Lumenis Holmium Solutions for Stone Lithotripsy

Bibliography of Published Studies & Peer-Reviewed Papers

The use of Holmium Laser for stone lithotripsy is clinically based, in its versatility for different stone sizes, high success rates, shorter procedure time and low complications of the procedure. The following list presents selected publications from the last 10 years, pointing out the advantages of using Holmium Laser for stone lithotripsy in Urology.

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Lumenis®
Energy to Healthcare

Energy to Healthcare

1990

Introduced
› UltraPulse® CO_2 and VersaPulse® Holmium laser systems
› patented waveguide delivery system for CO_2 laser.

1996

Introduced VersaPulse® C

2000

Introduced VersaPulse® PowerSuite™, world's first 100W Holmium laser for BPH

2009

Introduced
AcuPulse™ with SurgiTouch

2010

Introduced
VersaPulse P20

2012

Introduced
AcuPulse WaveGuide

2012

Introduced
› AcuPulse DUO
› FiberLase Robotic DIG
› MicroLase Fiber
› FiberLase GYN Handpieces

2014

Introduced
› Lumenis Pulse 120H
› Xpeeda Fiber
› SlimLine 200 D/F/L Fiber

2015

Introduced
› UltraPulse DUO
› Lumenis Pulse 100H
› Lumenis Pulse 50H

2016

Introduced
› Lumenis Pulse 30H
› Suction hand-piece
› Otolase Fiber Delivery System

2017

Launched MOSES™ technology
› Revolutionizing holmium laser lithotripsy

A Heritage of Innovation

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Peer-reviewed publications of using Holmium Laser for stone lithotripsy

Laser Stone Lithotripsy - an Overview

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Stone technology: intracorporeal lithotripters.	World J Urol. 35(9):1347-1351.	Scotland KB, Kroczak T, Pace KT, Chew BH.	2017	› A review of the different methods used in Intracorporeal lithotripsy, which is the most commonly used surgical method of stone treatment in Urology. › Holmium laser lithotripsy was found to be one of the most commonly used tools for intracorporeal lithotripsy and considered as the gold standard.	N/A
Contemporary ureteroscopic management of renal stones.	Int J Surg 36(Pt D): 681-687.	Proietti S, Knoll T, Giusti G.	2016	› A review describing the contemporary ureteroscopic management of kidney stones. › The introduction of holmium laser lithotripters,together with the increasing number of requests for minimally invasive procedures has ameliorated outcomes, patients' safety and comfort, making the use of flexible ureteroscopy for urinary calculi increasingly attractive and widespread among the urological community. › Due to its high stone-free rates and low morbidity, flexible ureteroscopy has become a viable option for the treatment of renal stones.	N/A

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Optimal power settings for Holmium:YAG lithotripsy.	J Urol, 187(3):914-9.	Sea J, Jonat LM, Chew BH, Qiu J, Wang B, Hoopman J, Milner T, Teichman JM.	2012	› Choosing optimal Holmium lithotripsy power settings to achieve maximal fragmentation, minimal fragment size and minimal retropulsion. › At low pulse energy (0.2 J) less fragmentation and retropulsion occur, and small fragments are produced. At high pulse energy (2.0 J) more fragmentation and retropulsion occur with larger fragments. › Holmium lithotripsy was found efficient in a bench test analysis for different pulse energy settings.	Lumenis system 100W 365/550 µm fiber
Holmium laser for stone management.	World J Urol;25(3):235-9.	Sea J, Jonat LM, Chew BH, Qiu J, Wang B, Hoopman J, Milner T, Teichman JM.	2007	› A review on the efficiency and safety profile of the Holmium laser, as a versatile multi-purpose instrument for use in the endoscopic treatment of a wide variety of urologic disorders, in particular urinary calculi. › The holmium laser is currently the most efficient intracorporeal lithotripter, while also providing extensive soft tissue applications, an excellent safety profile and the ability of being delivered through small flexible fibers.	

Moses™ technology for stone lithotripsy

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Ureteroscopic High-Frequency Dusting Utilizing a 120-W Holmium Laser.	J Endourol 32(4):290-295.	Tracey J, Gagin G, Morhardt D, Hollingsworth J, Ghani KR.	2018	› Assessment of a 120-W Holmium laser machine that permits high-frequency (>50 Hz) dusting for lithotripsy in 2 renal units (71 patients). › Mean stone size and density were 12.5 mm (SD 8.7) and 993 (SD 353), respectively. Ureteral access sheath was used in 15 (21%) patients. Mean total laser energy per case was 5.2 kJ. Dusting was exclusively performed in 84% of cases. There were 11 complications (13%) (grade 1=5, grade 2=6). The emergency department visit rate was 5.6%. There were no hospitalizations or reinterventions. › Outcomes utilizing a dusting technique demonstrated acceptable residual fragments and complication rates. Further study is needed to define the optimal role of dusting technique during laser lithotripsy.	Lumenis system 120W

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Moses technology in a stone simulator.	Can Urol Assoc J 12(4):127-130.	Ibrahim A, Badaan S, Elhilali MM, Andonian S.	2018	› Comparison of fragmentation efficiency of the conventional regular mode of Holmium laser to the MosesTM contact mode in a stone simulator using flexible ureteroscopy with artificial stones. › A significant reduction in stone retropulsion was noticed when comparing regular mode to the Moses contact mode (mean Grade 2.5 vs. Grade 1; $p<0.01$). When compared with the regular mode, the Moses contact mode was associated with significantly shorter procedural time during fragmentation (13.9 vs. 9.1 minutes; $p\leq0.01$) and dusting (9.3 vs. 7.1 minutes; $p\leq0.01$). In addition, when compared with the regular mode, the laser pedal was pressed significantly less often with the Moses mode during fragmentation (86 vs. 43 times; $p<0.01$) and dusting (50 vs. 26 times; $p<0.01$). Moses contact mode was associated with significantly higher percentage of lasing vs. pausing when compared with the regular mode for both fragmentation (0.8 J/10 Hz) and pulverization (0.4 J/50 Hz) settings (both $p<0.05$). › Using the stone simulator setup, Moses technology was associated with more efficient laser lithotripsy (shorter operative time) due to significantly reduced stone retropulsion.	Lumenis system 120W

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Initial Clinical Experience with a Modulated Holmium Laser Pulse-Moses Technology: Does it Enhance Laser Lithotripsy Efficacy?	Rambam Maimonides Med J. 16;8(4).	Mullerad M, Aguinaga JRA, Aro T, Kastin A, Goldin O, Kravtsov A, Assadi A, Badaan S, Amiel GE.	2017	› Comparing standard stone lithotripsy with Moses technology using Lumenis High-power Holmium Laser (120H) , in 5 urology surgeons using the technology in 34 ureteroscopy procedures (19 kidney stones, 15 ureteral stones; 22 procedures with a flexible ureteroscope, and 12 with a semi-rigid ureteroscope). › Overall, laser lithotripsy with Moses technology utilized laser energy in less time to achieve a satisfying stone fragmentation rate of 95.8 mm3/min versus 58.1 mm3/min, P=0.19. › The new Moses laser technology demonstrated good stone fragmentation capabilities when used in everyday clinical practice.	Lumenis system 120W

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Use of the Moses Technology to Improve Holmium Laser Lithotripsy Outcomes: A Preclinical Study.	J Endourol 31(6):598-604.	Elhilali MM, Badaan S, Ibrahim A, Andonian S.	2017	› In-vitro and in-vivo evaluation of the effects of Moses technology in Holmium laser with a comparison to regular mode in terms of lithotripsy efficiency and laser-tissue interactions using a high-speed camera, and stone ablation efficiency in a lab model, and assessment of stone fragmentation, dusting and laser-tissue interaction with the ureteral wall in a porcine ureteroscopy model. › A significant reduction in retropulsion when using the Moses mode was shown, so that the stone movement was reduced by 50 times at 0.8 J and 10 Hz ($p<0.01$). The pronounced reduction of retropulsion in the Moses mode was clearly observed during fragmentation setting (high energy) and dusting (low energy, high Hz). In addition, stone fragmentation tests showed that the Moses modes resulted in a significantly higher ablation volume when compared with the Regular mode (160% higher; $p<0.001$). In vivo assessment also supported the reduction in retropulsion when treating stones in the porcine kidney. Histological analysis of the porcine ureter after direct lasing in the Moses mode suggested less damage than in the Regular mode. › The Moses technology resulted in more efficient laser lithotripsy, in addition to significantly reduced stone retropulsion, and displayed a margin of safety that may result in a shorter procedural time and safer lithotripsy.	Lumenis system 120W

Dusting and fragmentation approaches in Holmium laser Lithotripsy

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Ureteroscopic Laser Lithotripsy: A Review of Dusting vs Fragmentation with Extraction.	J Endourol. 2018 Jan;32(1):1-6.	Matlaga BR, Chew B, Eisner B, Humphreys M, Knudsen B, Krambeck A, Lange D, Lipkin M, Miller NL, Monga M, Pais V, Sur RL, Shah O.	2018	› A review of the two primary Holmium laser treatment approaches in lithotripsy: dusting and fragmentation with extraction, and the effects of varying laser settings on the effectiveness of stone treatment. › Both dusting and fragmentation with extraction approaches to ureteroscopic stone treatment are effective. Each approach has relative advantages and disadvantages, which should be considered. › Although dusting tends to be associated with shorter procedure times and a lower risk of ureteral damage, this approach may place the patient at increased risk for future stone events should all of the resultant debris not be expelled from the collecting system. The active removal associated with fragmentation with extraction, in contrast, may provide for a more complete initial stone clearance.	N/A
Dusting versus Basketing during Ureteroscopy-Which Technique is More Efficacious? A Prospective Multicenter Trial from the EDGE Research Consortium.	J Urol. 199(5):1272-1276.	Humphreys MR, Shah OD, Monga M, Chang YH, Krambeck AE, Sur RL, Miller NL, Knudsen BE, Eisner BH, Matlaga BR, Chew BH.	2018	› A retrospective evaluation of dusting versus active basket extraction during ureteroscopy for kidney stones with regards to stone-free rate and complications in 159 patients in 2 groups. › The stone-free rate was significantly higher in the basketing group (74.3% vs 58.2%, p = 0.04) . In patients who underwent a basketing procedure operative time was 37.7 minutes longer than in those treated with a dusting procedure (95% CI 23.8-51.7, p <0.001). There was no statistically significant difference in complication rates, hospital readmissions or additional procedures between the groups. › The two techniques of dusting and active basket extraction should be in the armamentarium of the urologist.	Lumenis system 120 W

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Holmium Laser Lithotripsy in the New Stone Age: Dust or Bust?	Front Surg 29;4:57.	Aldoukhi AH, Roberts WW, Hall T, Ghani KR.	2017	› A review on using different settings during holmium laser ureteroscopy (URS), which can allow the surgeon to choose different combinations that have specific effects on stone lithotripsy. › Fragmentation employs settings of low frequency and high pulse energy to break stones that are then extracted with retrieval devices. Dusting is the utilization of high frequency and low pulse energy settings to break stones into submillimeter fragments for spontaneous passage without the need for basket retrieval. › Furthermore, use of the long pulse width mode during lithotripsy can reduce stone retropulsion and is increasingly available in new generation lasers. › An understanding of holmium laser settings will permit the surgeon to utilize various techniques for stone lithotripsy.	Lumenis system 120 W
Optimizing Use of the Holmium:YAG Laser for Surgical Management of Urinary Lithiasis	Curr Urol Rep, 15(4):397.	Patel AP, Knudsen BE.	2014	› An overview of Ho:YAG laser fibers utilized for lithotripsy during ureteroscopy and current data regarding optimal energy settings and different fragmentation techniques. › The Ho:YAG laser is capable of fragmenting urinary stones of all compositions while maintaining a wide margin of safety. › The Lumenis 100 W is the most versatile laser for urology, allowing dusting with a pulse frequency of 50 Hz.	Lumenis system 100 W

Holmium laser Lithotripsy compared with other methods

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Comparison of YAG Laser Lithotripsy and Extracorporeal Shock Wave Lithotripsy in Treatment of Ureteral Calculi: A Meta-Analysis.	Urol Int 98(4):373-381.	Yang C, Li S, Cui Y.	2017	› Evaluation of the clinical efficiency and safety of Holmium laser ureteroscopy lithotripsy versus extracorporeal shock wave lithotripsy (ESWL) on ureteral calculi using systematic reviews on 1,770 patients from 14 studies in 2 groups. › Stone-free rate was significantly improved (RR 1.15 (95% CI 1.06-1.26, p=0.002) and operation time was significantly reduced (SMD = -2.27 (95% CI -3.42 to -1.11), p = 0.0001) when using a Holmium laser ureteroscopy lithotripsy. › Holmium laser ureteroscopy lithotripsy is relatively a more efficient and safe method to treat ureteric stones, since it has shorter operation time and a better stone-free rate.	N/A
Comparison of Holmium: YAG Laser and Pneumatic Lithotripsy in the Treatment of Ureteral Stones: An Update Meta-Analysis.	Urol Int 98(2):125-133.	Chen S, Zhou L, Wei T, Luo D, Jin T, Li H, Wang K.	2017	› Comparing Holmium laser lithotripsy with pneumatic lithotripsy in randomized controlled trials (RCTs) evaluating the efficacy and safety of the 2 procedures in the treatment of ureteral calculi in 8 studies on 1,555 patients. › Holmium laser lithotripsy was found to have a significantl reduced operative time (weighted mean difference = -11.52, 95% CI -17.06 to -5.99, p < 0.0001), and increased early stone-free rate (OR 2.69, 95% CI 1.91-3.78, p <0.00001) and delayed stone-free rate (OR 2.12, 95% CI 1.40-3.21, p = 0.0004). A higher postoperative ureteral stricture rate (OR 3.38, 95% CI 1.56-7.31, p = 0.002) was observed in Holmium group over PL group. › Holmium laser lithotripsy can achieve shorter mean operative time, better early and delayed stone-free rate compared with pneumatic lithotripsy. Further trials are unlikely to considerably alter this conclusion.	N/A

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Application of Pneumatic Lithotripter and Holmium Laser in the Treatment of Ureteral Stones and Kidney Stones in Children.	Biomed Res Int. 2017:2505034.	Życzkowski M, Bogacki R, Nowakowski K, Muskała , Rajwa P, Bryniarski P, Paradysz A.	2017	› Evaluation of the effectiveness of Holmium laser and pneumatic lithotripters in 108 children who underwent ureteral stones and kidney stones lithotripsy procedures in 2 groups. › The mean operative time was shorter in the holmium laser group (34 versus 56 minutes, p=0.04) and a higher stone-free rate was observed in the holmium laser but it was not statistically significant. The rate of complications was similar in both groups. › The use of a holmium laser reduces the duration of the procedure and increases its effectiveness in comparison with the use of a pneumatic lithotripter.	N/A
A Prospective Randomized Comparison Between Shock Wave Lithotripsy and Flexible Ureterorenoscopy for Lower Caliceal Stones ≤2 cm: A Single-Center Experience.	J Endourol, 29(5):575-9.	Kumar A, Vasudeva P, Nanda B, Kumar N, Das MK, Jha SK.	2015	› Evaluate safety and efficacy of shock wave lithotripsy (SWL) and flexible Holmium laser ureteroscopy (RIRS) for lower caliceal calculus ≤2 cm in 195 patients in two groups. › Retreatment rate was significantly greater in SWL group (61.1% versus 11.1%; p<0.001). Complication rate was 6.6% in SWL versus 11.1% in group RIRS (p=0.21). › For 10-20 mm stones,flexible Holmium laser ureteroscopy (RIRS) was more effective, with significantly reduced retreatment.	Lumenis 100 W

Success Rate (Stone-Free Rate)

