

DEMODEX: DETERMINING PREVALENCE AND PREDICTING RISK



Data from a prospective case series serve as the foundation for an algorithm to predict the probability of *Demodex* mite infestation.

BY VINH NGO, OD; ALISON A. TEO, MD; ADAM JACOBSON, MD; ALANNA NATTIS, DO, FAAO; AND ERIC ROSENBERG, DO, MSCENG

There are more than 140 species of mites, but only *Demodex folliculorum* and *Demodex brevis* exist in humans.¹⁻⁵ *Demodex* mites tend to accumulate on the face, cheeks, forehead, nose, and external ear canal, where sebum excretion may provide a favorable habitat for breeding.^{1,4} The anatomical features of the eyelids can also create a favorable environment for *Demodex* mites to spread and flourish, which can lead to lid margin infection, ocular surface irritation, and symptoms of ocular discomfort such as itching, foreign body sensation, and stinging.^{2,3,6} Chronic infestation of the eyelids by *Demodex* mites may cause inflammation of the eyelid or ocular surface and secondary bacterial infection.^{1,2,5}

Several studies have shown a significant increase in the incidence of *Demodex* mite infestation in the eyelashes of individuals with chronic blepharitis compared with healthy individuals. The exact pathogenesis of chronic blepharitis, however, remains unclear. With few cross-sectional observational studies investigating the prevalence of *Demodex* mites in healthy individuals and no FDA-approved medications currently available, identifying and treating *Demodex* blepharitis has been exceedingly challenging. As of this writing, the most

common treatments for demodicosis include tea tree oil products and ivermectin.² Tea tree oil products are widely used. It is worth noting, however, that a recent Cochrane review found that their efficacy for the treatment of demodicosis is uncertain,⁷ and Chen et al reported that tea tree oil might be harmful to the human meibomian gland epithelial cells in vitro.⁸ Our study sought to provide information on the identification and treatment of *Demodex* blepharitis.

RESEARCH

Study design. We conducted a cross-sectional, nonrandomized prospective study at two large tertiary care medical centers in New York (one urban and one suburban; N = 199). We investigated the prevalence of *Demodex* mites among all patients presenting to general and subspecialty outpatient ophthalmology clinics at these two centers and identified comorbid conditions and risk factors associated with chronic blepharitis in affected individuals. We also set out to design and build a model to predict the incidence of *Demodex* in individuals presenting with the risk factors we identified.

We collected relevant data such as the duration of dry eye/blepharitis syndrome, demographics, use of medications, surgical history, previous

ocular treatments aimed at improving dry eye/blepharitis syndrome, and use of over-the-counter cosmetic products. Examination findings recorded included dry eye disease (DED), blepharitis, pterygium, use of eye makeup, and the presence of *Demodex* mites on epilated eyelashes (one from each lid).

Results. We identified 123 patients with blepharitis, and *Demodex* mites were identified in 68% of them. Patients with blepharitis practiced lid hygiene twice as often as those without blepharitis, suggesting that the former's symptoms prompted them to seek help or to change their daily routines. Among the 84 patients with blepharitis thought to be associated with *Demodex*, only one (1%) was receiving adequate management targeted to the pathology. In agreement with prior studies, we found a positive and linear correlation with age. Strong correlations were also observed between the presence of *Demodex* and a history of pterygium surgery, blepharitis, DED, and dermatochalasis.

Discussion. Validating our results, the Titan study, a retrospective chart review of 1,032 patients seen for any reason at six eye care clinics across the country, was also presented at this year's ASCRS meeting.⁹ Sadri et al reported that collarettes, the pathognomonic

A Demodex probability calculator for ophthalmologists

Signs		Probability of Demodex:
Age (years):	<input type="text"/>	
Dry Eye:	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Blepharitis:	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Dermatochalasis:	<input type="radio"/> Yes <input checked="" type="radio"/> No	
History of Pterygium Surgery:	<input type="radio"/> Yes <input checked="" type="radio"/> No	

B

Signs		Probability of Demodex:
Age (years):	<input type="text" value="57"/>	
Dry Eye:	<input checked="" type="radio"/> Yes <input type="radio"/> No	
Blepharitis:	<input checked="" type="radio"/> Yes <input type="radio"/> No	
Dermatochalasis:	<input type="radio"/> Yes <input checked="" type="radio"/> No	
History of Pterygium Surgery:	<input checked="" type="radio"/> Yes <input type="radio"/> No	

84%

Figure. The *Demodex* probability calculator (A) and a sample risk probability calculation (B). The calculator is available at www.DolHaveDemodex.com.

sign of *Demodex* blepharitis, were present in 58% of patients, similar to the prevalence of DED, and that 69% of blepharitis patients had *Demodex*, similar to our finding of 68%. Among patients using prescription medications for the treatment of DED, 60% still had collarettes. Both our study and the Titan study identified a largely underdiagnosed cohort of patients who were experiencing *Demodex* blepharitis with an inadequate management of disease.

