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Maximum force generated to retract three stone-trapping devices around a stone in a ureter model with a stricture

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Objective: Devices used to limit migration of stone fragments during lithotripsy also sweep fragments down the ureter. The objective of this study was to measure the forces generated while withdrawing three stone-trapping devices past an impacted stone.

Methods: A ureter model with an internal diameter of 5.7 mm and containing a 3 mm stricture at its distal end was constructed. A metal bead 5 mm in diameter simulating a stone was placed in the tube proximal to the stricture. Three stone-trapping devices, the Accordion (PercSys Inc), Stone Cone (Boston Scientific Corp) and N-Trap (Cook Urological), swept the stone to the stricture and then moved around the stone and through the stricture. A digital force gauge attached to the shaft of each device measured the maximum force (in Newtons) generated as they moved past the stone in five repetitions.

Results: The mean maximum force measured was 0.67 Newtons for the Accordion and 1.13 Newtons for the Stone Cone ($p = 0.01$). The Accordion released around the stone with a relatively constant force, whereas the Stone Cone produced its maximum force primarily at the end of its withdrawal. The N-Trap would not disengage from the stone at all.

Conclusions: Both the Accordion and the Stone Cone devices moved past the impacted stones without the need to manipulate the devices. The significant difference between the forces produced by these devices needs to be assessed in terms of injury to the ureter and success in stone-clearing capacity in clinical use.

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