# An Overview of Contact Lens Technology

## THE STRUCTURAL & CHEMICAL COMPONENTS OF A CONTACT LENS

Contact lens manufacturers design lenses based on diverse combinations of material formulas, as well as over 10 structural and chemical features. These combinations create lenses that are unique and proprietary to each manufacturer's brand and designed to suit a different set of corresponding needs.

Today, doctors have over 160 brands of contact lenses to chose from when navigating the unique needs of their patients. As highlighted by a recent literature review from The Ohio State University College of Optometry, **contact lenses are not freely interchangeable because every brand can elicit different reactions based on patients varying eye shapes, vision abilities, and physiological needs**.[1]

Importantly – because the U.S. Food and Drug Administration (FDA) classifies contact lenses as Class II/III medical devices – consumers can be confident that regulations ensure their lenses will continue to be safe and effective as even more combinations are discovered.

### SEE SOME OF THE FEATURES CONTACT LENS MANUFACTURERS CONSIDER WHEN DEVELOPING UNIQUE COMBINATIONS FOR THEIR BRANDS:


**THICKNESS**
*impacts wearer comfort and affects oxygen transmissibility of lens*

**SILICONE AND FLUORIDE CONTENT**
*influences the flexibility, oxygen permeability, and lipid/protein deposition*

**OXYGEN TRANSMISSIBILITY**
*determines the rate at which oxygen flows through the lens*

**RIGIDITY/MODULUS**
*aids in determining the flexibility of each lens*

**LIPID DEPOSITION**
*impacts optical performance, wettability, and comfort*

**DIAMETER**
*determines how the device sits on eye*

**BASE CURVE**
*curvature of the back surface of the lens which affects fit and comfort*

**IONICITY**
*affects lens surface sensitivity to changes in pH and to what degree it attracts protein deposits*

**MODALITY**
*refers to the length of time a contact can be worn prior to requiring replacement*

**WATER CONTENT**
*can affect the oxygen transmissibility, fragility, rigidity, and thickness of the lens*

**WETTABILITY/WETTING AGENT**
*Affects the moisture retention of the lens*

Johnson & Johnson VISION CARE, INC.

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**OXYGEN TRANSMISSIBILITY:** The oxygen transmissibility of a contact lens is critical in avoiding oxygen deprivation of the cornea and subsequent corneal damage. As transmissibility is determined by the thickness and material type of the lens, manufacturers continue to seek new material compositions to enhance oxygen transmissibility and better enable doctors to fine tune prescriptions to the physiological needs of their patients.

**WATER CONTENT:** In addition to determining classification, FDA regulates soft hydrogel lenses based on water content. High water hydrogel content lenses provide increased oxygen flow, while lower water content hydrogel lenses provide limited oxygen flow, but are more durable. As such, prescribers have options when identifying the lenses that balance the physiological response, durability preference and vision performance of their patients.

**IONICITY:** Ionic lenses are classified by FDA as group III and group IV lenses, while non-ionic contact lenses are FDA groups I and II. Ionicity (or the charge) of the lens material affects the tendency of protein from the patient's tear film to be attracted to the lens. Therefore, a patient's tear film can help determine the type of lens that will perform best with their eyes.

**RIGIDITY OR MODULUS:** Rigidity refers to the stiff or flexible structure of the lens, and modulus affects how the lens sits on the patient's eye and how it handles upon insertion. Both aspects can vary widely across brands and are determinants of patient comfort. Some brands offer more rigid lenses while others more flexible options, each serving a different patient preference.

**WETTABILITY/WETTING AGENT:** Contact lens manufacturers have developed a range of proprietary, specially-formulated wetting agents that continually improve the patients' wearing experience by interacting more seamlessly with the tear film and ocular surface. These advances provide options that allow doctors to meet the needs of their patients in changing environments where variations in humidity, temperature and airflow can impact a patient's success with contact lenses.

**THICKNESS:** Contact lens thickness can affect oxygen transmissibility, comfort, and lens centration over the cornea. Poor oxygen transmission can reduce wearing time and inflict potentially irreversible corneal damage. Poor centration can cause redness, irritation and general discomfort.

**SILICONE AND FLUORINE CONTENT:** Lens polymers can include a combination of both silicone and fluorine, neither, or an alternative material altogether. Some lens polymers contain hydrophilic (water-loving) silicones, while others contain hydrophobic (water-hating) silicones. How theses polymers are integrated into the contact lens material is critical to the success of the device on the patient's eye.

**LIPID DEPOSITION:** While most silicone-based lenses are prone to the appearance of fatty deposits in the lens, the degree of lipid deposition is dependent on each patient's biological response. Adding greater complexity, there are 'good' lipids and 'bad' lipids that can deposit on lenses, similar to 'good' and 'bad' cholesterol in the blood. That's why eye care professionals offer different contact lens materials based on individuals' tear film composition.

**DIAMETER:** Appropriate coverage of the cornea is important because a soft contact with too large or too small a diameter for the patient's cornea can move excessively, cause tearing or discomfort, may dislodge, or may not move compatibly with the patients' eyes.

**BASE CURVE:** Proper base curve selection is critical to ensuring proper alignment with the ocular surface. An appropriately aligned lens provides an optimal environment for tear exchange behind the lens, enables the provision of nutrients to the cornea and the removal of toxins. An ill-fitted lens, however, may slide up under the lid, fall out during wear, or adversely affect patient vision and comfort.

**MODALITY:** Modality is a decision made based on eye health and lifestyle. For example, patients with very busy and active lifestyles may be better suited to daily disposable lenses than reusable lenses. Patients who sleep in their lenses require lenses that have undergone rigorous safety testing and FDA approval to determine that the lens can be worn safely on an extended wear replacement schedule.

**Patients physiological reactions to contact lens brands vary significantly** due to chemical features, structural features, and varying combinations of the two.[2] That is why it's so important that eye doctors have a wide variety of lenses from which to choose when identifying the best brand for their patients needs. Thankfully, contact lens manufacturers have innovated, and continue to innovate, to bring these options to the 44 million contact lens wearers in the U.S. today.

1,2 Walline J, Morrison A, Smith M, Widmer D. "Are Contact Lenses Interchangeable"—The Ohio State University Technical Report, 2015 on behalf of Johnson & Johnson Vison Care.

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