1. Theme & goals of Course:
   The course is designed to assist attendees in understanding:
   1.1. How far we have come in learning how to characterize ophthalmic visscurosurgical devices, in a manner that relates directly to our uses of them in surgery.
   1.2. How the rheological characterization of OVDs leads directly to classification, which permits us to study the similarities and differences among available OVDs.
   1.3. How the classification of a given OVD can help us understand how to use it best in different situations.
   1.4. How phaco is rheology, and how understanding OVD rheology helps us perform better phaco surgery.
   1.5. How rheologic information helps us design newer better OVDs.

2. The roles of OVDs in surgery
   2.1. To create and preserve surgical spaces – viscosity / elasticity.
       - best achieved with most viscous-cohesive OVD
   2.2. To partition spaces – including endothelial protection
       - best achieved with lower viscosity dispersives.
   2.3. To provide a low viscosity space to perform surgery.
       - best achieved in a BSS space.

3. Historic and Current Classofication of OVDs.
   3.1. Differences between dispersion and pseudo-dispersion.
       - viscoadaptives, at high shear are pseuodispersives.

4. Zero-shear Viscosity and Cohesion, & how to measure them.
   4.1. Pseudoplasticity curves, Cohesion - Dispersion Index (CDI)

### New Classification of OVDs, 2005, modified and updated to 2015

#### Viscosities and Cohesiveness

<table>
<thead>
<tr>
<th>Viscosity Range</th>
<th>Cohesive OVDs</th>
<th>Dispersive OVDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 - 18 x 10^6 (ten millions)</td>
<td>CDI ≥ 30 (% asp / mm Hg)</td>
<td>CDI &lt; 30 (% asp / mm Hg)</td>
</tr>
</tbody>
</table>

**I. Viscoadaptives**

- Healon5®, iVisc®, (MicroVisc**, HyVisc***) Phaco, BD MultiVisc®

**II. Higher viscosity cohesives**

- A. Super viscous cohesives
  - Healon GV®, iVisc**, (MicroVisc**, HyVisc***) Plus BD Visco, AcHlyon Plus##
  - Ophtha1 Plus##
  - Proviscl®
  - Opeglan Hüt††
  - Obolon Primet+++†
  - Obolon+++†
  - *Amvisc*
  - Ophthalind®
  - Eyefill SC##

- B. Viscous cohesives
  - *Healon*
  - *iVisc* (MicroVisc**, HyVisc***)
  - Prolonged retention
  - *DisCoVisc*
  - *Viscoat *
  - *Amvisc Plus*

**III. Lower viscosity cohesives**

- A. Medium viscosity cohesives
  - *Healon5*, *DisCoVisc*
  - None

- B. Very low viscosity cohesives
  - *MicroVisc*
  - None

**II. Higher viscosity dispersives**

- A. Super viscous dispersives
  - None

- B. Viscous dispersives
  - *DisCoVisc*
  - *Amvisc Plus*

**III. Lower viscosity dispersives**

- A. Medium viscosity dispersives
  - *Viscoat*
  - Endofood®
  - *Rayvic* (Rayvic**, Healon 5®, Healon Endocoat*)
  - Cellulose

- B. Very low viscosity dispersives
  - *Opegart®, Eyefill HDB##
  - *OcuCoat*
  - *Visilogen, Ocuvis, Hymecel, Adadoc, Celofilat,...HPMCs

**Legend:**

* Abbot Medical Optics, ** iMed Pharma, *** Bohus Biotech, # Bectin Dickinson, # Carl Zeiss Meditec, §§ Shiheido Co., † Alcon laboratories, ~ Bausch & Lomb
### HPMC = hydroxypropylmethylcellulose, * Available in USA

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**CLASSIFICATION OF OVDs**

- **Ultra viscous-cohesive**
- **Pseudo-dispersive (solid)**
- **Create space**
- **Induce & sustain pressure**
- **Prolonged retention**
- **Partition spaces.**
5. Surgical OVD Techniques leading to Tri-Soft Shell Technique

5.1. Soft Shell Technique (SST).
Viscoat (low viscosity dispersive) injected first onto the surface of the lens, followed by a viscous cohesive, which pushes the dispersive up into a smooth layer against the endothelium, providing a protective layer, with a smooth fracture boundary separating the two OVDs.

5.1.1. Routine Cases
5.1.2. Fuchs’ Dystrophy
5.1.3. Broken Zonule cases (with CTR)
5.1.4. Small holes in posterior capsule
5.1.5. Isolating Frayed Iris

5.2. Achieve clean posterior capsules with BSS irrigating jet.

5.3. Healon5 & Ultimate Soft Shell Technique (USST)
- uses viscoadaptive and BSS (instead of dispersive).
- makes all cases much easier, and more stable.

5.3.1. Viscoadaptive rheology – how its different
5.3.2. Routine cases
5.3.3. Capsular Dye cases
5.3.4. USST for IOL injector cartridges
5.3.5. Adding BSS under all OVDs in all cases

5.4. SST-USST combinations ➔ Tri-Soft Shell Techniques.
- use layers of dispersive against the cornea, viscous cohesive centrally to establish stability, and BSS (or XYLO-PHE) on the lenticular surface (for a low-viscosity surgical space). Optimizes pupil dilation and makes cases easier.

5.4.1. General use
5.4.2. Fuchs Dystrophy – low endothelial cell counts
5.4.3. Flomax IFIS Soft Shell Bridge (SSB) technique
5.4.4. Worst case scenario TSST cases

5.5. Special circumstances
5.5.1. Can 1 OVD do it all – DisCoVisc?
5.5.2. Natural lens present – phakic IOLs
5.5.3. Exposed vitreous face – Secondary IOLs, no capsule.

6. OVDs & IOP
6.1. Do some OVDs cause worse IOP spikes than others?
6.2. Do post op IOP spikes suggest undiagnosed glaucoma?
6.3. Most effective drugs to prevent and treat IOP spikes?
6.4. Organized IOP spike management plan.
6.5. Preventing IOP spikes: OVD removal techniques
6.5.1. Rock & Roll Technique
6.5.2. Two Compartment Technique
6.5.3. USST removal of OVDs

7. The science of OVDs
7.1. Measuring cohesion-dispersion indices
7.2. Healon5 lies on the boundary of fluids and solids.
7.3. Designing new OVDs
References: