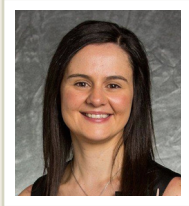


Contact Lens Update

CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

The link between nutrition and anterior eye health

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A high quality tear film is critically important to achieving successful contact lens wear. Ocular dryness, due to tear film deficiency, is one of the most frequent presentations encountered by eye care clinicians. Contact lens discomfort, which is “characterised by episodic or persistent adverse ocular sensations related to contact lens wear”¹ is the major reason for lens discontinuation.² Various clinical strategies exist to support the management of contact lens discomfort. A mainstay of therapy is artificial tear (lubricant) eye drops, which supplement the tear film by introducing aqueous and/or lipids to boost tear volume and stabilise the tears, thereby delaying break-up and tear film evaporation. However, self-administering artificial tears can be challenging and many patients strongly dislike instilling eye drops,³ which can compromise compliance and patient outcomes.

In recent years there has been increasing clinical interest in the potential influence of nutrition on ocular health and the utility of nutrition-based strategies for managing eye disease. In the context of retinal disease, as recently reviewed,⁴ epidemiological data have shown associations between diets rich in the macular carotenoids (zeaxanthin and lutein) and omega-3 (ω -3) long-chain essential fatty acids (EFAs), and a reduced long-term risk of late-stage age-related macular degeneration (AMD). In addition, the Age-Related Eye Disease Study (AREDS)⁵ showed that daily consumption of a specific formulation of high-dose antioxidant vitamins and minerals, reduced the risk of progression from intermediate-stage to late-stage AMD from 28% to 20% over a five-year period.

Diet and nutritional supplementation are also of relevance to anterior eye health, in particular tear film integrity. Research to date has primarily focussed upon the contribution of nutrition to the management of dry eye disease, with few studies specifically evaluating the application of such strategies for modulating contact lens-associated discomfort or dryness. Nevertheless, an improvement in anterior eye health would be predicted to translate into an enhanced ocular surface environment that is more conducive to successful contact lens wear. Understanding research relating to the impact of diet and nutritional supplements on anterior eye health is essential to informing evidence-based clinical recommendations in daily practice.

Water intake

Adequate daily water intake is recognised to be important for general health. Many would be aware of the recommendation to “drink six to eight glasses of water each day”, however interestingly there is a lack of rigorous scientific evidence to support this advice.⁶ In the context of anterior eye health, in a cross-sectional study involving people aged 60 years or over, those with dry eye were found to have higher plasma osmolality, being a marker of poorer hydration, than individuals without dry eye.⁷ In addition, hydration status may influence the clinical expression of dry eye. For example, tear osmolality measures are affected by systemic hydration. In healthy adults, tear osmolality was found to increase as a consequence of a low level of dehydration following exercise;^{8, 9} fluid intake was shown to attenuate the elevation of tear osmolality in this population.⁸ The consumption of alcohol has also been shown to induce tear hyperosmolality, reduced tear stability and increased

corneal staining in adults.¹⁰ However, whether improving whole body hydration is a useful therapy for improving tear film quality to manage dry eye is equivocal. In a small pilot study involving 29 participants with symptoms of dry eye, about three-quarters of participants reported a decrease in symptomatology after being advised to increase their daily water intake for two-weeks.¹¹ Further research is needed to rigorously evaluate the value of altering hydration status to treat the signs and symptoms of tear dysfunction.

Essential fatty acids (EFAs)

EFAs are termed ‘essential’ as they are necessary for optimal health.¹² As they cannot be synthesised directly in the body, they must be derived from dietary sources. The two main forms of EFAs are the omega-3 (ω -3) and omega-6 (ω -6) fatty acids, which are derived from different food sources (Table 1). The ω -3 EFAs are found in relatively high concentrations in oily fish (e.g., salmon, tuna, sardines) and some plant sources (e.g., chia seeds, walnuts). Food sources rich in ω -6 EFAs, which are consumed relatively more frequently in modern Western diets, include meat, poultry and eggs.

