Introduction - What we already have

- Pupil expansion rings mechanically dilate the pupil, prevent it from constricting, and restrain the iris from prolapsing.¹

- Morcher Ring, Perfect Pupil and the Graether ring
  - Difficult to position if pupil is less than 4.0 mm¹
  - If Anterior Chamber is shallow.¹


- Malyugin Ring is: ²
  - Highly effective in eyes with IFIS (Intraoperative Floppy Iris Syndrome),²
  - Easier & faster than iris retractors / other Pupil expansion rings.²

• Is the Malyugin Ring the end of the Road??

• Does it meet all our present day needs?

Introduction – What we Need & Why?

• Femtosecond Laser Assisted Small Pupil Phaco

  • A possible consequence of surgically entering the eye manually and then using the femtosecond laser - ingress of fluid into the anterior chamber - increasing the risk of endophthalmitis.  

  • Malyugin Ring – Sterile Zone – 2.75 mm
  • Femto Laser - Non Sterile Zone
  • Phacoemulsification - Sterile Zone

A Ring through a Smaller incision would
Reduce the Risk of Infection!!


Introduction – What we Need & Why?

• Bimanual MICS (Micro Incision Cataract Surgery) – tight fluidic seal - Useful Surgical strategy in IFIS patients.  

• Suppression of iris prolapse in IFIS - Advantage of Bimanual and Coaxial MICS.

• Malyugin Ring requires a 2.2 mm or larger incision

• Coaxial MICS uses Incisions < 2.0 mm &
• Bimanual MICS uses Incisions < 1.5 mm.

Introduction – What we Need & Why?

• 25G/23G/20G Small Pupil PPV (Pars Plana Vitrectomy)

  • > 2.2 mm Corneal incision to insert Malyugin ring in

Undesirable & Self defeating

A Smaller incision is desirable


Introduction – What we Need & Why?

• Shallow Anterior Chamber –
  – Vertical profile of the Scrolls of Malyugin ring (0.7 – 0.9 mm) - Can cause Endothelial touch

A Thinner Profile Device would be Safer !!!

Bhattacharjee Rings - Description

Bhattacharjee Pupil Expansion Rings
• Flexible closed rings made from 5-0 black monofilament polyamide (Nylon) (Off label use, Ethilon Nylon sutures, Johnson & Johnson Ltd.)
• Ends are butt joined with glue. The joint is notably slim
• Available in Square and Hexagon shapes.
• Rings have inward notches at corners and flanges at the sides.
• The entire ring is disposed within a thin single plane.
• Alternate flanges are tucked under the iris so that the notches engage the pupillary margin at different parts, pushing them apart, resulting in sustained enlargement of the pupil
• Square device 6.5 & 7.0 mm sizes & Hexagon 6.0, 6.5 & 7.0 mm sizes.
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Hexagon - Insertion & Engagement – Only Two 20G Incision

Hexagon – Unimanual Engagement – Kuglen Hook

Hexagon – 2.2 mm Micro Coaxial Phaco

Square – 1.4 mm Bimanual MICS
Intra Operative Miosis – Square Used Safely

Removal – 20 G Side Port Incision

Removal – 2.8 mm Phaco Incision

Rings used in Shallow Anterior Chamber Eyes
Eye1- ACD 1.72 mm, Eye2- ACD 1.91 mm
Results - Square Device

Intra Operative (Inverted)
Post Op Day 7 Round Pupil

Results - Hexagon Device

Intra Operative (Inverted)
Post Op Day 7 Round Pupil

Results – Shallow Anterior Chamber

- Other Eye RE: Blind – Angle Closure Glaucoma.
- This Eye LE: Peripheral Iridectomy – 20 Yrs. Anterior Chamber Depth – 1.72 mm

Post Op Day 7 Unaided – 6/9

Conclusion

Bhattacharjee Rings (Square & Hexagon):
- Can be Inserted & Removed through 0.9 mm (20 G) Incisions
- Can Effectively & Safely dilate the Pupil
- Hexagon preferred – Small Eyes – Geometric Advantage
- Useful For:
  - Standard Phaco & MICS
  - Femto Small Pupil Phaco
  - Shallow Anterior Chamber
  - Small Pupil Vitrectomy (PPV)
- Injector not yet available – though not necessary
For a 5 mm Capsulorhexis, an Incircle of 6 mm is required within the Regular Polygon shaped Pupil Dilating device. (Regular Polygon: All sides & angles equal)

A Square with an Incircle of 6 mm, lies within a 8.48 mm Circumcircle.

