



Laser Fiber's Efficiency: The Fiber's Tip is the Key

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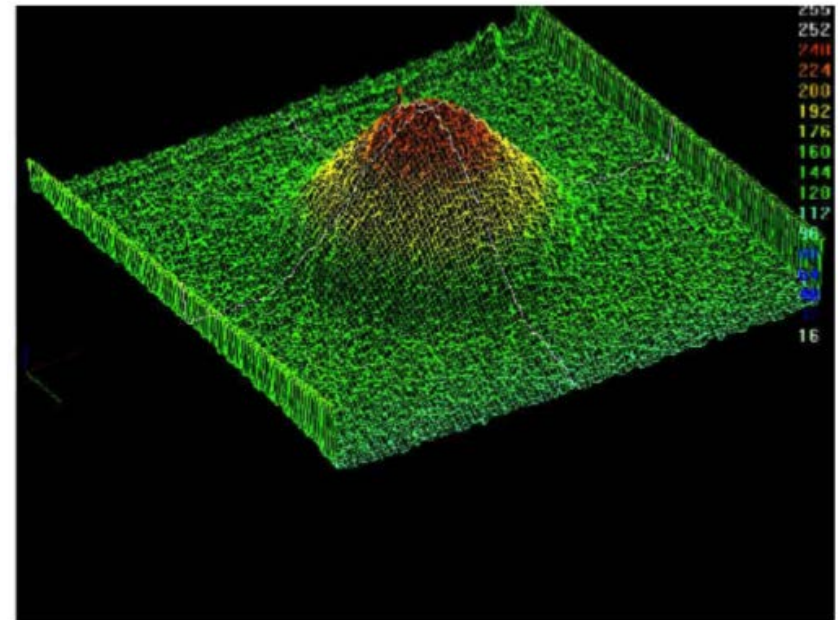


Introduction

- The tip of the laser fiber is an important factor for:
 - Optimal transmission of laser energy to target
 - Safe passage through endoscope
 - Ergonomically facilitating the procedure

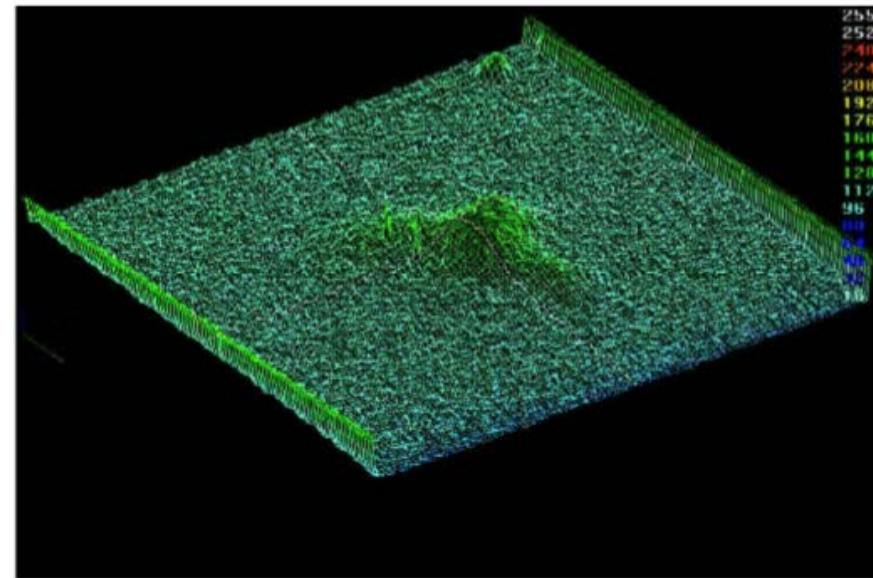
Beam Profile: Undamaged Fiber Tip

- New, polished fibers have best energy transmission and near gaussian beam profile
- Laser activation and stone contact degrade fiber tip resulting in decreased energy transmission



Beam Profile: Damage Fiber Tip

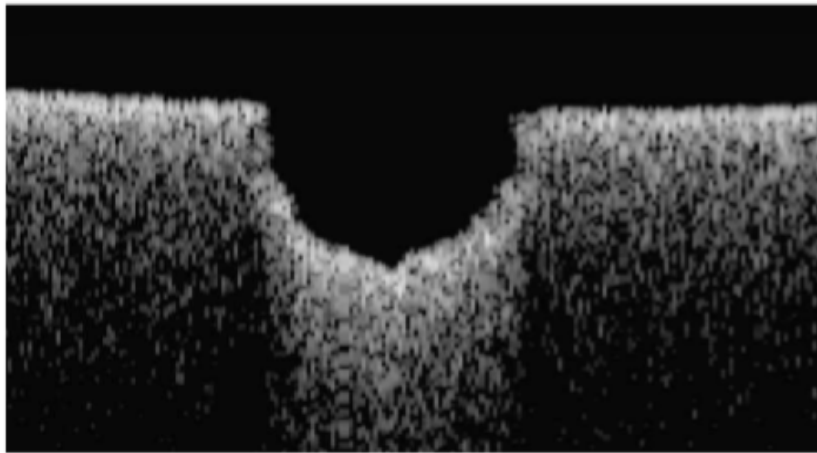
- After fiber tip begins to degrade, beam profile degenerates with hot spots and unpredictable irradiance contours



