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Anti-retropulsion devices increase stone fragmentation efficiency with Holmium:YAG laser lithotripsy.

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Background: Increased power using Holmium:YAG laser lithotripsy may cause stone retropulsion that results in higher failure rates and prolonged procedures. We hypothesized that anti-retropulsion devices would increase stone fragmentation efficiency for a given amount of laser energy during lithotripsy.

Methods: UltraCal 30 stones (N=180) were divided into 6 groups: control group (no backstop device), 7 mm and 10 mm Stone Cone (Boston Scientific), NTrap (Cook Urological), and 7 mm and 10 mm Accordion (PercSys). Each group was further divided into 3 power settings: 0.5J/10 Hz, 1 J/20 Hz, and 2 J/40 Hz to yield groups with sample sizes of 10. A total of 500 Joules of energy was delivered in each trial. Stones were placed in a horizontal 8.5 mm diameter acrylic tube immersed in saline. The primary endpoint was stone fragmentation efficiency as defined by stone mass change for a given unit of energy.

Results: At the lowest power setting, only the 7 mm Accordion and 10 mm Stone Cone increased stone fragmentation efficiency over control ($p < 0.05$). At the higher power settings (20 W and 80 W), all devices increased efficiency over controls ($p < 0.001$). Stone retropulsion increased significantly with higher power settings in the absence of any device ($p < 0.01$).

Conclusion: Anti-retropulsion devices increase stone fragmentation efficiency and facilitate high power lithotripsy compared to controls. No device was shown to be clearly superior to any other. Presumably, the improved efficiency was a result of increasing the contact time between the laser fiber and stone. Migration of stone fragments was uncommon and no fragments larger than 2 mm migrated past any device.

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