Typically, dry eye disease (DED) is not the first diagnosis that comes to mind when a child presents with red, irritated eyes. For starters, the signs and symptoms can mimic other ocular conditions that are much more common in this patient population, such as allergic and viral conjunctivitis. Additionally, children tend to have healthy tear films, so eye care practitioners are not inclined to suspect DED.

**THE TRUE COST OF UNDETECTED DED IN CHILDREN**

The incidence of DED in children is estimated to be low, with only about 1% to 2% ever complaining of its symptoms; however, if left untreated, DED carries the potential for permanent damage. Constant ocular discomfort and fluctuating vision can lead to children having difficulty concentrating in school. Because DED is exacerbated by demanding visual tasks such as reading and computer use, children may attempt to avoid these important activities. Chronic, untreated DED can increase a child’s risk for persistent corneal epithelial defects, ocular infection, ulceration, and permanent damage including neovascularization and scarring. Corneal scarring in a young child can have devastating consequences, including permanent vision loss and the development of form-deprivation amblyopia. In a small number of cases, the discovery of DED in a child can simply represent the tip of an iceberg.

**SYSTEMIC DISEASE AND DED**

DED can manifest in several childhood conditions and can even be the initial warning sign that a system-wide problem is brewing. Some studies have shown a seven- to 10-fold increase in DED symptoms with systemic diseases, such as juvenile arthritis and type 1 diabetes. Type 2 diabetes, formerly known as adult-onset diabetes, is a known risk factor for DED in adults, and the condition appears to be on the rise in the younger population where its prevalence was previously virtually nonexistent.

Other childhood conditions can be associated with DED (Table). Although primary Sjögren syndrome (SS)

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**TABLE. FACTORS SUSPECTED TO CONTRIBUTE TO DED IN CHILDREN**

<table>
<thead>
<tr>
<th>Intrinsic</th>
<th>Extrinsic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermatological (rosacea, psoriasis, blepharitis)</td>
<td>Environmental (air conditioning, fans, heaters, low humidity/high altitude, cigarette smoke/pollutants, allergens)</td>
</tr>
<tr>
<td>Endocrine (thyroid disease, type 1 and type 2 diabetes)</td>
<td>Medication (antihistamines, beta-blockers, retinoids, topical preservatives)</td>
</tr>
<tr>
<td>Autoimmune (lupus, juvenile arthritis, Sjögren syndrome, graft-versus-host disease, Stevens-Johnson syndrome, sarcoidosis)</td>
<td>Postinfectious (HSV, HZV, HIV, Epstein-Barr, trachoma, measles, hepatitis C)</td>
</tr>
<tr>
<td>Congenital (cystic fibrosis, Riley-Day syndrome, Turner syndrome, ectodermal dysplasia syndromes, Allgrove syndrome, alacrima)</td>
<td>Nutritional (poor diet, malabsorption syndromes, vitamin A deficiency)</td>
</tr>
<tr>
<td>Lid aperture disorders, thyroid ophthalmopathy</td>
<td>Contact lens wear, video games/computer use</td>
</tr>
</tbody>
</table>

Abbreviations: HSV, herpes simplex virus; HZV, herpes zoster virus; HIV, human immunodeficiency virus.
is most often associated with postmenopausal women, it has been identified in children as young as 5 years of age and is believed to be underdiagnosed in the pediatric population. SS can also present secondary to other systemic diseases, including hypothyroidism and connective tissue disease, and should be investigated in children with these conditions. Identifying SS is imperative, as it has been reported that these individuals have a much higher incidence of developing lymphoma.

