LENS AND PERIPHERAL RETINAL RELATIONSHIPS DURING VITRECTOMY: COMPARISON OF 23, 25, AND 27-GAUGE VITRECTOMY AND CURVED ENDOLASER PROBES

Jayanth Sridhar MD

Bascom Palmer Eye Institute

Co-authors:

Jacob Duker MD

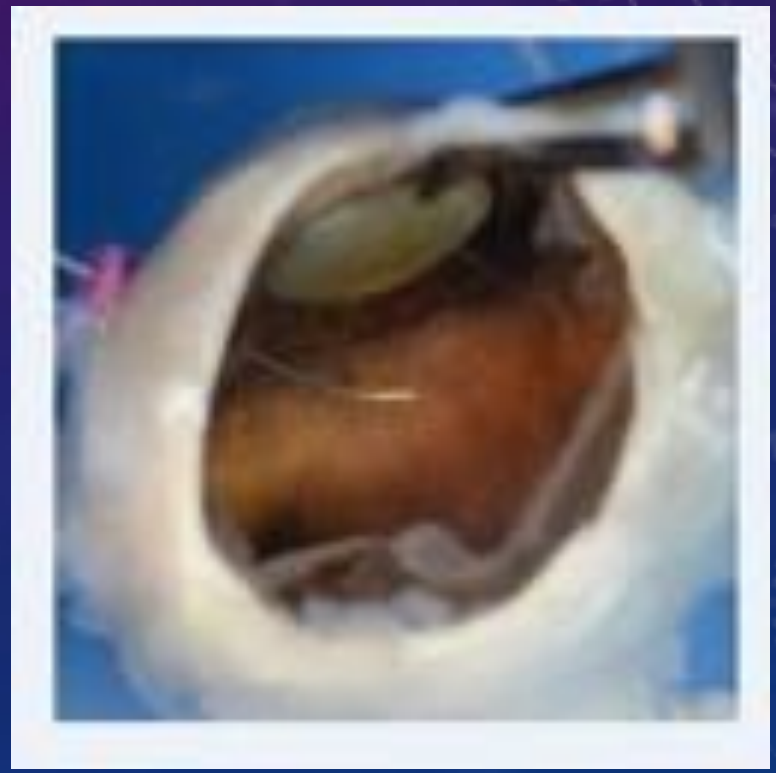
Michael Venincasa MD

William Smiddy MD

Sander Dubovy MD

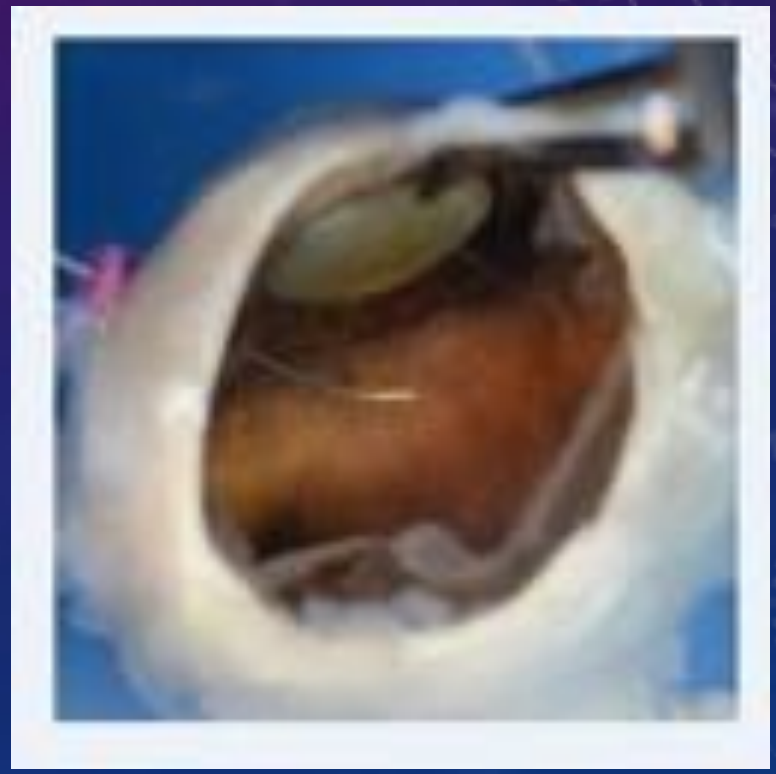
RELEVANT DISCLOSURES

- JS: Consultant for Alcon
- All other authors report no relevant financial disclosures