Table 1 - Common dietary sources of essential fatty acids (EFAs)

| Type of EFA | Name of polyunsaturated fatty acid | Structure (number of carbons: number of double bonds) | Common food sources |
|-------------|--|---|--|
| Omega-3 | Alpha-linolenic acid | C18:3 (short-chain) | Flaxseed, canola oil, chia seeds, walnuts |
| | Eicosapentaenoic acid and docosahexaenoic acid | C20:5 (long-chain) C22:6 (long-chain) | Oily fish (salmon, trout, sardines, mackerel, swordfish, tuna) and shellfish |
| Omega-6 | Linoleic acid | C18:2 (short-chain) | Soybean oil, safflower oil, and corn oil |
| | Arachidonic acid | C20:4 (long-chain) | Meat, poultry, and eggs |

Importantly, the ratio of consumed ω -3 to ω -6 EFAs affects the body’s inflammatory status.¹³ In contemporary Western diets, the ratio of ω -6: ω -3 intake is often 15:1, whereas an ideal ratio is 4:1 or less.¹⁴ This is due to the differential affects of ω -3 and ω -6 fatty acid metabolism on systemic cytokine production. Overall, the ω -3 fatty acid metabolic pathways promote the generation of anti-inflammatory metabolites (e.g., resolvins and protectins), which limit inflammatory responses within the body. Conversely, the ω -6 pathway predominantly promotes the production of pro-inflammatory mediators. For this reason, researchers have sought to understand whether enhancing ω -3 EFA intake using nutritional intervention, can impart systemic anti-inflammatory effects that are useful for treating a range of conditions that have an inflammatory overlay, including dry eye.

Similar to the observational data for retinal disease, epidemiological data suggest that dietary EFA intake can influence anterior eye health. In the Women’s Health Study, which involved almost 40,000 female health professionals, a higher dietary intake of ω -3 EFAs was associated with a reduced incidence of dry eye disease.¹⁵ In this study, Miljanovic and colleagues reported a 30% reduction in the risk of dry eye for each 1000mg of ω -3 EFAs consumed daily.¹⁵ Tear film lipid composition is also influenced by EFA dietary intake. For example, the polar lipid pattern of meibomian gland secretions is affected by ω -3 EFA consumption.¹⁶ Most recently, the ratio of ω -6: ω -3 lipids in the tear film was found to be higher in people with dry eye, and this was found to be in proportion to the extent of tear instability and corneal staining.¹⁷

In addition to these cross-sectional studies, over the past few years several clinical trials have been undertaken with the aim of evaluating the efficacy and/or safety of EFA supplementation for treating tear film abnormalities.¹⁸

Although evidence to support the use of EFA supplements for dry eye disease is mounting, there is still a need to determine the optimal daily dose, ideal formulation and required duration of the intervention. To date, only one study has evaluated the potential benefit of ω -3 EFA supplementation for improving ocular comfort in soft contact lens wearers. In this randomised, double-masked clinical trial conducted in India, low dose ω -3 EFA supplementation was compared to a 'control' intervention (comprising corn oil, being an ω -6 fatty acid) over six months. Compared with the ω -6 fatty acid supplementation, which is potentially pro-inflammatory, contact lens wearers who consumed ω -3 EFA supplements were reported to have reduced dry eye symptoms at the study endpoint.¹⁹

To promote the provision of evidence-based advice to patients in relation to diet and nutritional supplementation and its influence on eye health, our research unit (The Anterior Eye, Clinical Trials and Research Translation Unit at the University of Melbourne) has recently developed a novel quantitative diet and nutritional supplementation tool. The tool provides evidence-based summaries about diet and nutritional supplements and their effects on eye health, for use by optometrists to provide advice to their patients in these areas. Optometrists who are interested in receiving further information about the clinical tool can contact the author via email.

In conclusion, a multi-faceted approach, which includes a consideration of a patient's nutritional status, is essential to achieving the desired goal of successful contact lens wear.

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