Prevalence of Meibomian Gland Atrophy in Keratoconus

Nau A, Brown K, Leach E, McLeod A

Eyewell Clinic, Boston MA
Forefront Eye Care, Boston MA
New England College of Optometry, Boston MA

Introduction

Keratoconus (KC) is a bilateral, asymmetric, non-inflammatory corneal ectasia characterized by progressive thinning of the corneal stroma resulting in corneal bulging and distortion. Patients with this condition often rely on full time use of contact lenses to achieve functional vision.

Studies suggest that contact lens use impairs complete blinking and contributes to development of meibomian gland dysfunction, the primary driver of dry eye disease. In patients without KC, meibomian gland dysfunction (MGD) is a primary cause of contact lens dropout. Currently, patients with KC who become intolerant of contact lenses risk serious visual disabilities or are sent for invasive and expensive procedures such as corneal transplantation. While visual outcomes for transplantation patients are continually improving, a majority still require use of therapeutic contact lenses post-operatively to optimize their vision.

The structure of the MG [represented by meibomian gland atrophy (MGA)] are biomarkers for severity of evaporative dry eye.

Purpose

- Use meibography images (Lipiview II, TearScience) to investigate the structure of meibomian glands in a cohort of KC patients.
- Determine whether age is a risk factor for MGA in persons with KC.
- Determine whether gender is a risk factor for MGA in persons with KC.

Methods

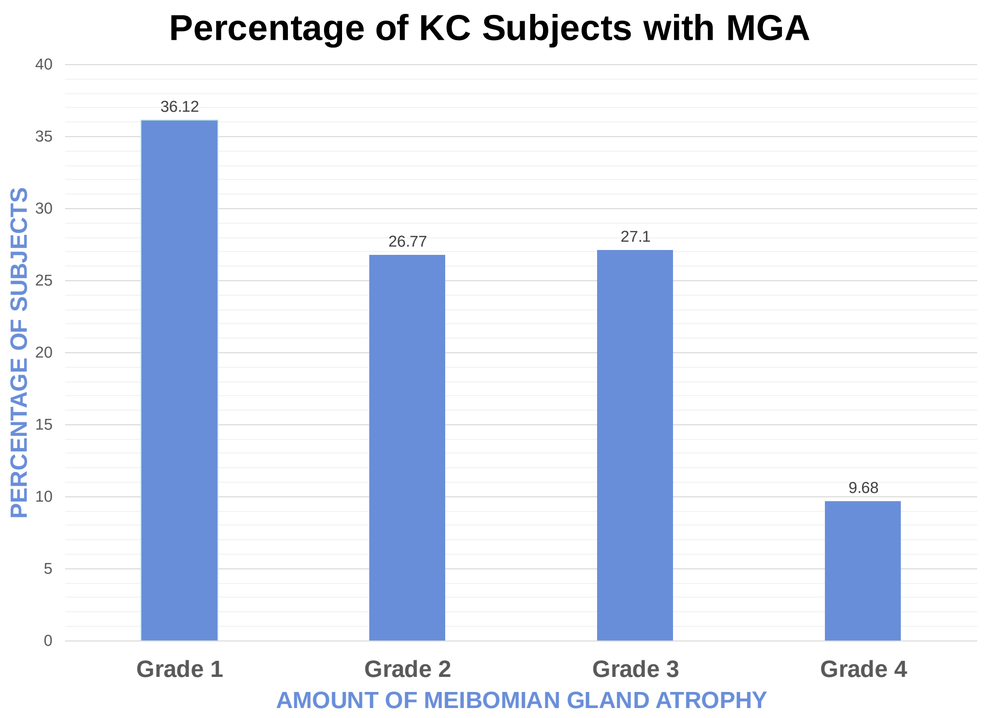
This was an IRB approved, single center, retrospective study of adult KC patients in an urban private practice (Boston, MA, USA) that specializes in medical contact lenses. Inclusion criteria included a diagnosis of KC of any severity, with or without prior corneal transplantation, who had valid meibography images. Use of contact lenses was not a requirement. Type of lens used was not included in the analysis due to the extremely varied history of lens modality.

Subjective assessment of lower lid meibomian gland atrophy (MGA) was performed by 3 independent masked investigators who graded MGA as Grade I (0-25%), II (26-50%), III (51-75%) or IV (76-100%).

Descriptive statistics, Mann-Whitney U Test and Linear Regression results are presented.

Results

Valid meibomian gland images were obtained from 305 eyes of 153 subjects [n=58 females average age 57 years (SD 14.75), range 29-77, and n=95 males average age 51.62 years (SD 13.55), range 26-75 years].



- There was no significant difference between the right and left eyes for either gender.
- On average, males exhibited more MGA than females (Mann-Whitney, $P<0.5$).
- Age for any gender did not show a relationship to MGA with linear regression analysis ($R^2=0.524$).
- Only 9 patients in this cohort did not currently wear contacts, but had in the past. Therefore a separate analysis of non-contact lens wearing KC patients was not possible.

Conclusions

63.88% of KC Patients Manifested Greater Than 25% MGA

- KC alone may not cause MGD. A larger study of age and gender matched non-contact lens wearing KC patients is needed to determine the influence of contact lenses.
- Data-driven recommendations for prophylactic and rehabilitative care of meibomian glands may decrease the economic and social burden of dry eye disease in patients with KC.

Bibliography

1. Shorter E, Harthan J, Nau A, Fogt J, Cao D, Schornack M, Nau C. Dry Eye Symptoms in Individuals With Keratoconus Wearing Contact Lenses. Eye Contact Lens. 2021 Sep 1;47(9):515-519
2. Nau A, Nau C, Shorter E, Schornack M, Fogt J, Harthan J. Opportunities for Improving the Long-Term Management of Keratoconus. JCLRS Vol 8. No. 1 2024
3. Mirza E, Oltulu R, Oltulu P, Mirza GD, Okka M. Dry eye disease and ocular surface characteristics in patients with keratoconus. Saudi J Ophthalmol. 2022 Jul 11;36(1):117-121. doi: 10.4103/sjopt.sjopt_37_21. PMID: 35971496; PMCID: PMC9375454.