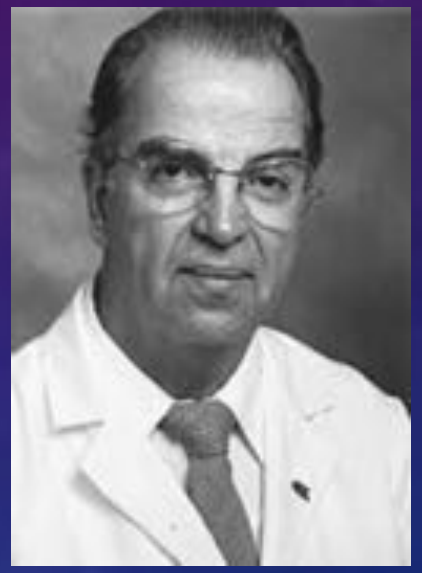
SUMMARY SLIDE

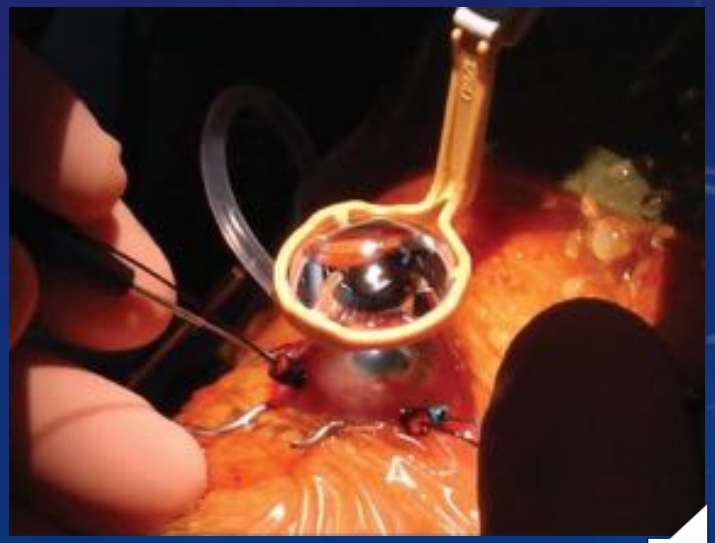
- Cadaver phakic eye study examining lens relationships with vitreoretinal instruments
- 23, 25, and 27 gauge cutter and laser utilized
- No difference in maneuverability relative to the lens between instruments of different gauge size
- The size of the eye matters more than the instrument gauge in accessing peripheral retina



INTRODUCTION

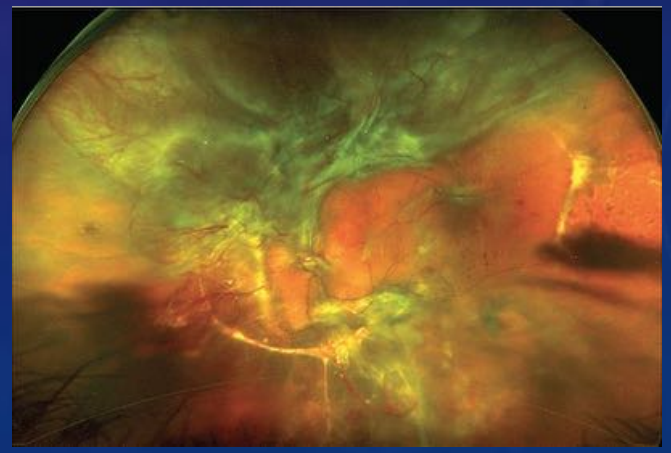
- Pars plana vitrectomy (PPV) popularized by Machemer et al. in 1971
- Since then, there have been advances in wide angle viewing systems
  - Improved visibility of peripheral vitreous base
  - Allowed surgeons to engage far peripheral retina without scleral depression





