Examining Meibomian Gland Structure and Function in Patients With *Demodex* Blepharitis


Findings from a retrospective analysis highlight the association between *Demodex* blepharitis and meibomian gland structure and function.

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Meibomian gland disease (MGD) is defined as dysfunction of meibomian glands (e.g. obstruction, atrophy, or poor-quality meibum) that leads to tear film disruption, visual disturbance, and ocular discomfort.[1] Inflammation from *Demodex* mites may cause serious consequences, like *Demodex* blepharitis and MGD. When discussing MGD, it's important to include consideration of concurrent *Demodex* blepharitis. According to a study published in 2022, 58% of US patients (n = 595/1032) who visited an eye care clinic and underwent a slit-lamp examination, regardless of chief complaint, had *Demodex* blepharitis, including consultations for cataract or refractive surgery.[2]

A retrospective study by Cheng et al reported a positive rate of *Demodex* infestation in MGD patients (89%; n = 103 eyes of 52 patients) compared to control (43%; n = 62 eyes of 31 non-MGD patients).[3] In a separate single-center study, Bhandari et al concluded that the incidence of *Demodex* infestation was 60% for patients with MGD (n = 60) and 18% for control (n = 50).[4] Finally, Lim Bon Siong et al reported that the overall incidence of *Demodex* blepharitis was 85% for MGD patients (n = 65) and 34% for control patients (n = 50).[5] Although *Demodex* blepharitis may be asymptomatic in a small proportion of patients (≤1% in one prospective observational study of 515 patients; n = 4), most patients (98.3%) reported two or more symptoms.[6] Symptoms can stem from *Demodex* mites triggering inflammation leading to swollen eyelid margins, reduced gland openings, and compromised meibum flow.[7,8]

Additionally, *Demodex* infestation may be an important contributor to inflammatory MGD and can lead to structural and functional changes in the meibomian glands.[8] Symptoms from *Demodex* blepharitis and MGD can impact tear film stability and ocular surface integrity, and may also lead to altered biometry and abnormal corneal topography measurements, which can potentially affect cataract or refractive surgery planning and increase the risk of postoperative dissatisfaction.[9-12] Therefore, evaluation for *Demodex* blepharitis should be considered when managing MGD, particularly in patients undergoing such procedures.

STUDY RATIONALE AND DESIGN

In early 2025, we published a study in the *Journal of Cataract and Refractive Surgery* to answer one primary question: How do structural and functional measures of MGD compare in eyes with moderate-to-severe *Demodex* blepharitis (collarette grades 2–4) versus those with collarette grade 0?

For this retrospective, single-center, observational study, we examined case records of 438 patients ≥18 years with available data for collarettes and MGD signs (e.g., telangiectasia, meibum expressibility, meibum quality, meibography).[8] Collarettes were graded per eyelid on a 0 to 4 scale:

- Grade 0: 0 to 2 lashes/eyelid with collarettes.
- Grade 1: 3 to 10 lashes/eyelid with collarettes.
- Grade 2: >10 to <1/3 (~50) lashes/eyelid with collarettes.
- Grade 3: ≥1/3 to <2/3 (~100) lashes/eyelid with collarettes.
- Grade 4: ≥2/3 (~150) lashes/eyelid with collarettes.

Patients were divided into two groups based on collarette grade: those with confirmed presence of grade 2 or higher collarettes, indicative of moderate-to-severe *Demodex* blepharitis (>10 collarettes) at the slit lamp, and those with collarette grade 0 (0 to 2 collarettes).

To assess the structure and potential atrophy of the meibomian glands (MG), we performed infrared meibography of the lower eyelids bilaterally. Gland atrophy was evaluated using a 0 to 4 grading scale with a Lipiscan device. Additionally, lid margin telangiectasia and meibum secretion quality were similarly graded on scales of 0 to 4 and 1 to 4, respectively. Meibum expressibility was also assessed. For all measurements, higher scores indicated worse outcomes.

KEY FINDINGS

We learned a considerable amount from these results. However, the key finding was that among patients with moderate-to-severe

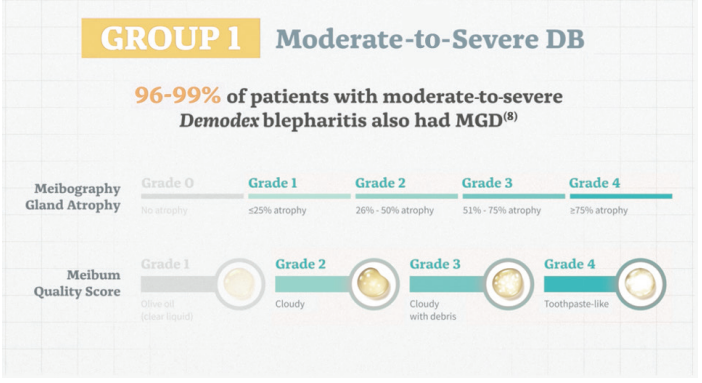

Figure 1. Study results showed that most patients in the moderate-to-severe *Demodex* blepharitis group had meibomian gland disease.