Ablation Stone Craters

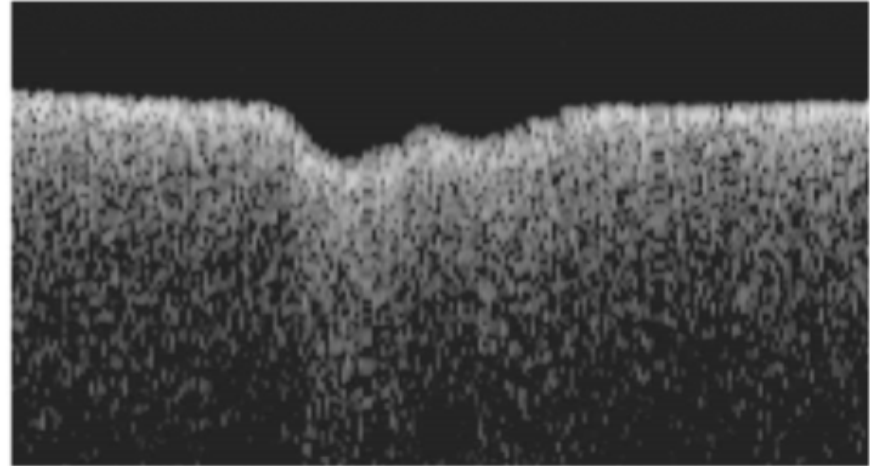
500 μ m

A



Undamaged fiber tip

B



Damaged fiber tip



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Clinical Studies

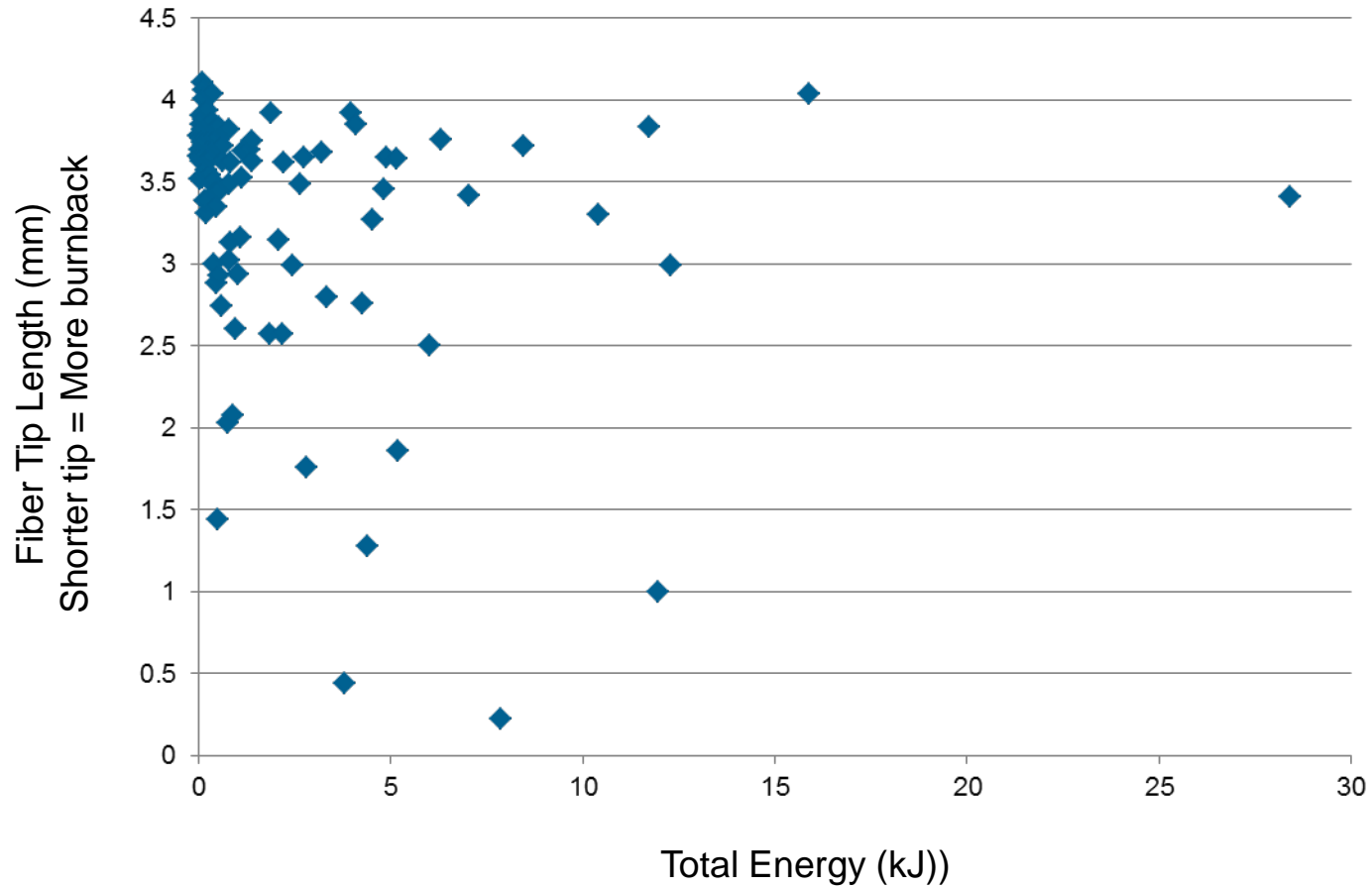
- Clinical study has show that laser fiber tips degrade during procedures at variable rates
- By understanding the factors that cause tip degradation (burn back), they can be adjusted to help preserve the fiber tip

Results

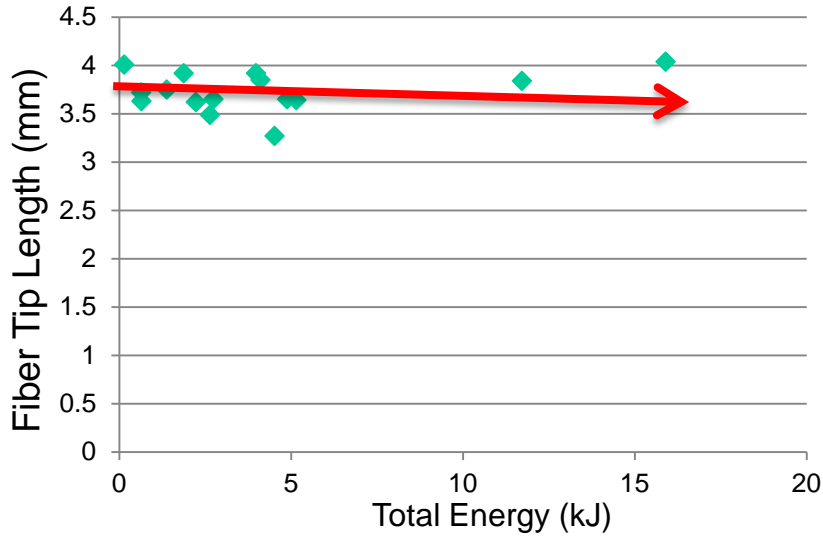
- The ball-tip burnt back in 49% of cases
 - Completely in 36/98
 - Partially in 11/98
- It remained intact in 51/98 (51%) of procedures
- No fiber fractured along the shaft (did not break within scope channel)