A Hexagon with an Incircle of 6 mm, lies within a 6.92 mm Circumcircle.

Smaller Hexagonal device - easier to handle – less injury to Cornea, Iris & Angle.

Smaller Hexagonal device - less stretch & damage to sphincter – Post Op Round pupil.

**Conclusion**

<table>
<thead>
<tr>
<th>Property</th>
<th>Polypropylene (Malyugin)</th>
<th>Nylon (Bhattacharjee)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floatability</td>
<td>Floats</td>
<td>No</td>
<td>PP tends to float and when disengaged may touch endothelium</td>
</tr>
<tr>
<td>Stiffness (Bend Recovery)</td>
<td>Good</td>
<td>Excellent</td>
<td>Nylon device regains shape better after being deformed as it passes through the incision, giving desired pupil size and shape</td>
</tr>
<tr>
<td>Flicking (springiness)</td>
<td>Good</td>
<td>Excellent</td>
<td>Nylon device regains shape faster after being deformed</td>
</tr>
<tr>
<td>Stiffness in Water</td>
<td>Excellent</td>
<td>Fair</td>
<td>Nylon (6 &amp; 66) tends to soften a little by the end of the procedure, Removal is Easier. PP does not absorb water &amp; does not soften.</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>Poor</td>
<td>Fair</td>
<td>PP can be bent and worked upon at lower temperature</td>
</tr>
<tr>
<td>Heat Distortion/Deflection Temperature</td>
<td>60-80 °C</td>
<td>165 - 185 °C</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Cheaper</td>
<td>Costlier</td>
<td>A very small quantity being required to make a device, the difference is not significant.</td>
</tr>
</tbody>
</table>

**Feature**

<table>
<thead>
<tr>
<th>Malyugin Ring</th>
<th>Bhattacharjee Ring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strand Thickness</td>
<td>0.2 mm</td>
</tr>
<tr>
<td>Design</td>
<td>Biplanar</td>
</tr>
<tr>
<td>Pupil engaging part</td>
<td>Helical coil – Scroll</td>
</tr>
<tr>
<td>Usage</td>
<td>Side facing pupil engaging gaps in scrolls difficult to visualize from Top view</td>
</tr>
<tr>
<td>Incision Size required</td>
<td>&gt;2.2 mm</td>
</tr>
<tr>
<td>Single use Injector</td>
<td>Required</td>
</tr>
<tr>
<td>2.2 mm Bimanual Phaco</td>
<td>Yes</td>
</tr>
<tr>
<td>1.4 mm Bimanual MICS</td>
<td>No</td>
</tr>
<tr>
<td>2.0 mm Coaxial MICS</td>
<td>Yes</td>
</tr>
<tr>
<td>Femto Laser Assisted Cataract Surgery</td>
<td>5.8 mm incision</td>
</tr>
<tr>
<td>Vertical Profile</td>
<td>0.7 – 0.9 mm</td>
</tr>
</tbody>
</table>

**Shallow Anterior Chamber**

- Malyugin Ring
- Bhattacharjee Ring
Conclusion

• Mechanical devices like Malyugin Ring incur:\(^2\)
  – Additional Surgical time
  – Expense

• The Bhattacharjee Rings:
  – Easier /Faster/ Safer than the Malyugin Ring
  – Simple single plane design –
    • Plastic Molding/ Stamping may be used
    • Truly continuous Ring with no joint can be manufactured

• Translating to - Faster production- Reduced Costs – Less Financial Burden

Thank You for your attention!