Urolithiasis (2024) 52:85
https://doi.org/10.1007/s00240-024-01589-w

CORRESPONDENCE

Advancing laser lithotripsy insights – a synergistic perspective on holmium and thulium lasers

Fu-Xiang Lin[1] · Jian-Hua Huang[1] · Zhan-Ping Xu[1]

Received: 29 May 2024 / Accepted: 4 June 2024

This commentary refers to the article provided at https://doi.org/10.1007/s00240-024-01541-y.

Dear Editor,

Recent studies in the realm of urolithiasis have illuminated the dynamic landscape of laser lithotripsy, particularly with the advent of the thulium fiber laser (TFL) as a promising alternative to the established holmium: yttrium-aluminum-garnet (Ho: YAG) laser [1–3]. The groundbreaking work by Wanderling et al., comparing Ho: YAG and TFL in a meticulously crafted anatomic hydrogel kidney model [1], alongside Wei et al.'s exploration of thermal consequences with Ho: YAG at varying parameters in vitro [2], and the ex vivo thermal profiling by Hein et al. during endourological procedures [3], collectively contribute to our understanding but also raise intriguing avenues for refinement.

While these studies have meticulously characterized thermal doses and temperature profiles, the need persists for a comprehensive evaluation of the interplay between laser characteristics and biological tissue responses across varied surgical scenarios. For instance, Wanderling's findings underscore TFL's tendency for higher thermal loads, yet without definitive trends distinguishing fragmentation from dusting impacts [1]. This gap underscores the necessity for further granular analysis of laser settings, considering not just thermal outcomes, but also their translation to clinical sequelae.

Wei et al. innovatively demonstrated the thermal damage correlation with Ho: YAG power and duration, highlighting the pivotal role of irrigation in thermal mitigation [2]. This echoes Hein's conclusion on the criticality of irrigation rates in preventing renal damage [3], underscoring the universal principle that safe laser lithotripsy necessitates a nuanced irrigation strategy tailored to laser parameters.

However, future inquiries should delve deeper into the long-term histopathological outcomes and functional implications, beyond acute thermal injuries. Moreover, a comparative ex vivo study encompassing both Ho: YAG and TFL with controlled blood flow simulation would offer a more realistic perspective on clinical realities. Additionally, the exploration of laser-tissue interaction dynamics in a broader range of stone compositions and anatomical contexts is vital to inform laser selection strategies.

Innovation in laser lithotripsy demands a synthesis of physics, engineering, biology, and surgical expertise. The cited studies set a strong foundation, but to advance, we must embrace interdisciplinary collaborations that integrate computational modeling, in vitro/in vivo studies, and clinical trials to unravel the complexities of laser-tissue interactions comprehensively. By doing so, we ensure not only safer, but also more efficacious therapies, aligning with the precision medicine paradigm.

In conclusion, the studies reviewed have significantly advanced our comprehension of thermal management during laser lithotripsy. Their combined insights urge for a multidimensional approach to future research that bridges the gap between bench and bedside, enhancing patient outcomes in urolithiasis management.

Acknowledgements None.

Author contributions The authors of the research mentioned are Fu-Xiang Lin, Jian-Hua Huang, and Zhan-Ping Xu. Each author has contributed significantly to the work as follows: Fu-Xiang Lin and Jian-Hua Huang: ideas, manuscript writing, approval for submission. Zhan-Ping Xu: ideas, supervision, approval for submission. All authors actively participated in the review process, providing feedback,

✉ Zhan-Ping Xu
xuzhanping2004@163.com

Fu-Xiang Lin
dr_linfx@163.com

Jian-Hua Huang
JHHuang_FZMW@163.com

[1] Department of Urology, Foshan Hospital of Traditional Chinese Medicine, Foshan 528000, Guangdong, People's Republic of China

Published online: 07 June 2024

refining ideas, and approving the final version of the manuscript before submission.

Funding sources None.

Data availability No datasets were generated or analysed during the current study.

Declarations

Statement of ethics The authors have no ethical conflicts to disclose.

Disclosure statement The authors have no conflicts of interest to declare.

Informed consent All authors consent to the publication of the article.

References

1. Wanderling C, Saxton A, Phan D, Doersch K, Shepard L, Schuler N, Hassig S, Quarrier S, Osinski T, Ghazi A (2024) Getting hot in here! Comparison of Holmium vs. thulium laser in an anatomic hydrogel kidney model. Urolithiasis 52(1):49. https://doi.org/10.1007/s0240-0024-01541-y
2. Wei W, Chen M, Xie L, Mai Y, Zhu H, Xu Z (2024) Comparison of temperature and renal tissue thermal damage by holmium laser with different energy parameters during lithotripsy in vitro porcine kidney model. Int Urol Nephrol. https://doi.org/10.1007/s11255-00-03943943-8
3. Hein S, Petzold R, Müller P, Schoenthaler M, Miernik A (2019) Thermal effects of Ho:YAG laser lithotripsy during retrograde intrarenal surgery and percutaneous nephrolithotomy in an ex vivo porcine kidney model. World Journal of Urology. https://doi.org/10.1007/s00345-00345-019-02808-5