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Effect of laser pulse mode on stone retropulsion and “jumping phenomenon” during ureteroscopy and laser stone fragmentation

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Introduction: Stone fragmentation with laser energy during ureteroscopy can become more challenging if there is significant retropulsion and bouncing around of the stone as a result of the pulsatile nature of the fragmentation energy being applied. This in addition to the ventilatory excursion of the kidney can render fragmentation of a moving target more difficult and less effective.

Methods: We present a video demonstrating the differences in retropulsion and “bouncing/ jumping phenomenon” of the targeted stone during ureteroscopic laser fragmentation with the application of different pulse mode settings on the EMS Swiss LaserClast Holmium Laser machine.

Results: The EMS laser can be set on 2 different modes, i.e. the Short Pulse (Stone Mode) and Long Pulse (Tissue Mode). A more controlled fragmentation with less bouncing around/ jumping of the targeted stone is seen when lasering in the Long Pulse Mode as compared to the Short Pulse Mode at the same energy and frequency settings.

In the Short Pulse Mode the pulse duration is short (approximately 150 to 400 microseconds depending on the energy and frequency settings). The energy that is set is therefore delivered to the stone over a relatively short time period. This generates a very high peak power enabling sudden, rapid and forceful fragmentation.

In the Long Pulse Mode the pulse duration is longer (approximately 400 to 1000 microseconds depending on the energy and frequency settings). The set energy is therefore delivered over a longer time period. Hence the peak power is lower. The effect is therefore a more controlled fragmentation with less of a pushback effect on the stone than that seen in the Short Pulse Mode.

Conclusions: Lasering in Tissue Mode can enable better fragmentation with a reduced retropulsive effect on the stone resulting in more effective stone breakage, a more controlled and precise dusting, reduced operating duration and improved stone free rates.

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