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Phacodynamics: Protection in Hard Cataracts

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Introduction

- The Problem:

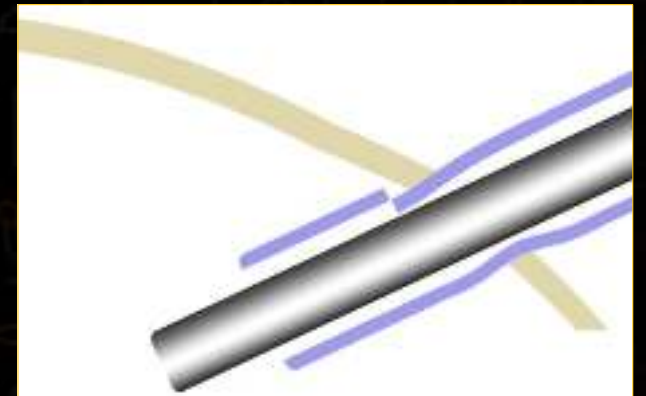
Increased nuclear density requires higher ultrasound (US) energy and vacuum, raising risks of corneal wound burns and posterior capsule (PC) rupture.

- The Goal:

Maximize mechanical disassembly while minimizing "Cumulative Dissipated Energy" (CDE) and maintaining chamber stability.

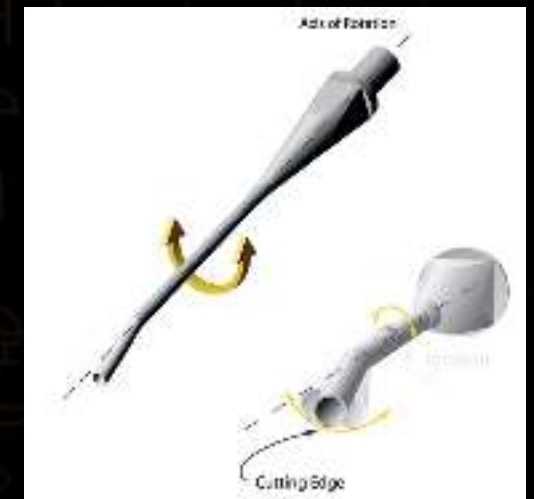
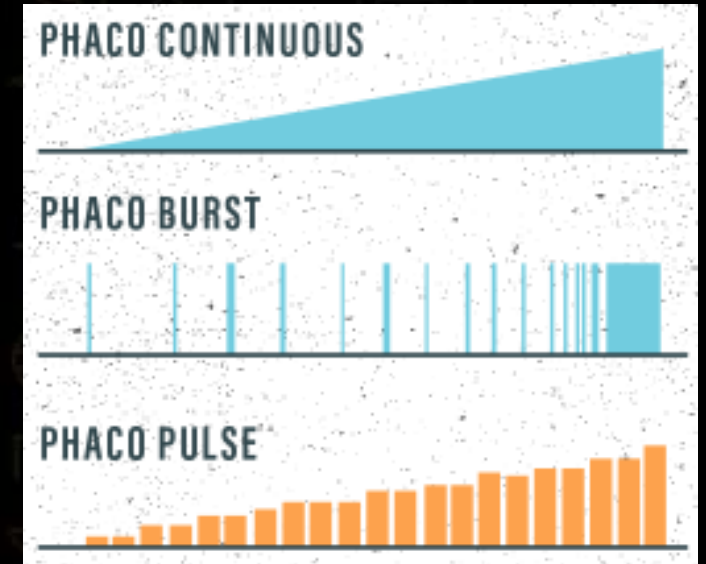
Understanding Thermal Damage

- Mechanisms: Frictional heat from the vibrating tip against the sleeve and conversion of electrical to mechanical energy.
- Risk Factors: High US power in continuous mode, tight incisions, and "lens milk" clogging the aspiration line, which halts the cooling flow of BSS.
- Thermal injury to the intraocular structures can be avoided/reduced by:
 - Use proper sleeve to wound size to avoid inflow obstruction.
 - Using adequate flow rate (for cooling effect).
 - Cooled Fluids.
 - Avoid excessive use of U/S specially in full occlusion.
 - Use power modulations (Pulse/Burst).



Power Modulations for Thermal Safety

- Burst Mode: Ideal for "impaling" the nucleus; provides high-power packets with "off" intervals to allow cooling and vacuum build-up.
- Pulse/Micro-pulse: Reduces total "on-time" (duty cycle), effectively lowering the thermal profile while maintaining efficiency.
- Torsional/Elliptical US: Side-to-side or elliptical motion reduces friction within the incision compared to traditional longitudinal US, significantly lowering burn risk.

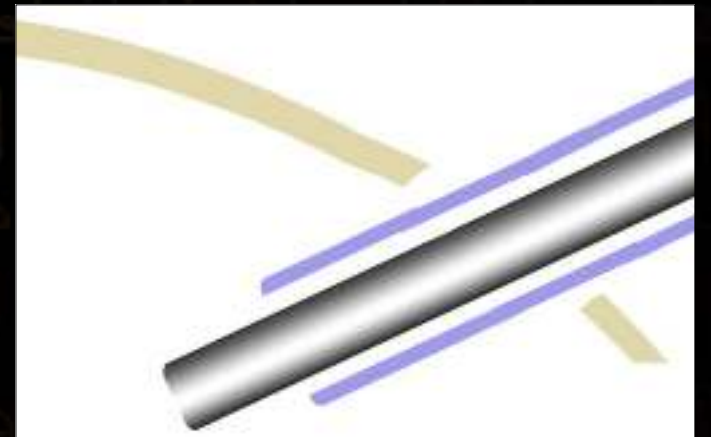


Fluidics & Surge Management

- Surge Definition: Sudden AC shallowing when an occlusion breaks, caused by a mismatch where outflow briefly exceeds inflow.
- The "Hard Cataract" Paradox: High vacuum is needed to hold dense fragments, but high vacuum increases surge amplitude upon occlusion break.

Fluidics & Surge Management

- **Overcoming surge:**
 - Increase bottle height
 - Increase infusion pressure?
 - Reduce flow rate
 - Reduce vacuum
 - Use linear flow and vacuum settings
 - Use adequate power?
 - Empty drape and relax speculum
 - Use proper sleeve to wound size to avoid excessive outflow





Thank You !

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