

Supplementary Information

Intracorporeal lithotripsy of salivary stones: in vitro comparison of different methods

European Archives of Oto-Rhino-Laryngology

Schulze Cathrin¹, Thangavelu Kruthika¹, Gehrt Francesca¹, Schatton Robert³, Keil Christian², Heers Hendrik², Abozenah Nermin H.¹, Stuck Boris A.¹, Geisthoff Urban¹

¹ Klink für Hals-Nasen-Ohren Heilkunde, Kopf- und Hals-Chirurgie, Universitätsklinikum Marburg

² Klinik für Urologie Universitätsklinikum Marburg, Philipps-Universität Marburg,

³ HNO Praxis Wülfrath

Address for correspondence:

Cathrin Schulze: Univ.-HNO-Klinik, Baldingerstrasse, 35043 Marburg, Tel. 06421 58-66488, Fax -66367,

Email: (cathrinschulze@gmx.de)

Online Resource 1

Table 1: Published in vitro studies regarding fragmentation rates and time

Author	Year	Setting	Stone phantom size	Device	Fragmentation	stone clearance time (s)
					impulses or energy used M ± SD	
Iro	1993	Extirpated human submandibular glands	salivary stones	EHL	Stone clearance 53/58 (91%). In 5 cases (9%) no effects were seen	
Vorreuther	1998	Under water fragmentation and measurement of displacement	chalk hard clay cubes 10 x 10 mm	Lithoclast (pneumatic)	Weight loss 24 ± 4 mg/pulse for 20 pulses	
				EKL Combilith	Weight loss 25 ± 3 mg/pulse for 20 pulses	
Marguet	2005	Underwater fragmentation in vertical syringe with 2 mm hole	plaster of Paris stones -	Nd:YAG Laser	at 300 J mean % weight loss: 44,85%, at 400 J: 86,8%	
				Ho:YAG-Laser	Total energy J of 300: mean % weight loss: 3,26%, at 480 J 7,1%	
Siedek	2008	Fragmentation on sieve 1x3 mm mesh	salivary stones	Nd:YAG Laser	107,0 ± 84,5 impulses	
				Ho:YAG-Laser	175,9 ± 120,8 impulses	
Wang	2012	Under water fragmentation on 4 mm sieve 10 mm	spherical BegoStones 1 cm	LithoBreaker	430 ± 97 impulses	484 ± 79 s
				StoneBreaker	29 ± 3,7 impulses	122 ± 56 s
		Ureteroscopic stone fragmentation in horizontal tube		LithoBreaker	178,2 ± 54,1 impulses	97,4 ± 26,7 s
				StoneBreaker	33,2 ± 19,8 impulses	142,6 ± 121,3 s
				Ho:YAG-Laser	1,84 ± 0,3 kJ	304,4 ± 99,9 s
Martov	2014	Fragmentation on sieve 2 mm mesh	cuboid BegoStones 100/256/320 mm³	EHL	Stone clearance 83% 2 failures in 12 tests	
Schrötzlmair	2015	Fragmentation on mesh sized 1,5 mm	Salivary stones	Ho:YAG-Laser	Fragmentation rate 1J/pulse: 0,41 ± 0,33 mg/pulse	
Hoffmann	2016	Fragmentation in a silicone duct model	salivary stones	StoneBreaker	98 impulses	32 minutes
Eisel	2018	Underwater setup mesh size 2,3 mm	BegoStones cubical 5 mm spherical 6 mm	Ho:YAG-Laser	Dusting ratio 60% at 1J/pulse, 0,3 ms, 10 Hz 73% at 1J/pulse, 1,2 ms, 10 Hz	
Andreeva	2020	Underwater setup with perforated cuvette: 3 mm or 1 mm diameter Horizontal tube	COM stones 8 – 10 mm Uric acid stones 6 – 8 mm	Thulium fiber laser	Dusting < 1mm COM stones 0,2 J, 40 Hz, 8W: 0,6 ± 0,2 mg/s	228 s
					Dusting (<1 mm), uric acid stones 0,2 J, 40 Hz, 8 W: 1,1 ± 0,2 mg/s	294 s
				Ho:YAG-Laser	Dusting < 1mm COM stones 0,2 J, 40 Hz, 8W: 0,2 ± 0,1 mg/s	1015 s
					Dusting (<1 mm), uric acid stones 0,2 J, 40 Hz, 8 W: 0,6 ± 0,1 mg/s	short pulse 495 s

Table 2: Selected published in vitro studies regarding fragmentation rates and time – those more suitable to compare to our study

Author	Year	Setting	Stone phantom size	Device	Fragmentation	
					impulses or energy used M ± SD	stone clearance time
Siedek	2008	Fragmentation on sieve 1x3 mm mesh	salivary stones	Nd:YAG Laser	107,0 ± 84,5 impulses	
				Ho:YAG-Laser	175,9 ± 120,8 impulses	
Wang	2012	Under water fragmentation on 4 mm sieve 10 mm	spherical BegoStones 1 cm	LithoBreaker	430 ± 97 impulses	484 ± 79 s 08:04 ± 01:19 min.:s
				StoneBreaker	29 ± 3,7 impulses	122 ± 56 s 02:02 ± 00:56 min.:s
		Ureteroscopic stone fragmentation in horizontal tube		LithoBreaker	178,2 ± 54,1 impulses	97,4 ± 26,7 s 01:37 ± 00:27 min.:s
				StoneBreaker	33,2 ± 19,8 impulses	142,6 ± 121,3 s 02:23 ± 02:01 min.:s
				Ho:YAG-Laser	1,84 ± 0,3 kJ	304,4 ± 99,9 s 05:04 ± 01:40 min.:s
Hoffmann	2016	Fragmentation in a silicone duct model	salivary stones	StoneBreaker	98 impulses	32 minutes
Andreeva	2020	Underwater setup with perforated cuvette: 3 mm or 1 mm diameter Horizontal tube	COM stones 8 – 10 mm Uric acid stones 6 – 8 mm	Thulium fiber laser	Dusting < 1mm COM stones 0,2 J, 40 Hz, 8W: 0,6 ± 0,2 mg/s	228 s
					Dusting (<1 mm), uric acid stones 0,2 J, 40 Hz, 8 W: 1,1 ± 0,2 mg/s	294 s
				Ho:YAG-Laser	Dusting < 1mm COM stones 0,2 J, 40 Hz, 8W: 0,2 ± 0,1 mg/s	1015 s
					Dusting (<1 mm), uric acid stones 0,2 J, 40 Hz, 8 W: 0,6 ± 0,1 mg/s	short pulse 495 s
This study		Underwater fragmentation on sieve mesh size 1,5 mm	BegoStone 5 mm	StoneBreaker	46,1 ± 8,1	01:50 ± 00:28 min.:s
				EKL	79,4 ± 12,8	02:49 ± 00:37 min.:s
				Ho:YAG-Laser	563,6 ± 93,4	05:12 ± 00:58 min.:s
		Salivary stones	StoneBreaker	72,0 ± 14,6	02.42 ± 00:36 min.:s	
			EKL	64,0 ± 25,2	02:59 ± 01:31 min.:s	
			Ho:YAG-Laser	459,6 ± 349,4	02:52 ± 01:42 min.:s	