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
Ureteropyeloscopic treatment of large, complex intrarenal and proximal ureteral calculi.	BJU Int, 111(3 Pt B):E127-31.	Cohen J, Cohen S, Grasso M.	2013	› 145 patients underwent retrograde ureteroscopic lithotripsy using Holmium Laser. › Clearance rates were high: for proximal ureteral (97%) and renal pelvic (94%) stones with no major intraoperative complications. › Retrograde flexible ureteroscopy is an alternative to percutaneous therapy with acceptable efficacy and low morbidity.	365 µm fiber
Laser and pneumatic lithotripsy in the endoscopic management of large ureteric stones: a comparative study.	Urol Int , 88(3):311-5.	Kassem A, Elfayoumy H, Elsaied W, Elgammal M, Bedair A.	2012	› Comparing the results of Holmium laser and Pneumatic Intracorporeal Lithotripsy (PIL) for large ureteric calculi in 80 patients in two groups. › Delayed stone-free rate was 95% in Holmium laser group and 85% in PIL (p=0.139). In addition, stone migration occurred in only 5 cases in the Holmium group versus 12 cases in the Pneumatic group. › Both PIL and Holmium Laser are effective and safe modalities in treating large ureteric stones. Holmium laser had less cases of stone migration.	Lumenis system 100W 550 µm fiber
Comparison of pneumatic and laser lithotripsy in the treatment of pediatric ureteral stones.	J Pediatr Urol, 9(3):308-12	Atar M, Bodakci MN, Sancaktutar AA, Penbegul N, Soylemez H, Bozkurt Y, Hatipoglu NK, Cakmakci S.	2012	› 64 patients underwent either pneumatic or Holmium laser lithotripters in the treatment of pediatric ureterolithiasis. › Stone-free rates were higher (97% versus 79%) in the Holmium group and operative time was shorter (20.5 versus 25.2 min) in the Holmium group. › In the ureteroscopic treatment of pediatric ureterolithiasis, laser lithotripsy has a higher stone-free rate and lower complication rate.	N/A

Reducing procedure time and post-operative complications

Title	Publication	Authors	Year	Short summary of study and conclusion	Laser system
High- versus low-power Holmium laser lithotripsy: a prospective, randomized study in patients undergoing multitract minipercutaneous nephrolithotomy.	Urology, 79(2):293-7.	Chen S, Zhu L, Yang S, Wu W, Liao L, Tan J	2012	› 273 patients with large staghorn renal calculi were randomized to undergo multitract Minimally Invasive Percutaneous Nephrolithotomy (MPCNL) with 30-W (2.0J*15 Hz) low-power or 70-W (3.5 J* 20 Hz) high-power Holmium laser lithotripsy. › The operation time in the high-power group was significantly shorter than that in the low-power group (129.20 versus 105.18 minutes). › A combination of multitract MPCNL and high-power Holmium laser lithotripsy can greatly decrease the operative time without increasing the intraoperative complications compared with low-power Holmium laser lithotripsy.	Lumenis system 100W 1000 µm fiber
Randomized trial of stone fragment active retrieval versus spontaneous passage during Holmium laser lithotripsy for ureteral stones.	J Urol, 183(3): 1031-5.	Schatloff O, Lindner U, Ramon J, Winkler HZ	2010	› Comparing spontaneous passage of small fragments with complete intraoperative extraction during semirigid ureteroscopy for ureteral stones in 60 patients undergoing ureteroscopy and Holmium laser lithotripsy in two groups. › A lower rate of unplanned visits in the emergency rooms (3% vs 30%) was found in the Holmium group. There was also a trend toward lower rates of rehospitalization in the Holmium group (0% vs 10%). › There is a lower risk of unplanned medical visits and rehospitalization when intraoperative retrieving of fragments is performed using Holmium laser lithotripsy.	Lumenis system 80W 365 µm fiber

Risk information: The use of the Lumenis laser systems, accessories and their delivery devices in urology is contraindicated for patients who are unable to receive endoscopic treatments or are intolerant to prolonged anesthesia, as well as for resection or excision of large vascularized organs. Lumenis Holmium laser systems and accessories are solely intended for use by physicians trained in the use of the Ho:YAG (2.1 µm) wavelength. Incorrect treatment settings can cause serious tissue damage. The laser should be used only on tissues that are fully observable. See the system user manual for a complete list of contraindications and risks.

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