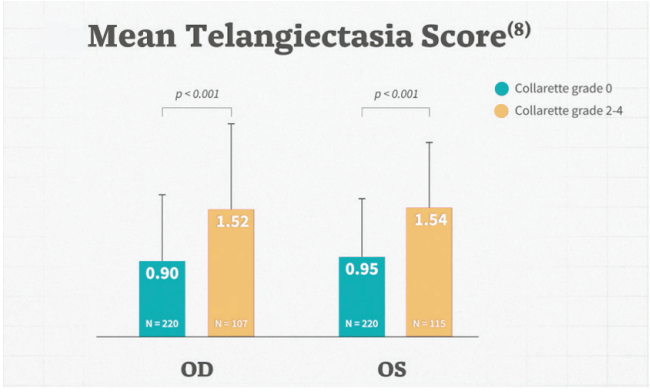

Figure 2. Mean lid margin telangiectasia scores were significantly higher in the moderate-to-severe *Demodex* blepharitis group than those with collarette grade zero.

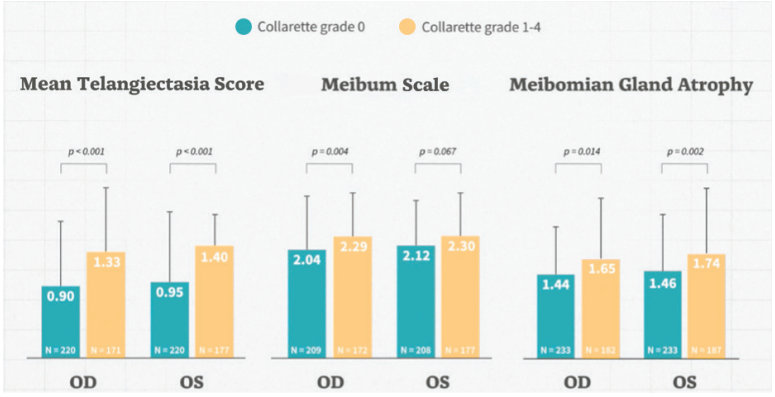

Figure 3. Meibomian gland atrophy, meibum quality, and mean telangiectasia score were all worse for people with moderate-to-severe *Demodex* blepharitis.

Demodex blepharitis, 96% to 99% were found to have MGD with either grade 2 to 4 meibum quality—which exhibits a cloudy to toothpaste-like secretion quality—or grade 1 to 4 MG atrophy (Figure 1).

As we dove deeper into meibum quality score data, we found that eyes with moderate-to-severe *Demodex* blepharitis had statistically significantly worse scores than eyes with collarette grade 0 for both right and left eyes. Even after adjusting for age and sex, statistically significant differences were observed between the two patient groups for telangiectasia, meibum quality, and MG atrophy.[8] We observed that lid margin telangiectasia severity results were similar to the meibum quality.[8] Scores were significantly higher in the moderate-to-severe *Demodex* blepharitis group than in those with collarette grade zero, with $P<0.001$ demonstrating a statistical significance (Figure 2).[8] Additionally, MG atrophy scores were also statistically significantly worse in the moderate-to-severe *Demodex* blepharitis group.[8]

Other notable data came from our correlation analysis on the relationship between collarette grade and MGD signs. We discovered a positive correlation between collarette grade and telangiectasia score, meibum quality score, and MG atrophy score.[8] There was no significant correlation between collarette grade and meibum expressibility.[8] Data also supported that higher collarette grade was associated with more severe MG structural and functional impairment, particularly MG atrophy and lid margin telangiectasia.[8]

Additional analysis comparing collarette grades 1 to 4 versus grade 0 showed a similar pattern of worsened telangiectasia, meibum quality, and MG atrophy in eyes with any collarettes (1 to 4) vs grade 0 (Figure 3).[8] This evidence suggested that even mild *Demodex* blepharitis may impact MG structure/function as well.[8]

CLINICAL IMPLICATIONS AND CONCLUSIONS

Overall, our study suggests that *Demodex* infestation is likely an important factor associated with MG structure and function and, therefore, MGD.

These findings can have many implications for doctors and their patients, particularly related to cataract and refractive surgery. For instance, patients with *Demodex* infestation may experience prolonged inflammation, redness, and irritation after surgery, contributing to patient dissatisfaction. Cataract surgery and postoperative topical steroid use have been shown to worsen *Demodex* infestation after cataract surgery,[13,14] and symptoms from *Demodex* blepharitis and MGD can impact the tear film and ocular surface, thereby leading to potential altered biometry and abnormal topography.[10-12]

In conclusion, this study demonstrated that both structural and functional measures of MGD—including meibum quality, telangiectasia score, and MG atrophy—were significantly worse in eyes with moderate-to-severe *Demodex* blepharitis.[8] Early identification and targeted management of *Demodex* blepharitis may represent a critical opportunity to help with ocular surface health in patients undergoing cataract or refractive surgery. ■

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