The Optimal Laser Fiber Core Size for Endourological Performance

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Introduction / AİMS

Laser technology is central in endourology. Core fiber size directly affects outcomes. We evaluated energy delivery, tip degradation, thermal safety, durability, fracture resistance, retropulsion, and flexibility.

Methods

Databases: PubMed & Cochrane.
Records: 1,148; Duplicates removed: 109; Excluded by title/abstract: 996.
Full texts reviewed: 43; Included: 14 (1 added manually).
Parameters: fiber core size, laser type (Ho:YAG, TFL), outcomes listed above.

Discussion

Smaller fibers (≤300 µm) demonstrated superior energy transmission and flexibility, making them ideal for lithotripsy. Larger fibers (≥300 µm) showed greater energy efficiency, durability, and reduced tip degradation, favouring high-power applications such as laser enucleation of the prostate. Larger fibers require proper irrigation for thermal safety. TFL showed better flexibility, lower fracture rates, and reduced retropulsion compared to holmium: yttrium-aluminum-garnet

Conclusion

Laser fiber core size influences energy delivery, durability, thermal safety, flexibility, and retropulsion
Selecting the appropriate fiber size enhances surgical efficiency and outcomes.

Results

Smaller core fibers (≤300 µm) provide higher energy delivery and greater flexibility but are prone to tip degradation and exhibit lower durability under high-power settings. Larger core fibers (≥300 µm) demonstrate superior energy efficiency, reduced tip degradation, and enhanced fracture resistance. Thermal safety is linked closely to irrigation and fiber size. Smaller fibers maintain safer temperatures under irrigation. Retropulsion is less pronounced in smaller and larger fibers compared to medium-core fibers (365–550 µm). Bubble formation during Thulium fiber laser (TFL) procedures is affected by fiber core size. Smaller fibers (150 µm) produce larger bubbles than Larger fibers (272 µm). TFL showed better flexibility, lower fracture rates, and reduced retropulsion compared to holmium: yttrium-aluminum-garnet (Ho: YAG) lasers

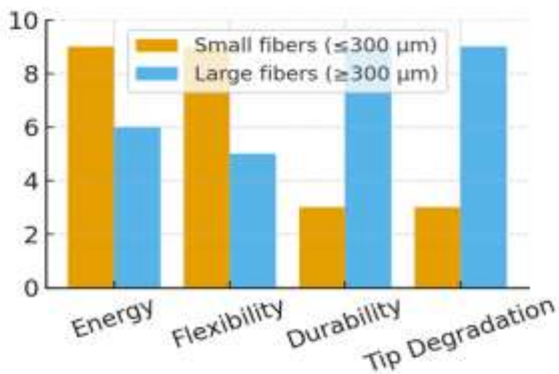

Figure . The chart compares small fibers (blue) with high energy and flexibility but lower durability, to large fibers (orange) with lower energy but greater durability and reduced degradation