ALGORITHM FOR PREDICTING RISK

Visualizing *Demodex* mites requires epilation of the eyelashes and direct observation under light microscopy, both of which are impractical and time-consuming at most clinics. In an effort to streamline diagnosis, we leveraged the data collected in our

study to develop a predictive calculator to determine the likelihood of any one patient's having *Demodex* (Figure). The calculator is available online at www.DolHaveDemodex.com. *Demodex* activity can then be confirmed in these patients at the slit lamp by looking for collarettes.

CONCLUSION

Identifying and treating *Demodex* mites in patients with associated blepharitis and DED can provide them with symptomatic relief. Studies such as ours clearly demonstrate the need for innovative, effective, and safe treatments that address the root cause of blepharitis. ■

1. Kheirkhah A, Casas V, Li W, Raju VK, Tseng SCG. Corneal manifestations of ocular *Demodex* infestation. *Am J Ophthalmol*. 2007;143(5):743-749.
 2. Naveil V, Mulliez A, d'Azy CB, et al. Efficacy of treatments for *Demodex* blepharitis: a systematic review and meta-analysis. *Ocul Surf*. 2019;17(4):655-669.

3. Randon M, Liang H, Hamdaoui ME, et al. In vivo confocal microscopy as a novel and reliable tool for the diagnosis of *Demodex* eyelid infestation. *Br J Ophthalmol*. 2015;99(3):336-341.
 4. Zhong J, Tan Y, Li S, et al. The Prevalence of *Demodex* folliculorum and *Demodex* brevis in cylindrical dandruff patients. *J Ophthalmol*. 2019;8949683. doi: 10.1155/2019/8949683
 5. Zhu M, Cheng C, Yi H, Lin L, Wu K. Quantitative analysis of the bacteria in blepharitis with *demodex* infestation. *Front Microbiol*. 2018;9:1719.
 6. Bhandari V, Reddy JK. Blepharitis: always remember *Demodex*. *Middle East Afr J Ophthalmol*. 2014;21(4):317-320.
 7. Savla, K., Le, J.T., and Pucker, A.D. Tea tree oil for *Demodex* blepharitis. *Cochrane Database Syst Rev*. 2020;6(6):CD013333.
 8. Chen D, Wang J, Sullivan DA, Kam WR, Liu Y. Effects of Terpinen-4-ol on Meibomian Gland Epithelial Cells In Vitro. *Cornea*. 2020;39(12):1541-1546.
 9. Sadri E, Yeu E, Trattler W, Holdbrook M, Baba S. The prevalence of collarettes and *Demodex* blepharitis in ophthalmology and optometry practices. Paper presented at: American Society of Cataract and Refractive Surgeons Annual Meeting; July 23-27, 2021; Las Vegas, Nevada.

ADAM JACOBSON, MD

- Assistant Professor, Ophthalmology and Visual Sciences, University of Michigan
- jacobsonab@gmail.com
- Financial disclosure: None

ALANNA NATTIS, DO, FFAO

- Cornea, cataract, and refractive surgeon and Director of Clinical Research, SightMD, Babylon, New York
- Associate Professor of Ophthalmology and Surgery, NYIT-COM, New York
- asn516lu@gmail.com
- Financial disclosure: Consultant (Alcon, Carl Zeiss Meditec, Glaukos, Novartis, Sight Sciences, Tarsus); Research support (Glaukos, Ocular Therapeutix)

VINH NGO, OD

- Optometrist, Luxottica Retail North America, Minnetonka, Minnesota
- vngo6@student.touro.edu
- Financial disclosure: None

ERIC ROSENBERG, DO, MSCENG

- Cornea and complex anterior segment surgeon, SightMD, Babylon, New York
- Assistant Professor, New York Medical College, Valhalla, New York
- ericr29@gmail.com
- Financial disclosure: Consultant (Alcon, Beaver Visitec International, Carl Zeiss Meditec, New World Medical, Omeros, Santen, Sight Sciences, Tarsus)

ALISON A. TEO, MD

- Pediatric ophthalmologist and adult strabismologist, Mary Bridge Children's Hospital, Tacoma, Washington
- teox015@umw.edu
- Financial disclosure: None