INTRODUCTION

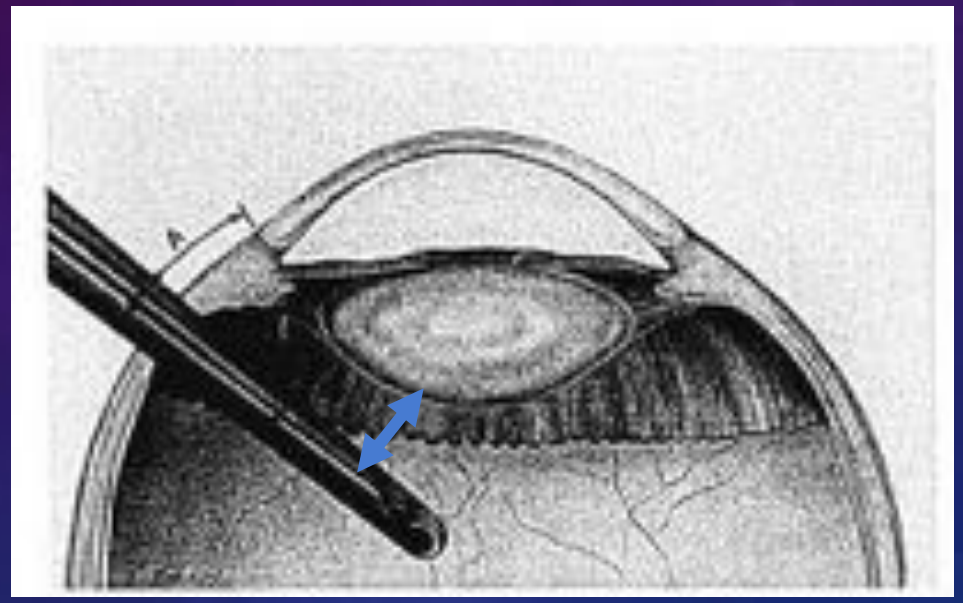
- Wide angle view necessary for peripheral PPV
- Peripheral PPV is helpful for surgery for proliferative fibrovascular disease, proliferative vitreoretinopathy, and rhegmatogenous retinal detachment
- Adequate excision without damaging lens is challenging:
  - 1.2 to 9% of pars plana vitrectomy (PPV) has lens touch (Elhousseini et al. 2016, Jackson et al., 2013)
  - More difficult if lens is clear
  - Lens touch: increases chance of early cataract, posterior capsule rupture in subsequent surgery



SMIDDY ET AL (1991)

- Set out to describe relationships between vitrectomy probe and crystalline lens in phakic cadaver eyes
- Obtained three measurements as follows

