EDITORIAL

Re: Panthier et al., Pulsed lasers and endocorporeal laser lithotripsy, Progrès en Urologie, 2021

Re: Panthier et al., « Lasers pulses et lithotritie laser endocorporelle », Progrès en urologie, 2021

A modern operating room is unimaginable without access to the latest laser devices. In order to meet the ever-evolving needs of surgeons, lasers have developed constantly over the last 30 years. Lasers, an effective tool for cutting tissue as well as ablation, have, however, a number of disadvantages, which has historically put limits on their use. Holmium YAG laser is an effective tool for stone lithotripsy, but it requires Moses effect to minimise stone retropulsion. Tm:YAG is also effective in cutting tissue, but this can lead to increased carbonisation. But, it is only recently that they have advanced in such great strides. The latest generation of laser systems, so-called fibre lasers, are now frequently used. Subsequent they need to overcome these major disadvantages.

The authors in their work aimed to describe the physical principles grounding the use of thulium fibre laser in lithotripsy. Highlighting the advantages of the novel Thulium fibre laser (TFL), the authors pointed out that it could rival the conventional Ho: YAG laser. Among the many strengths of this novel device, it should be stated that it has high absorption in water, modulating peak power together with high frequencies, which facilitate an effective lithotripsy [1]. Also, the authors presented main regimens that are used during laser lithotripsy, all backed up with an impressive theoretical background. It is worth mentioning that the novel Thulium fibre laser emits wavelengths of 1940 nm compared to the Ho:YAG with its 2100 nm. The TFL wavelength is close to the water absorption peak and absorption coefficient of this laser in water is 114 cm\(^{-1}\) which is more than 4 times higher than that of Ho:YAG (26 cm\(^{-1}\)) [2]. This allows for a much more efficient ablation of the stones (due to instantaneous vaporisation of water inside stone pores), which was confirmed in preclinical trials (the lithotripsy efficiency was at least 2–4 times higher) [3].

DOI of original article: https://doi.org/10.1016/j.purol.2020.11.008.

1166-7087/© 2020 Published by Elsevier Masson SAS.
Another result of better water absorption is the theoretical penetration depth: for TFL it is 0.15–0.2 mm compared to Ho:YAG’s 0.4 mm. Whilst mention has already been made of its efficiency, it is worth remembering that, when we talk about such a novel laser device, it is imperative to ensure the device is absolutely safe to use. Previously, a number of concerns were raised regarding the impact of TFL on urinary tissue during laser lithotripsy. Some felt that TFL hypothetically could lead to an increase in temperature where the laser was used. Nonetheless, in the preclinical study, Taratkin et al. showed that there was no difference between the novel TFL and Ho:YAG in terms of temperature changes. A substantial increase of temperature was neither found in low- nor in high-frequency regimes [4]. Subsequently, it was evaluated in an in-vitro study that even if the surgeon misfires and TFL damages the tissue, it results in minimal coagulation depth (0.1 ± 0.1 mm) with even better hemo-stasis than the Ho:YAG [5].

Another point we would like to stress is that the Panthier et al. article gave an extensive overview of the highlights of TFL in lithotripsy from a theoretical point of view. However, there is growing evidence regarding the clinical application of this laser in lithotripsy thus far. There exists published data where TFL was used in RIRS and it was shown that high frequency regimes or “fine-dusting” (up to 200 Hz) were highly effective with almost no repulsion and slightly decreased visibility [6]. Moreover, TFL also proved itself to be an effective modality for PCNL with low complication rate, decreased repulsion and good visibility [7].

It should be noted that, in Russia, two different types of TFL have been available since 2016. Quasi-continuous (QCW) Thulium fibre laser (TFL U1) is characterised by peak and average power of 120 W [2]. QCW means that the device has cutting properties similar to those of continuous wave devices, yet the short pauses between laser pulses allow for increase in thermal relaxation time [5]. This, in turn, decreases carbonisation in comparison with CW lasers (e.g. Tm:YAG) [2]. The other laser type is SuperPulsed Thulium fibre laser (TFL U2), which is characterised by peak power of 500 W and average power of 50 W. TFL U2 allows for highly effective explosive vapourisation with Holmium-like effect on tissues [2]. This laser operates with longer pulse duration and lower peak power resulting in a smaller bubble and, subsequently, dramatically decreased repulsion, which makes it more suitable for lithotripsy [2,8]. This laser is manufactured by NTO IRE Polus, Fryazino and Olympus, and has recently become available in both Europe and the USA. The Olympus device is identical to TFL U2 with the exception of Solitive having an increased power of 60 W. Therefore, the only worldwide available TFL is a SuperPulsed TFL, and we are looking forward for a QCW device becoming available.

The forthcoming next generation of novel thulium fibre laser promises even more new avenues for surgical exploration and has the potential to change radically the lithotripsy landscape.

Disclosure of interest

The author declares that he has no competing interest.

References


