A Grain of Salt?

Skeptics wonder if osmolarity testing lacks clinical value. Here's why they're wrong.

By Paul M. Karpecki, OD

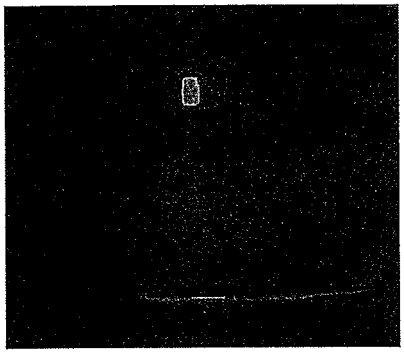
Darwin noted that those who are best able to adapt are the ones who survive. So it's no surprise that much of a clinician's success can be attributed to their ability to adapt to change; in optometry, this requires time, research, observation and evidence. When all of this leads to improved patient care and more effective management, the new way of thinking takes hold.

Two recent major changes from traditional thinking stand out. First is the realization that dry eye disease (DED) is often asymptomatic, and, second, osmolarity testing is not just a number used for patient compliance purposes; it can actually change the diagnosis and treatment plan.

For decades we've been taught that dry eye is a symptomatic disease and treatment will make your patients happy. Yet, research suggests that relying on symptoms to diagnose DED would produce an incorrect diagnosis over 40% of the time.[1-3] Imagine if you had to remake spectacles over 40% of the time—it'd be hard to build a practice on a process that error prone; it's the same with building an OSD or DED practice.

Signs vs. Symptoms

So why is there such a disparity between signs and symptoms? Research shows that we may not be asking all the right questions; for example, we rarely ask about blurred vision, yet it is one of the most consistent symptoms of DED in all severity levels.[4] Additionally, although tear fluid hyperosmolarity initially increases nerve activity of cold thermoreceptor endings in the cornea, leading to symptoms of dryness, chronic dry eye disease shows that symptoms dissipate as the disease progresses and corneal hypoesthesia develops.[5,6] If inflammation-induced hypersensitivity to polymodal or cold receptors occurs, patients may develop a neuropathic dry eye, which is extremely difficult to manage.[7] To make DED symptomatology even more complex, Sjögren's syndrome patients with longstanding aqueous tear deficiency and keratoconjunctivitis sicca (KCS) have reduced corneal sensitivity, yet they still complain of more irritation than other longstanding DED patients.[8]



Corneal staining is a late-stage disease indicator.

Because DED symptoms go through a cycle, a patient whose inflammation is not addressed (e.g., uses only OTC artificial tears) during the symptomatic phase of the disease may actually progress until the nerves are altered or downregulated, causing the patient to believe the disease has resolved. In actuality, it has likely progressed and the patient will only seek help when vision is significantly decreased due to advanced DED signs. These patients are not mentioning dryness, burning, grittiness or any typical dry eye symptoms, making it difficult to diagnose correctly.

With chronic inflammation, alterations in corneal nerve morphology develop, including thicker appearing stromal nerves (but no increase in nerve density) and nerve growth of cone-like structures often associated with dendritic antigen-presenting cells, thus implicating longstanding inflammation as a cause.[6-8] If it persists long enough, neuropathic pain, potentially involving the central and peripheral trigeminal sensory network, may develop.[9]

Additionally, symptoms that mimic dry eye disease can be caused by numerous conditions, including asthenopia from vertical imbalance, convergence insufficiency or fixation disparity, Salzmann's nodular degeneration, recurrent corneal erosion, giant papillary conjunctivitis, allergic conjunctivitis, bacterial or viral conjunctivitis, blepharitis, pinguecula, conjunctivochalasis, etc.[10-24] Many of these conditions involve symptoms of gritty, dry, burning eyes that give the impression of DED, based on a symptomatic approach, yet the causes and management are entirely different.

Osmolarity Testing

One test that may help make the DED diagnosis without relying on symptoms alone is osmolarity testing. Although there are over 2,000 studies

on osmolarity and the ocular surface, with the majority of them (>90%) supporting the technology in DED management, many doctors remain unsure of its applications and how, or even if, it benefits clinical care.[25]

Although most clinicians will state that it is mainly used to monitor disease progression and provide a number to assist patient compliance, I disagree. The primary purpose of tear osmolarity testing is to know if a patient has dry eye disease. Hyperosmolar status, whether through decreased tear production or an increased evaporative state, indicates reduced aqueous levels.[26] The test indicates whether or not the patient has a higher salt content than normal: as the volume of aqueous declines, the salt concentration in tears increases. When using osmolarity testing in an untreated patient, if you get a reading under 290mOsmol/L and each eye is within 8mOsmol/L of the other (e.g., 281 and 285), the patient doesn't have DED—end of story.[27] Don't put them on steroids, Restasis (cyclosporine ophthalmic emulsion, Allergan) or even artificial tears. Instead, look for other causes such as the various forms of conjunctivitis, conjunctivochalasis or eye alignment issues like vertical disparity or fixation/proprioceptive disparity between the eyes.

A recent patient with symptoms of dry eyes, grittiness and burning, which were worse while working on a computer or late in the day, tested positive for inferior corneal staining, a rapid tear break-up time and a small tear meniscus. She was put on topical steroids, Restasis and artificial tears, but reported no improvement after six months and discontinued all her drops. Four months later, she was observed in our clinic and osmolarity was measured at 287 and 289—no dry eye. *Demodex* blepharitis and vertical phorias were diagnosed. Both conditions were treated, and symptoms fully resolved. Without osmolarity testing, patients such as this one are often prescribed drops for months or years to treat DED. It is only after therapies fail do we decide they don't have DED. I'd rather perform osmolarity testing and know the answer in seconds on the first evaluation.

Treating DED

Knowing patients' osmolar status can also help with treatment options. Anecdotally, through a registry of hundreds of patients, we have determined that a patient with elevated osmolarity (i.e., >320) and any level of MGD is going to respond better to a tear that lowers osmolarity more than others, such as Blink (Abbott Medical Optics) or TheraTears (Akorn), and will typically choose it over a lipid-based tear.[28-30] By contrast, a patient with <310 osmolarity and mild to moderate MGD will often choose a lipid-based tear—such as Retaine MGD