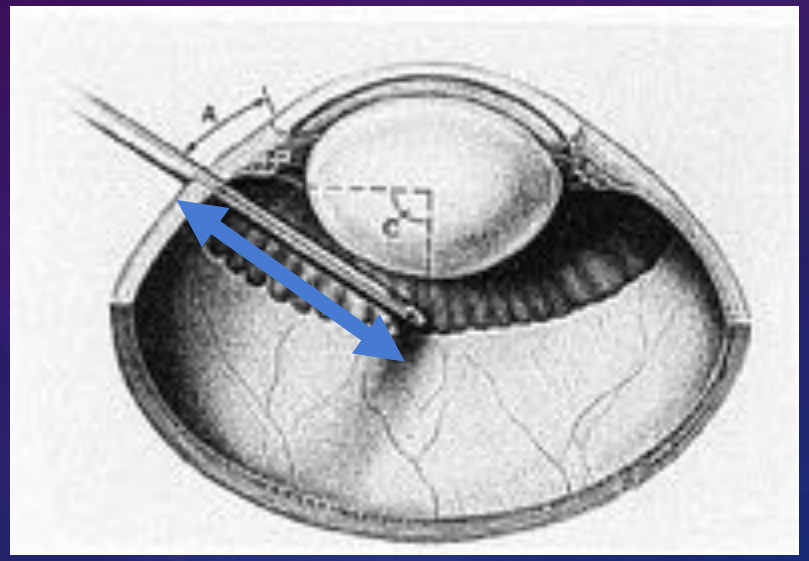
SMIDDY ET AL. (1991) – 1ST MEASUREMENT



-Vitrectomy probe introduced to geometric center of globe

-Distance between vitrectomy shaft and proximal edge of crystalline lens

SMIDDY ET AL. (1991) – 2ND MEASUREMENT



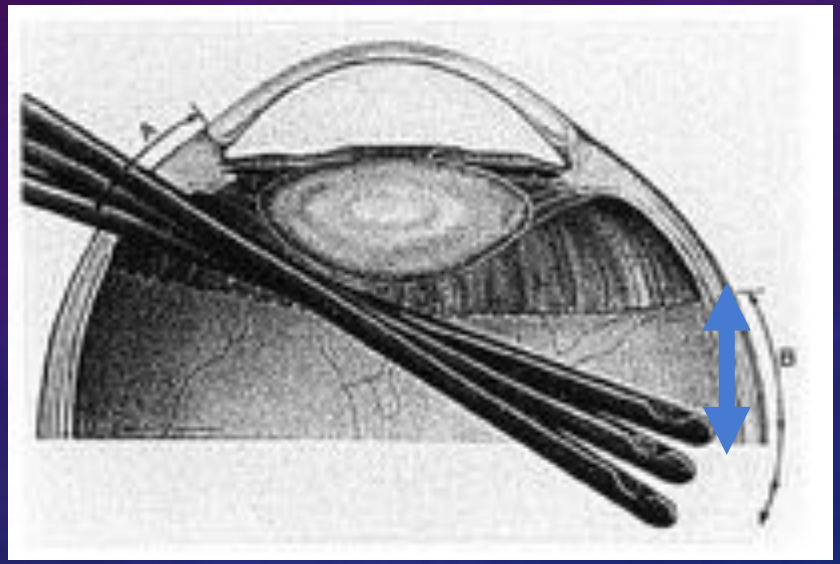
-Probe positioned so that tip overlied ora serrata in same meridian as sclerotomy

-Tip moved along ora until instrument touched lens

-The chord length from sclerotomy to tip was measured

-Using trigonometry: circumferential arc of instrument access to ora on both sides of sclerotomy

SMIDDY ET AL. (1991) – 3RD MEASUREMENT



-Vitrectomy probe directed toward the equatorial retina 180 degrees from sclerotomy

-Tip advanced anteriorly until the instrument touched the crystalline lens

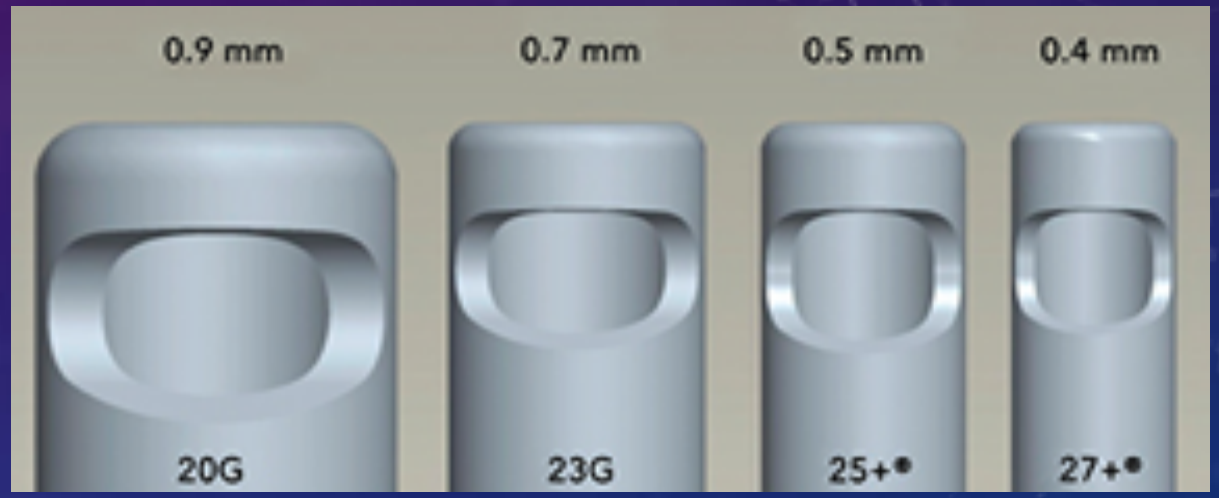
-Distance between instrument tip and ora serrata in the meridian opposite the sclerotomy site was measured with calipers

SMIDDY ET AL. (1991)

- Conclusions:
  - First to quantitate the intraocular relationships among the lens, the surgical instruments, and the location of the sclerotomy
  - Sclerotomy sites 4mm posterior to limbus in phakic eyes are advantageous
    - Wider range of accessibility to anterior retina on opposite side of eye and the ora serrata extending circumferentially from meridian of sclerotomy
    - Basis for intravitreal injection and port placement technique

