**AIM**
To keep the retina attached by creating internal tamponade of retinal breaks, prevent fluid from entering a break, helps retinal pigment epithelium (RPE) in faster absorption of sub retinal fluid.

**Materials used**
**Gases**
First used by Ohm. Gases have the highest surface tension and specific gravity lower than water. Buoyancy of gas bubble keeps the retina against RPE. Three phases of gas dynamics are seen in the vitreous cavity- expansion, equilibrium, and dissolution. After vitrectomy a non-expansible gas fill is done, where as in pneumatic retinopexy, pure expansible bubble is used.

**Various gases used are**
- Air
- Sulphur hexafluoride (SF6): used at isovolumetric concentration, after fluid-gas exchange (20%), lasts for 10-14 days
- Perfluoroethane (C2F6):16%, duration 30-35 days
- Perfluoropropane (C3F8): 12-16%, lasts for 55-65 days

**Indications**
- Retinal detachment surgery with vitrectomy
- Macular hole surgery
- Displacement of subretinal haemorrhage (choroidal neovascularization, trauma, retinal artery macroaneurysm)
- Superior breaks
- Up rolling giant retinal tear
- Pneumatic retinopexy
- Scleral buckle

**Complications**
- Glaucoma
- Cataract
- Migration of bubble into sub-retinal space
- Small bubble size
- Hypotony
- Iatrogenic break formation

**Perfluorocarbon liquids (PFCL)**
- High specific gravity, heavier than water
- Synthetic fluorinated hydrocarbons containing carbon-fluorine bonds. Viscosity ranges from 0.8 to 2.7 milli-Pascal seconds and sp gravity 1.76-2.03
- Optically clear, visible PFCL- fluid interface, high boiling point- allow endophotocoagulation, immiscible with water and silicone oil, easy to inject and remove.

**Indications**
- Dissection and removal of membranes in Proliferative vitreoretinopathy (PVR)
- Unroll folded retina in giant retinal tear (GRT)
- Management of traumatic retinal detachment (RD) – stabilize retina, to displace subretinal, preretinal or suprachoroidal blood, removal of incarcerated retina, and foreign body removal

<table>
<thead>
<tr>
<th>Properties of commonly used gases</th>
<th>Gas</th>
<th>Molecular wt</th>
<th>Maximum expansion (hours)</th>
<th>Duration</th>
<th>Non-expansible concentration</th>
<th>Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air</td>
<td>29</td>
<td>NA</td>
<td>5-7 days</td>
<td>NA</td>
<td>0</td>
<td>0</td>
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<tr>
<td>SF6</td>
<td>146</td>
<td>24-48</td>
<td>1-2 weeks</td>
<td>20%</td>
<td>2</td>
<td>2</td>
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<tr>
<td>C2F6</td>
<td>138</td>
<td>36-60</td>
<td>4-5 weeks</td>
<td>16%</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>C3F8</td>
<td>188</td>
<td>72-96</td>
<td>6-8 weeks</td>
<td>14%</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>C3F8</td>
<td>188</td>
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<td>6-8 weeks</td>
<td>14%</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
• Removal of dislocated lens, fragments and intra ocular lens (IOL)
• Management of suprachoroidal haemorrhage
• Complicated retinal detachment – diabetic, coloboma, ROP

Complications
• Retinal toxicity
• Rise in IOP
• Endothelial cell loss

Silicone oils (SO)
• First introduced by Paul Cibis
• Made up of units of siloxane (-Si-O-)
• Low specific gravity and float
• Can be lighter or heavier than water
1. Lighter than water SO – made of polydimethyl siloxane, sp gravity – 0.97, float in water & aqueous. Buoyancy less than of gas bubble, nearly 100% fill is required to achieve good tamponade. Interfacial tension keeps the bubble single. Presence of blood, proteins and other impurities reduces interfacial tension. When surface energy is reduced oil bubble emulsifies. Viscosity varies from 1000cSt-5000cSt.

2. Heavy tamponade: Fluorinated silicone oils, heavy tamponades like Densiron 68, Oxane HD, HWS 46-3000 are commercially available heavy tamponades. Useful in retinal detachment with inferior and posterior PVR. Iridotomy to be done superiorly. Severe intraocular inflammation, early emulsification, sticky SO to IOLs, retinal surface, under surface of Iris, ciliary body are the side effects of heavy SO.

Indication of SO
• Complex retinal detachments with PVR C3 and more (better visual recovery, reduced post operative hypotony),
• GRT
• Severe proliferative diabetic retinopathy (enables rapid visual recovery, can examine fundus clearly during postoperative follow up, reduces vascular proliferation and post operative bleeding)
• Retinal detachment associated with macular holes in pathological myopia
• Retinal detachment associated with CMV retinitis
• Retinal detachment with coloboma and optic disc pit
• Trauma
• Endophthalmitis.

Complications
• Silicone oil in anterior chamber
• Glaucoma pupillary block, due to over fill of oil, secondary open angle glaucoma (OAG), secondary angle closure glaucoma (ACG), oil migration into anterior chambe (AC)
• Cataract
• Oil emulsification
• Band keratopathy and bullous keratopathy.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Chemical composition</th>
<th>Specific gravity</th>
<th>Viscosity</th>
<th>Surface tension (mN/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicone oil (1000cSt)</td>
<td>PDMS-100%</td>
<td>0.97</td>
<td>1000</td>
<td>21</td>
</tr>
<tr>
<td>Silicone oil (2000 cSt)</td>
<td>PDMS-100%</td>
<td>0.97</td>
<td>2000</td>
<td>21</td>
</tr>
<tr>
<td>Silicone oil (5000cSt)</td>
<td>PDMS-100%</td>
<td>0.97</td>
<td>5000</td>
<td>21</td>
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<tr>
<td>Densiron 68</td>
<td>F6H8-30.5% PDMS 5000cSt-69.5%</td>
<td>1.06</td>
<td>1349</td>
<td>19.13</td>
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<tr>
<td>Oxane HD</td>
<td>RMN3-11.9% Oxane 5700cSt-88.1%</td>
<td>1.02</td>
<td>3300</td>
<td>n/a</td>
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<tr>
<td>HWS 46-3000</td>
<td>F4H5-55% PDMS-10000cSt-45%</td>
<td>1.118</td>
<td>2903</td>
<td>18.8</td>
</tr>
</tbody>
</table>