

Published April 15, 2009

## Which Drop for Dry Eye?

When it comes to treating dry eye, keep your armamentarium well stocked. No single artificial tear works well for every form of dry eye. Rather, each option has benefits in certain situations.

Srihari Narayanan, O.D., Ph.D.



When it comes to treating dry eye, keep your armamentarium well stocked. No single artificial tear works well for every form of dry eye. Rather, each option has benefits in certain clinical situations. **By Srihari Narayanan, O.D., Ph.D.**

Dry eye disease is observed often in our practice as primary eye care providers. In general, dry eye is characterized as a disease that occurs due to increased tear evaporation or decreased tear secretion that resulted in symptoms of ocular irritation.<sup>1</sup>

The recent International Dry Eye WorkShop (DEWS) defined dry eye disease as follows: Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface.<sup>2</sup> As outlined in the DEWS definition, dry eye disease not only causes ocular irritation, but also affects the quality of the patients visual acuity and can affect the integrity of the ocular surface.

Estimates of the prevalence of dry eye vary considerably between different populations of the world. In the United States, it is thought that dry eye occurs in 5% to 30% of the population.<sup>3</sup> As practitioners, we are well aware that this disease affects women more than men and also increases in incidence in the older population.<sup>3</sup>

Dry eye disease does cause significant economic burdens on the patient through the costs for obtaining treatment, follow-up visits, additional testing and loss of working hours.<sup>4</sup> Furthermore, it has been shown that dry eye disease affects the quality of life of a patient.<sup>5</sup>

A wide variety of therapeutic options are available for dry eye disease. Various treatment strategies, such as artificial tears or rewetting agents (henceforth called artificial tears), punctal plugs, anti-inflammatory agents (topical steroids or oral fatty acids), moisture goggles, secretagogues, autologous serum, prescription immunomodulatory drugs (topical and oral) as well as surgical options, are available for the treatment of dry eye disease.

Identification of the underlying cause of dry eye aids in successful treatment of this disease. However, its multifactorial nature makes it complicated to identify a single cause in a particular patient.

The diagnostic challenge is further increased for dry eye disease because no single test is available to correctly diagnose its various forms. Current research suggests that inflammation at the ocular surface plays an important role in the pathogenesis of dry eye.<sup>6</sup>

Among all therapeutic options for dry eye disease, artificial tears are still the mainstay in the initial management of a dry eye patient.<sup>7</sup> Ophthalmic physicians usually begin a newly-diagnosed dry eye patient on a regimen of topical artificial tears and then add to or modify the course of treatment from there.

Currently, there are various artificial tears available over-the-counter; one brand (FreshKote, Focus Laboratories) is available by prescription only. Artificial tears are generally designed to lubricate the ocular surface and replace tear volume.

Due to the complex nature of the tear film, it is difficult to design an artificial tear solution that is identical to human tears. However, many artificial tear brands try to improve their quality by altering the composition, viscosity and/or osmolarity of the solution.

This article details some of the commonly available compositions of artificial tears and discusses their potential use in specific causes of dry

eye disease. There is no single brand of artificial tears that works well for every form of dry eye. Rather, each option (organized here by formulation composition) has benefits for certain clinical situations.

### **CMC-Based Artificial Tears**

Carboxy methylcellulose (CMC, discussed below) and hydroxypropyl methylcellulose (discussed later) are polysaccharides known as mucilages.<sup>8</sup> The methyl and hydroxypropyl cellulose derivatives are widely used in artificial tear formulations. They increase the residence time of tears as well as increase the viscosity of tears.<sup>8</sup> Interestingly, the refractive index of 1% methylcellulose is 1.336, which closely matches that of human tears.<sup>8</sup>

Commonly available CMC artificial tears include the Refresh brand of tears (Allergan) as well as TheraTears (Advanced Vision Research). CMC-based artificial tears may protect the integrity of the ocular surface.<sup>9</sup>

Refresh is available in both preserved and non-preserved as well as in liquigel formulations. It has been shown that the mid-viscosity (1.0% CMC) Refresh Liquigel promotes significant reduction in the signs and symptoms of dry eye compared to lower viscosity agents.<sup>9</sup> So, CMC-based artificial tears may be indicated in patients who demonstrate ocular surface staining with vital dyes. TheraTears has the added benefit of being a hypotonic solution. Hyperosmolarity is a common feature of most forms of dry eye disease.<sup>1</sup> Therefore, the hypotonic TheraTears solution may provide comfort in dry eye patients.

### **HMC-Based Artificial Tears**

Several brands of artificial tears, such as Tears Naturale and Bion Tears (Alcon), GenTeal (Novartis) and Visine Tears (Pfizer) are hydroxypropyl methylcellulose (HMC) based. Tears Naturale is available both with and without preservatives. Bion Tears is preservative free and has been suggested for use in patients with severe dry eye.<sup>10</sup> GenTeal is available in three different formulations, one each for mild, moderate or severe dry eye.<sup>11</sup> Visine Tears is available with or without preservatives. HMC-based artificial tears work on the simple principle of lubricating the ocular surface in order to promote the integrity of the surface.<sup>10</sup>

### **HP Guar-Based Artificial Tears**

Systane (Alcon) is formulated with hydroxypropyl guar (HP guar). The HP guar in this artificial tear brand is gel-forming and offers a unique mechanism to approach the problem. These properties of HP guar improve recovery of the ocular surface due to possible increased retention time of the artificial tear drop.<sup>12</sup>

Also, the increased retention time may be responsible for the increase in tear film break-up times observed with HP guar-based artificial tears compared to CMC-based tears.<sup>13</sup> Tear evaporation may be reduced by the use of HP guar containing artificial tears.<sup>14</sup> So, HP guar-based artificial tears may be helpful in patients with conditions causing evaporative dry eye (e.g., meibomian gland disease) as well as patients demonstrating ocular surface staining.

### **SH-Based Artificial Tears**

Blink Tears and Blink Contacts (Abbott Medical Optics) and AQuify comfort drops (CIBA Vision) are brands that include sodium hyaluronate (SH) as an inactive ingredient. Blink Tears and AQuify comfort drops

# Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

## Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

## Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

## Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

## API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

## LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

## FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

## E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.