CURRENT STUDY: PURPOSE

- Since Smiddy et al. reported their findings in 1991, vitrectomy instruments have been modified to increase performance and safety
  - Curved instruments designed to avoid contact with posterior lens
  - Smaller gauge instruments developed (23, 25, 27-gauge)
- **Re-examine the relationships between lens and vitrectomy instruments of different gauges**



METHODS

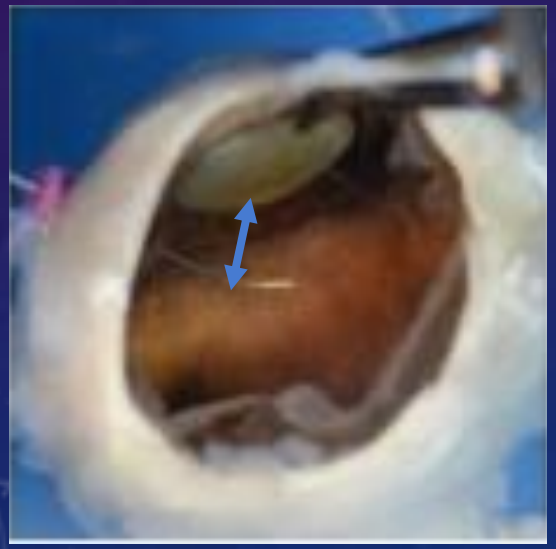
- 8 fresh, fixed in formalin <24 hours, phakic eyes
- Each eye had 23, 25, 27- gauge valved trocar placed in superotemporal quadrant 4 mm from limbus
- Superior cap of globe removed
- Measurements of relationships taken for 23, 25, 27- gauge vitrectomy and curved endolaser probes (Alcon, Irvine, CA)

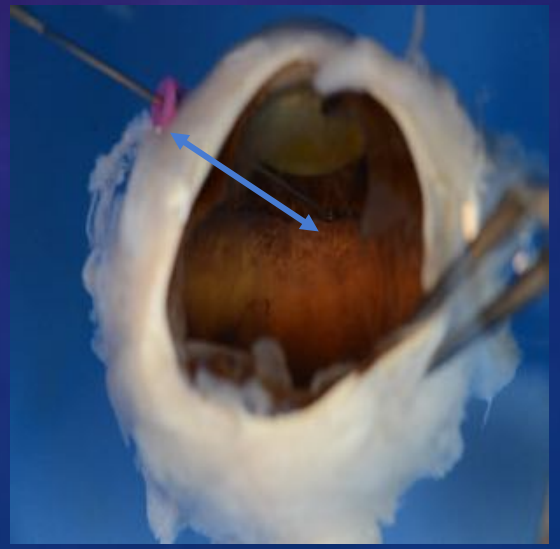
8 eyes	Axial length (mm)	Ora serrata diameter (mm)
Mean	23.6	17.3
Median	23.5	17.5
SD	1.4	1.7
Range	21-26	14-20.5

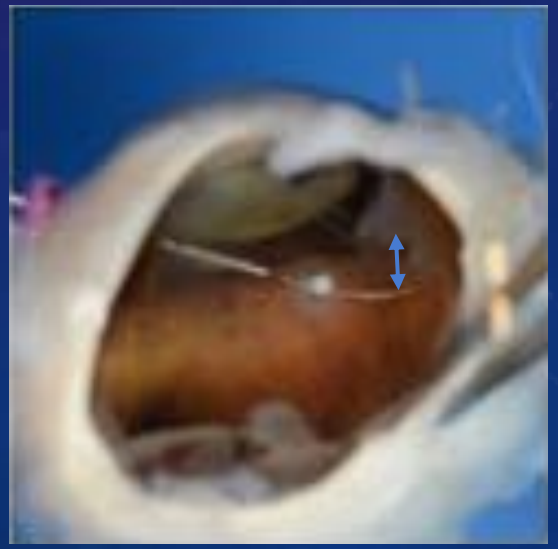
METHODS

Distances measured with standard calipers to the nearest 1.0 mm:

1. Distance from lens to instrument in geometric center of globe
2. Chord length (arc length calculated)
3. Distance between ora and instrument when lens is touched







RESULTS: DISTANCE TO LENS AT GEOMETRIC CENTER

	Cutter (mm)		Laser (mm)		Cutter vs Laser
	Mean (SD)	P-Value*	Mean (SD)	P-Value*	P-Value**
23-Gauge	5.44 (0.77)	0.83	5.69 (0.86)	0.72	0.55
25-Gauge	5.56 (1.01)		5.50 (1.09)		0.96
27-Gauge	5.69 (0.43)		5.63 (0.60)		0.78

