacy.
- MANUFACTURING
    - Opportunities and limitations
- SURVIVAL OF THE FITTING
    - Finding better standard lenses for any given eye – or by creating customized soft lenses may prove to be instrumental for the future of soft lens fitting – and our profession. Example: If the base curve of a soft contact lens remains the same, but the diameter increases - what does this mean in terms of sagittal depth of the lens? The sagittal depth of the lens decreases, and vice versa.
    - The difference in sagittal depth between one base curve soft lens of '8.4' and another '8.4' of a different company, could be as much as 400 microns.

Fitting the normal eye with soft lenses

- The fit of a contact lens is thought to be critical for normal physiology to be maintained and to present physical damage to the ocular surface, but what evidence if there for this and what parameters are critical.
- The difference between the flattest and the steepest eye (in microns) in sagittal height over a 15mm chord in a normal population is in the range of 900 micron
- The average sagittal height of a normal eye (over a 15mm chord in the horizontal meridian) is in the range of 3750 micron
- Example: for a steep cornea, with a large corneal diameter - you would expect a higher-than-average sagittal height value on the ocular surface

- How is lens fit best defined and what is acceptable? Does base-curve significantly affect soft contact lens fit or should a clinician be able to choose a different lens diameter instead?
- Does corneal shape and the transition across the limbus onto the sclera matter?
- This presentation will bring together the latest research on soft lens fit to demonstrate why one-lens fits all approaches are limited, particularly at the extreme ends of normal ocular shape and how lens fit can be better evaluated and recorded.

The out-of standard-eye: how to better fit specialty lenses?

- CUSTOM MADE LENSES
  - Custom soft lenses seem to have a place in contact lens practice, whether myopia related or for standard soft lenses
  - The tide on the 'major limitations' mentioned seems to be changed. First: silicone hydogel lens materials became available for lathe-cutting. Hence, the same high-quality materials we are used to work with in disposable lenses now can be used for custom-made lenses too, for the first time ever. Also, the manufacturing facilities to make custom-made lenses are ultra-sophisticated these days. The accuracy of the lenses is not in microns, but in nanos if needed (a nano is 1/1000 of a micron).
  - Custom options in terms of back surface (design and fit) and optics (toric, multifocal, decentered optical zones) are discussed.

2. SOFT LENS FITTING – THE <u>FRONT SURFACE</u> (IN MYOPIA MANAGEMENT)

- The mechanism for soft contact lenses designed for myopia management, is to induce myopic defocus simultaneous competitive myopic defocus on the peripheral retina while maintaining an acceptable visual performance for distance.
- The power profiles of eight lenses on the marked world-wide for myopia management will be covered and discussed.
- The optical profiles vary substantially between the different designs.
- From an educational standpoint, we divided the eight lenses analyzed into four main profile categories:
  - 1. Multiconcentric - with sharp changes of power in three rings of power surrounding

the central distance zone

  - 2. Multifocal - 'classic' multifocal design - with a center distance zone
  - 3. EDOF - (with catenary optics or non-monotonic/aperiodic optics)
  - 4. Torus – center near lens design described as 'torus' profile, with the highest difference in dioptric value in this profile.

- When looking at an optical zone diameter of 8 mm for these lenses, the difference between the minimum and maximum power within one lens design was noted to be quite substantial.
- The lenses tested also showed considerable differences for SAG values, although maybe not as much as you might expect given the differences in lens diameter (range between 13.8 and 14.5) and base curve radius (range between 7.9 and 8.6).
- Base curve radius, as reported on previously, proves again not be a good predictor of lens overall lens shape. The lens with the steepest base curve (7.9), a daily disposable, was not substantially different from the other lenses in that category that have much flatter base curves.
- Daily disposable lenses where slightly higher in SAG than monthly lenses (172 µm on average).
- The temperature of 20°C is the standard (ISO required) temperature to measure and label soft contact lenses. However, when the lens goes on the eye – this will change some of the lens parameters; in general, lenses shrink on the eye when going from room-temperature to eye-temperature (at 35C°C). At this higher temperature, all the lenses in our study also showed a reduction of SAG compared with SAG at 20°C).
- This means that there are differences between lenses, that could potentially influence lens fit, and on lens centration potentially. This also means, that the temperature change when a lens goes on the eye needs to be investigated in more detail to fully understand lens behavior on-eye better, and the practical consequences of that.

3. CONCLUSIONS, DISCUSSION & CLINICAL APPLICATION