

Contact lens wear is intrinsically inflammatory: Implications for specialty lens fitting

One Hour Lecture

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Course Description:

It has recently been demonstrated that uncomplicated contact lens wear meets the clinical definition of inflammation (heat, redness, swelling, pain, and loss of function) and the sub-clinical definition of inflammation (cytological changes and inflammatory release). Consideration of both classical and contemporary thinking about the role of inflammation in the human body leads to the perhaps surprising conclusion that the chronic, subclinical inflammatory status of the anterior eye during contact lens wear – referred to as ‘para-inflammation’ – is a positive, protective phenomenon that reflects an upregulation of the immune system, in a non-damaging way, so that it is in a state of ‘heightened alert’, ready to ward off any extrinsic noxious challenge. But what about specialty lenses, which may be fitted to eyes that are already inflamed to some extent? Depending on the circumstances, specialty lens fitting may be protective or may exacerbate an already existing inflammatory process. Specialty lens fitters are advised to consider the ‘homeostasis–para-inflammation–inflammation’ nexus as a continuum, rather than discrete stages as originally proposed by Medzhitov. This approach will facilitate the development of considered management strategies aimed at optimizing the para-inflammatory status of the eye in patients wearing specialty lenses.

Course Objectives:

Upon completion of this course, the participant should:

1. understand the sub-clinical inflammatory nature of contact lens wear
2. appreciate that this sub-clinical inflammatory nature of contact lens wear is protective
3. be aware of the implications of the sub-clinical inflammatory nature of contact lens wear for specialty lens fitting

Course Outline:

- I. Introduction: Considering the inflammatory nature of contact lens wear
 - a. Professor Efron first mooted this notion in 1985, publishing a paper entitled “Is contact lens induced corneal oedema inflammatory?” (Aust J Optom 1985; 68: 167–172).
 - b. He then revisited this question in 2012, again asking “Is contact lens wear inflammatory?” (Br J Ophthalmol 2012; 96: 1447–1448).
 - c. In this course Professor Efron directly addresses this question by testing whether physiological changes occurring during contact lens wear meet classic and contemporary definitions of inflammation.
 - d. The first contact lens papers by Muller (1887) and Fick (1888) alluded to inflammatory signs during contact lens wear
- II. Classic Latin definitions of inflammation as defined by Celsus (5 BC) and Galen (150 AD):
 - a. Rubor (redness)
 - i. The eye goes red during contact lens wear
 - ii. This reaction is related to contact lens oxygen permeability, noting that hypoxia is a driver of inflammation
 - iii. More redness is seen with hydrogel vs. silicone hydrogel lenses
 - b. Calor (heat)
 - i. There is a slight increase in temperature beneath a contact lens
 - ii. Conjunctival hyperemia is associated with increased conjunctival temperature
 - c. Tumor (swelling)
 - i. Corneal swelling occurs in response to contact lens wear
 - ii. This reaction is related to contact lens oxygen permeability, noting that hypoxia is a driver of inflammation
 - d. Dolor (pain)
 - i. Patients can feel contact lenses within the first few minutes after insertion
 - ii. Contact lenses cause discomfort towards the end of the wearing period
 - e. Functio Laesa (loss of function)
 - i. 40% of patients discontinue soft contact lens wear after 12 months
- III. Contemporary definitions of inflammation
 - a. Cellular reactions
 - i. Corneal confocal microscopy can be used to observe cellular reactions to contact lens wear
 - ii. Langerhans cells are observed to increase in numbers in the corneal within the first few hours of contact lens wear

- b. Biochemical reactions
 - i. Inflammatory mediators can be measured from the tear film during contact lens wear
 - ii. There is an upregulation of numerous inflammatory mediators during contact lens wear

- IV. Characterizing the subclinical inflammatory response to contact lens wear:
 - a. Medzhitov (2008) proposed that inflammation occurred in 3 phases:
 - i. Homeostasis
 - ii. Para-inflammation
 - iii. Inflammation (Nature 2008; 454: 07201)
 - b. It is hypothesized that para-inflammation is essentially the intrinsic, sub-clinical inflammatory response to contact lens wear
 - c. The presenter proposes that a better approach is to consider the inflammatory response to contact lens wear as a *continuum* rather than the three discrete stages, as originally described by Medzhitov

- V. The subclinical inflammatory response to contact lens wear is protective
 - a. Menkin wrote a paper in 1931 entitled "Inflammation: a protective mechanism" (Arch Int Med 1931; 48: 261)
 - b. It is proposed that para-inflammation is a positive, protective phenomenon that reflects an upregulation of the immune system, in a non-damaging way, so that it is in a state of 'heightened alert', ready to ward off any extrinsic noxious challenge.
 - c. Severe bacterial keratitis associated with daily wear of contact lenses has an incidence of 4 cases per 10,000 patients per year
 - d. This very low rate of infections may be due to the protective sub-clinical inflammatory status of contact lens wear.
 - e. Not all experts agree that contact lens-induced para-inflammation is protective

- VI. Implications for specialty lens fitting
 - a. Consider the inflammatory impact of lens type being fitted:
 - i. Daily disposable soft
 - ii. Reusable soft
 - iii. GP
 - iv. Scleral
 - v. Corneo-scleral
 - vi. Hybrid

- b. Consider the eye being fit
 - i. Examples of eyes being fit with specialty lenses that are not inflamed
 - 1. High astigmatism
 - 2. Myopia control
 - ii. Examples of eyes being fit with specialty lenses that are possibly inflamed
 - 1. Keratoconus
 - 2. Associated eye rubbing
 - iii. Examples of eyes being fit with specialty lenses that are inflamed
 - 1. Sjögren's syndrome
 - 2. Post-keratoplasty
 - 3. Neurotrophic keratitis
- c. Consider competing influences:
 - i. Achieving a balance between the inflammatory impact of the lens vs. anti-inflammatory impact of drug release lenses or the therapeutic impact of lenses
 - ii. Aim to keep eye-lens system in the "sweet zone"
- d. Specialty lens fitting strategies to keep the eye-lens system in the "sweet zone":
 - i. Fit lenses that minimize para-inflammation
 - ii. Anti-inflammatory lens coatings
 - iii. Anti-inflammatory drug release lenses
 - iv. Anti-inflammatory systemic or ocular medications
 - v. Dietary modifications/supplements
- e. Optimizing contact lens comfort:
 - i. Introducing an inflammatory model for contact lens associated para-inflammation
 - ii. "Dolor" (discomfort) is at the center of the model

VII. Conclusions

- a. Contact lens wear is intrinsically inflammatory
 - i. This subtle, sub-clinical inflammatory response is referred to as para-inflammation
- b. It is hypothesized that para-inflammation is a positive attribute of contact lens wear
 - i. Para-inflammation is protective
- c. There are implications for specialty lens fitting
 - i. Consider the inflammatory response to lens wear as a continuum
 - ii. Aim to maintain the lens-eye system on the "sweet spot"
 - iii. Consider an inflammatory model for alleviating contact lens discomfort