MEIBOMIAN GLAND DISEASE IN CHILDREN

Thanks to the recent work of the International Workshop of Meibomian Gland Dysfunction, the meibomian gland has moved into the spotlight, and eye care practitioners are more aware than ever of the important role this tiny structure plays in DED. Altered gland function can result in significant instability of the tear film, causing evaporation and inflammation, which can further exacerbate the symptoms of DED. One condition that directly affects meibomian gland function is ocular rosacea, a disease that is somewhat common in adults, affecting approximately 10% of the population. Ocular rosacea is often misdiagnosed in children, because the dermatological signs that are normally seen in mature patients (ie, facial flushing, papules, erythema, acne, and telangiectasias) are largely absent in prepubescent children. In fact, two studies found that only about one-third of children present with cutaneous signs. Proper diagnosis can be complicated by the fact that ocular rosacea can mimic a variety of conditions, as these patients often have a history of recurrent hordeolum, phlyctenular keratoconjunctivitis, and/or staphylococcal marginal disease. Clinical observations often include meibomian gland dysfunction (MGD) (Figure), posterior lid inflammation, scalloped lid margins, lid telangiectasia, conjunctival injection, and punctate keratitis. Advanced cases can lead to permanent corneal damage and complete meibomian gland atrophy.

TREATMENT CONSIDERATIONS

Artificial tears are the most common therapy for all etiologies of DED. Success can often be achieved with drop therapy if these lubricants are chosen selectively and dosed frequently; however, compliance can be a problem. Oil-based formulations, such as Systane Balance (Alcon Laboratories, Inc.), Refresh Optive Advanced (Allergan, Inc.), and Retaine MGD Ophthalmic Emulsion (Ocusoft, Inc.) work well for MGD, and nonpreserved tears are necessary for greater than q.i.d. administration to avoid preservative toxicity issues. A hand-written prescription for over-the-counter drops can go a long way toward ensuring patient compliance and is often required if artificial tears are to be administered at school. If a prescription lubricant is required, Freshkote (Focus Laboratories, Inc.) is currently the only artificial tear available.

For mild cases of MGD and anterior blepharitis, daily warm compresses and lid scrubs should be used to prevent sequelae, but patients and their parents should be educated that these are not overnight solutions and are often a lifetime commitment. In some circumstances, topical antibiotics must be used to control lid flora. If MGD is moderate to severe, a low-dose oral tetracycline may be indicated for a period of several months. Tetracyclines are known to accumulate in the sebum, decrease the production of bacterial lipase, and lower the concentration of free fatty acids. In addition, they may decrease production of microbial inflammatory mediators. Tetracyclines are contraindicated in children younger than 8 years of age, because of potential interference with proper development of teeth and bones. Parents should be made aware of other possible side effects, including photosensitivity and dyspepsia. For very young children, and in other cases where tetracyclines are contraindicated, consider topical azithromycin (AzaSite, Merck & Co., Inc.), massaged nightly into the lids and lashes for 1 month. This macrolide is very well tolerated, and although it is considered an off-label use to prescribe it for MGD, it is gaining popularity among eye care practitioners to treat patients of all ages due to its intrinsic combination of anti-infective and anti-inflammatory properties.

For those patients with aqueous-deficient DED or conditions that cause excessive corneal exposure, permanent punctal occlusion may be beneficial. Studies have shown that plugs are an effective treatment option for children.

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as young as 1.5 years, however, patients this young often require mild sedation for placement. It is imperative to control ocular allergy and inflammation prior to occlusion, or symptoms will likely worsen. If significant inflammation is present, a short course of low-dose topical corticosteroids may be used to help the patient look and feel better quickly. This treatment strategy can have the added benefit of instilling parental confidence in the care provider. Be aware, however, that long-term use of topical corticosteroids can cause cataract, and the intraocular pressure response in children using certain robust steroids can be more frequent and severe than in adults.

Environmental modification is also an important part of treating DED, including decreasing the use of fans, redirecting air vents away from the face, limiting video or computer games (or taking visual breaks with drop instillation every 30 to 60 minutes), and avoiding the overwear of contact lenses. A healthy diet with increased water consumption, reduced soda/caffeine intake, and a good balance of omega-3 and omega-6 essential fatty acids is an important complement to any treatment therapy.

CONCLUDING THOUGHTS

DED is underdiagnosed in general, and the condition can have a significant impact on young patients. Testing for DED, performed routinely in adults, should be employed in all symptomatic or at-risk children, including the instillation of vital dyes (such as lissamine green and sodium fluorescein) and meibomian gland expression. DED can affect ocular health, but in some cases, it can also provide valuable clues regarding a child’s systemic well-being.

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