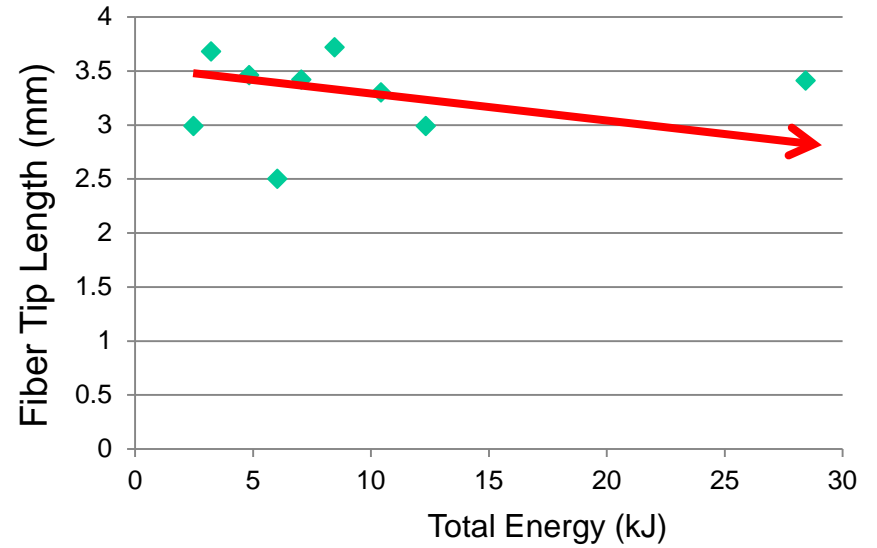
Length of Fiber Tip vs Total Energy Delivered (All Settings)



