Methods: Modeling Bending

- We couple fluid and solid mechanics to create a mathematical model of the contact lens on the eye.
  - First, we consider the effects of bending forces in the lens alone on the pressure distribution.
    - The tear film is modeled as a Newtonian fluid with a viscosity near that of water.
    - Lubrication theory governs its mechanics.
    - To simplify the mechanics, the contact lens is modeled as a solid beam.
    - Gravity and momentum are both neglected.
    - The shape of the contact lens is approximated as that of a spherical cap satisfying a height h above the y-axis and a radius r at the y-intercept.
    - The cornea is modeled as a flat, solid surface. The contact lens is then mapped to this surface, and only the motion of the center line of the lens is considered.
    - The equation for the pressure underneath the lens results from a force balance and the application of boundary conditions.

Methods: Modeling Stretching

- To determine the effects of lens stretching on the tear film and pressure distribution, we model the lens as a network of interconnected springs.
- Nodes each have eight contacts, resulting in a hoop (Figure 1)

Conclusions

- The bending force plays a minor role in keeping the contact lens on the eye. To achieve the estimated pressure distribution under the lens through bending forces alone, results suggest that the entire lens would need to be flipped outward.
- Consequently, the force due to bending can be neglected when modeling lens dynamics, shifting the focus to an analysis of the elastic forces in the lens.
- Further work is in progress to explore the role of stretching in the lens's centration and the underlying pressure distribution. Modeling the lens as a network of springs will provide insight into these mechanisms.
- Future research involves applying the results of these models to an in vitro study of the detrimental effects of contact lens wear on the cornea.

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