Supplementary Data

The Supplementary table 1 illustrating PVA's functional groups is important in that it graphically and briefly illustrates the chemical features-namely the hydroxyl functionalities and polymer chain-the ones behind PVA's lubricating, bioadhesive, and anti-inflammatory properties on the ocular surface. This table provides scientific perspicuity in the form of chemical structure to therapeutic activity correlation, allowing reader access to mechanism of action. It serves Reviewer 2's requirement of a chemical scheme and allows the manuscript to stay clinically focused while still being able to incorporate needed chemical information in supplementary material.

Supplementary Table 1: Functional Groups of Polyvinyl Alcohol (PVA) Relevant to Anti-inflammatory and Lubricating Effects

Component / Functional Group	Structure / Description	Role in Ocular Therapy
Hydroxyl group (-OH)	Repeating units of hydroxyl groups along the polymer backbone	Enhances hydrogen bonding with mucins and epithelial surfaces, improves moisture retention
Polymeric backbone (-CH2CHOH-)	Linear, high molecular weight polymer of vinyl alcohol units	Forms protective viscoelastic film over the ocular surface, reducing friction and irritation
Hydrophilic surface	Water-attracting surface due to hydroxyl functionality	Facilitates even tear film distribution and surface hydration
Bioadhesive properties	Resulting from PVA’s interaction with corneal epithelium	Prolongs residence time of the drop on ocular surface, increasing therapeutic effect
Inert and non-irritant nature	Chemically stable, free of reactive or allergenic substituents	Reduces risk of inflammatory response and enhances tolerability