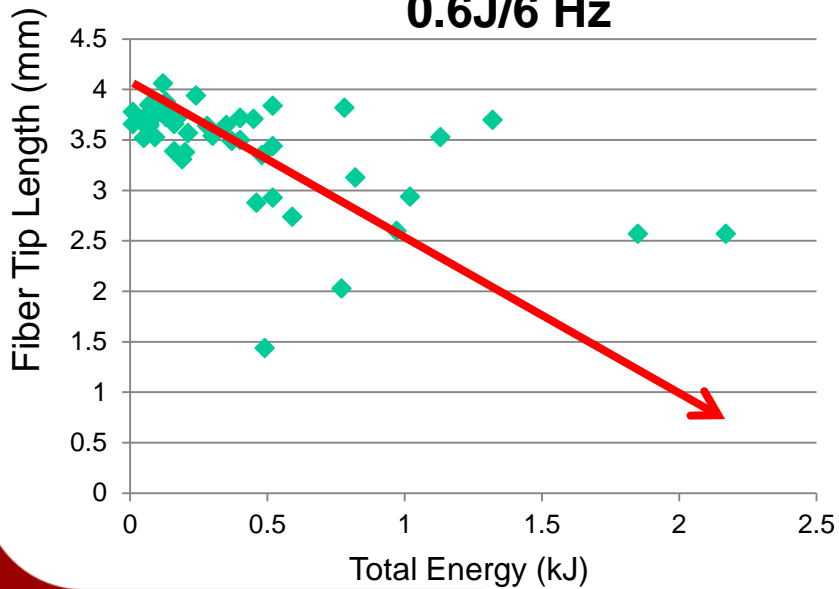
0.2J/50 Hz



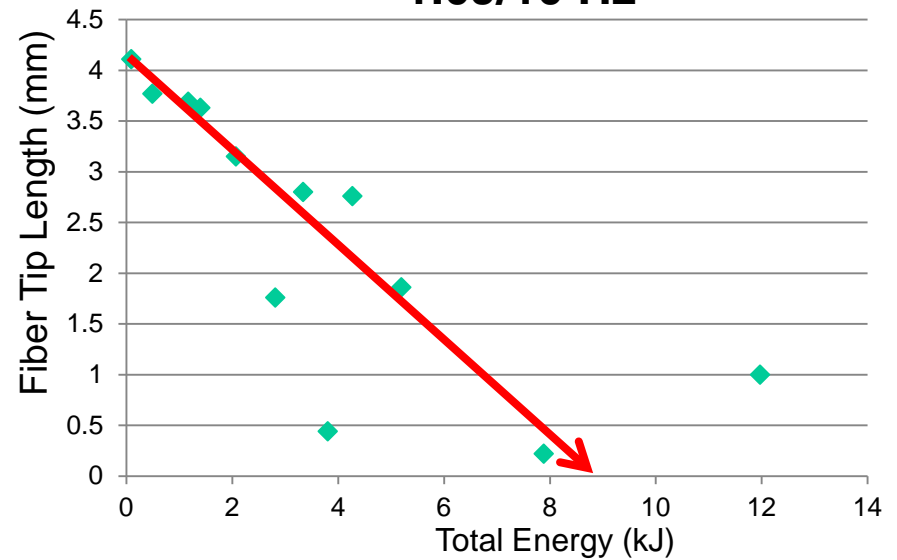
0.4J/50 Hz



0.6J/6 Hz



1.0J/10 Hz



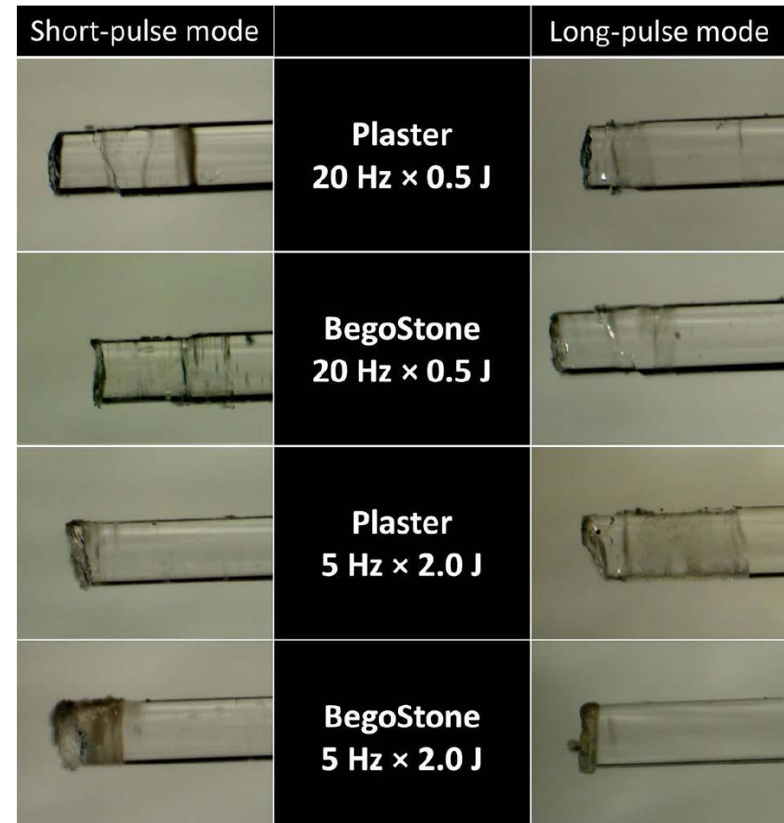
Conclusions

- During clinical use, ball-tip degradation (burnback) dependent on laser pulse energy settings
- Higher *pulse energy = greater burn back*
- *0.2 – 0.4 J ideal setting*
- Ball-tipped fiber durable with no failures along the shaft



Short versus Long Pulse Duration

- Less retropulsion with longer pulse duration
- Less fiber tip degradation with longer pulse duration



Ball Tipped Fibers: Rationale

- Laser fibers commonly implicated in cases of ureteroscope damage
 - Damage to working channel as fiber advanced
 - Damage from fiber fracturing in channel
 - Inadvertent lasering of scope

- **Ball tipped laser fibers intended to allow passage of the fiber with the scope deflected without trauma to the working channel**
 - Potential to curtail costs