* Kruskal-Wallis Test
**Wilcoxon Rank-Sum Test

RESULTS: ARC LENGTH

	Cutter		
	Mean *degrees* (SD)	Mean *clock hours*	P-Value*
23-Gauge	111.91 (23.09)	3.73	0.16
25-Gauge	129.96 (19.96)	4.33	
27-Gauge	126.79 (14.42)	4.23	

* Kruskal-Wallis Test

RESULTS: DISTANCE TO ORA AT LENS TOUCH

	Cutter (mm)		Laser (mm)		Cutter versus Laser
	Mean (SD)	P-Value*	Mean (SD)	P-Value*	P-Value**
23-Gauge	1.81 (0.90)	0.27	1.00 (1.50)	0.93	0.11
25-Gauge	1.63 (0.89)		0.50 (0.83)		**0.03**
27-Gauge	1.00 (0.83)		0.75 (1.09)		0.50

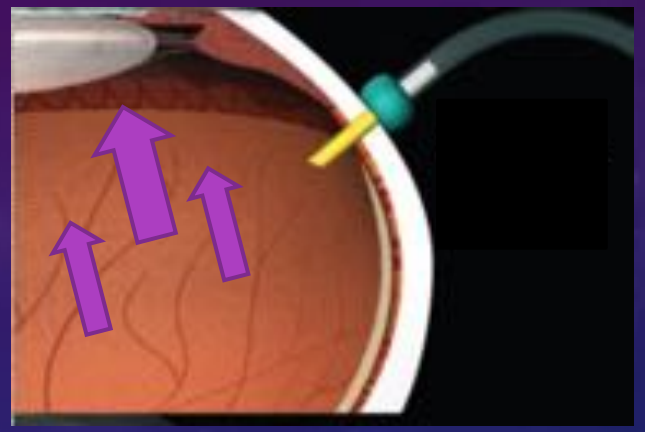
* Kruskal-Wallis Test
**Wilcoxon Rank-Sum Test

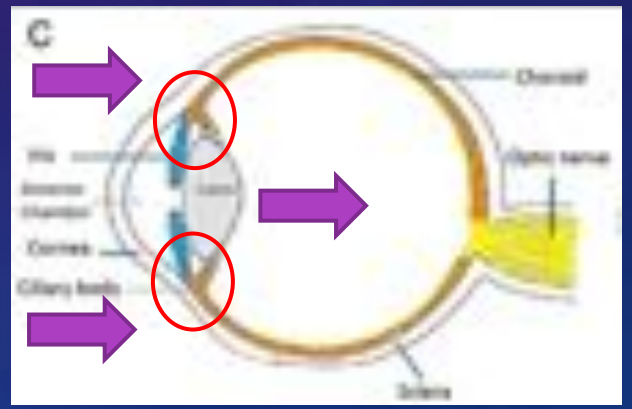
CONCLUSIONS

- There were no significant differences between vitrectomy probe or endolaser gauges
- The distance from lens to any instrument at geometric center of globe from a sclerotomy of 4 mm is 5.5 mm
- The circumferential arc of the cutter's access to ora on both sides of sclerotomy is 4 clock hours per side
- Vitrectomy cutter could be advanced without lens touch to contact retina within 2 mm from ora insertion site
- Curved endolaser probe could be advanced without lens touch to contact retina within 1 mm from ora insertion site
- In eyes with axial length ≥25, vitrectomy cutter can cross to ora in same meridian as sclerotomy without touching lens

LIMITATIONS

- Not *in vivo* study: Intraoperative conditions affect lens position
  - **Infusion pressure** -> displaces lens-iris diaphragm anteriorly
  - **Cycloplegics** -> tighten the lens zonules by relaxing the ciliary muscle -> lens-iris diaphragm pulled posteriorly
  - Surgical technique:
    - Tilt: Eye is rolled superiorly or inferiorly to improve access to vitreous
    - Torque: Distortion of sclera from instruments
  - Other surgical factors causing pressure changes: retrobulbar block, suprachoroidal hemorrhage, etc.
- 4 mm from limbus trocar insertion site





IMPLICATIONS

- No difference in maneuverability relative to the lens between instruments of different gauge size
- The size of the eye matters more than the instrument gauge in accessing peripheral retina

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