

Duster Buster: Endourological Device To Remove Stone Fragments From Kidneys

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Overview

When performing laser fragmentation (lithotripsy) on kidney or ureteral stones, it is common to have small fragments remain in the kidney. Existing methods for extracting these fragments and "dust" have shown insufficient performance. We propose a unique tool, the "duster buster", that cleans the kidney from small fragments and dust/sand-like particles. This novel approach is straightforward, economical and integrates seamlessly with current ureteroscopes and endourological procedures.

Background and Unmet Need

Laser fragmentation, or lithotripsy, used to treat kidney and ureteral stones, often results in small fragments (less than approximately 2-3 mm) remaining in the kidney. These fragments are challenging to remove due to their elusive nature, small size, or sheer number, rendering traditional basket removal methods ineffective. In recent years advances in laser technology have led to the use of more powerful lasers. These advanced lasers have broadened the scope of laser lithotripsy, allowing for the treatment of larger stone burden. This in turn leads to frequent situations where numerous small stone fragments are retained in the kidney after the procedure. It was believed that urine production and flow would naturally flush these fragments and sand-like "dust" to the bladder. However, in reality, many of these remnants remain in the kidney, potentially becoming nuclei for future stone formation. Current and proposed removal methods, such as flushing with irrigation water or use of suction, have proven inadequate. Therefore, there is an urgent need for an effective method that immediately removes these stones fragments following laser lithotripsy.

The Solution

Prof. Berkowitz and his collaborator, endourologist Dr. Yaniv Shilo, invented the "duster buster" - a novel device that removes small, dust-like stone fragments from the kidney following laser lithotripsy.

Technology Essence

In a ureteroscope, one channel is dedicated to housing the camera/light, while the other channel, which remains open, is used for inserting various treatment devices such as laser fiber for stone fragmentation and baskets for the removal of stone fragments. This versatile second channel can also accommodate the duster buster system. The system's tube, known as the "duster unit", is inserted into the working channel of the ureteroscope. Inside this tube is a "guidewire spine", to which several sets of feather-like or string-like strands are attached. These strands, known as "duster units" are connected to the spine via a ring. Each set of strands is pre-coated with a gel that is FDA-approved ensuring safe internal use.

During the procedure, the ureteroscope is positioned within the kidney. The operator then carefully advances the guidewire spine approximately 1-2 centimeters forward, deploying the first "duster unit" to capture stone fragments or dust. After the "duster unit" successfully collects the debris, the ureteroscope is gently withdrawn. The used "duster unit" is then detached and disposed of and the process can be repeated as necessary with fresh units.



Figure 1: Left - Cross-section of kidney. Stone fragments and dust can accumulate and remain immobile in the major and minor calyces; Middle - Ureteroscope; Right - "Duster Buster" conceptual method of operation: (top) a "duster unit" prior to ejection from the tube, and (bottom) its expansion following ejection from the tube.

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Applications and Advantages

- Removal of small stone fragments and dust/sand-like particles from the kidney.
- Compatible with existing ureteroscopes and endourological practices.
- Improvement of patient safety and well-being, reducing the likelihood of stone recurrence.
- Reduces the potential need for patients to return for additional hospitalization and operating room treatments.
- Simple and easy to use.
- Cost-effective.

Development Status

Prof. Berkowitz and his collaborator, endourologist Dr. Yaniv Shilo, have developed a novel "duster buster" inspired by the design of a "feather buster". They have successfully demonstrated its proof-of-concept and created a working prototype.

Market Opportunity

The market opportunity is immense. As dusting emerges as the "standard" practice, driven by the introduction of more potent lasers for use in laser lithotripsy, the challenge of removing the resulting "dust" becomes increasingly critical. However, there is a notable absence of endourological instruments that can tackle this issue effectively.