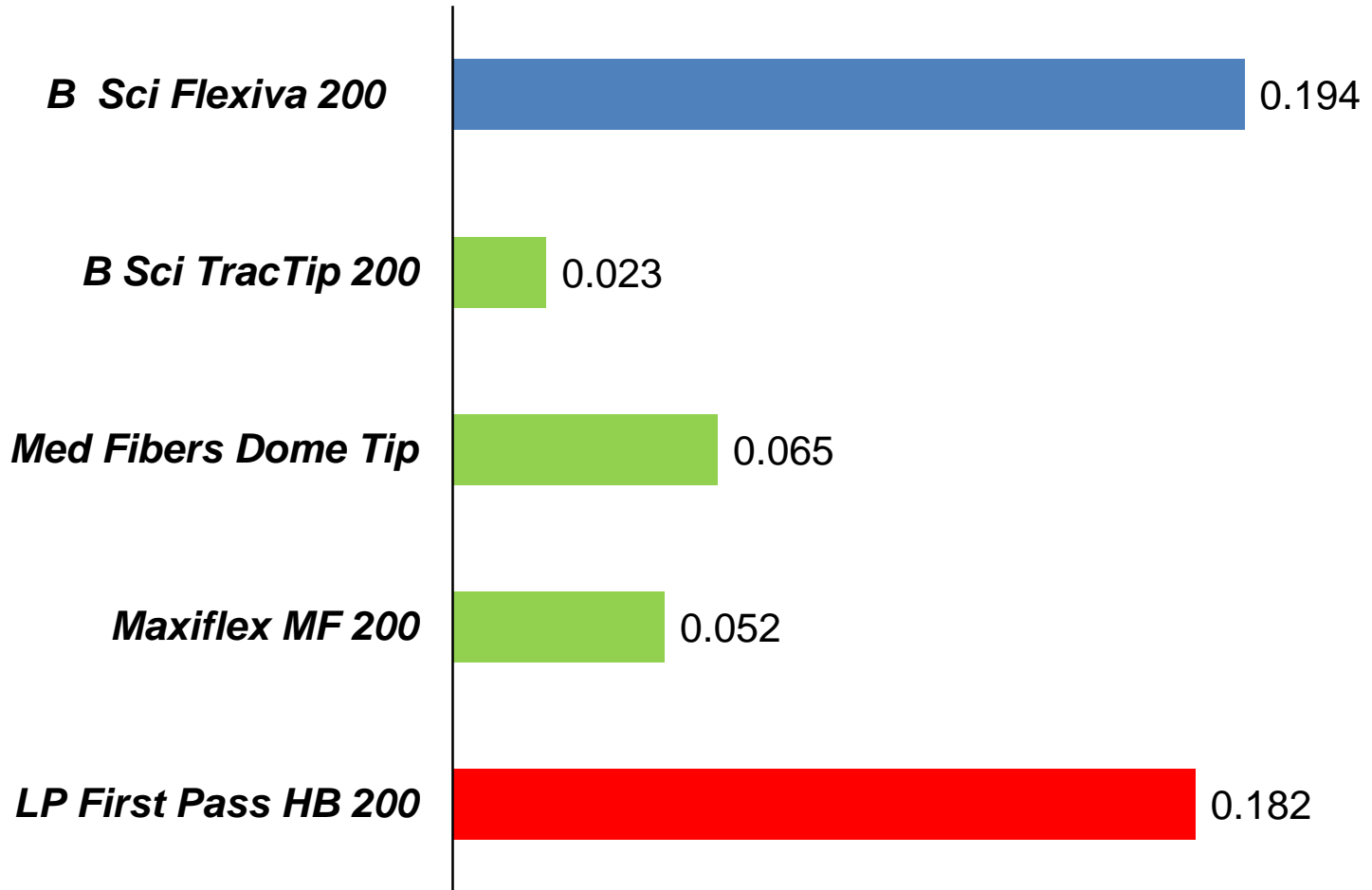


Methods



Insertion force necessary to pass fiber through a ureteroscope in a 240 degree-deflected configuration

Results: Insertion Force (N)



student t test $p < 0.05$ (compared to non ball tipped)

Therefore... the Tip is the Key

