Lasers

Laser pulse shapes influenced efficiency in stone disintegration

Study: Influence of the laser pulse shape on the treatment of stones in the upper urinary tract[1]

Urinary stones can be successfully treated using a Holmium:Yttrium-Aluminum-Garnet (Ho: YAG) laser. The success rate of laser lithotripsy is influenced by laser pulse energy, frequency, and pulse width other than stone-related factors. The influence of the pulse shape on the success of the laser's efficiency is unclear.

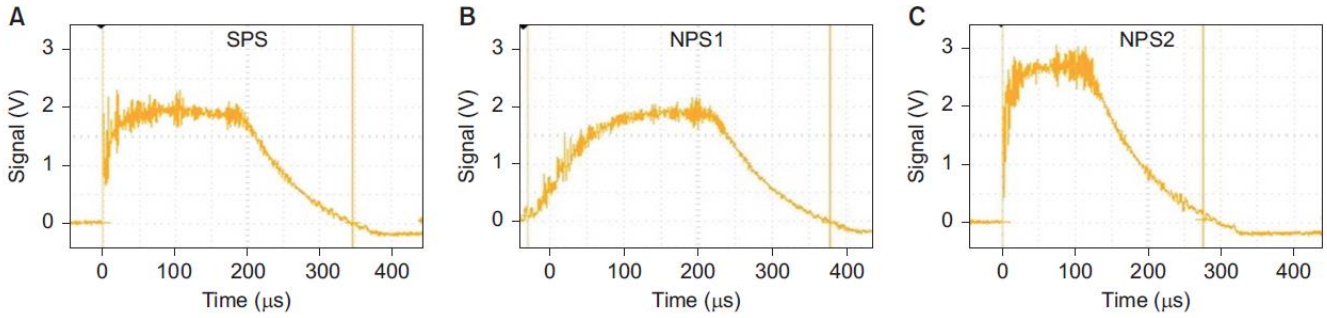
Objective

This study aims to evaluate different laser pulse shapes in a real-world setting.

Research Method

The Dornier Medilas H Solvo 35 (Wessling, Germany) was used in the treatment of ureter and kidney stones. Patients were randomized into standard pulse shape (SPS) and new pulse shape groups (NPS1; ureter) and (NPS2; kidney pelvis). The pulse shapes NPS1 and NPS2 used in this study provided pulses with differences in power at the beginning of the laser pulse and different pulse durations compared to the standard pulse shape (Figure 1).

The primary endpoint was laser efficiency, defined as mm^3 stone destruction per overall operating time. The overall operating time was defined as the time between the beginning of the laser procedure to the removal of the last stone fragment. Secondary endpoints encompassed the number of stone recoveries, laser time, overall operating time, and stone-free rate.



▲ *Figure 1: With courtesy of Dornier MedTech: Laser beam profile for the pulse shapes (A) standard pulse shape (SPS), (B) new pulse shape 1 (NPS1), (C) new pulse shape 2 (NPS2).*

Research Findings

Altogether 145 patients (24 SPS vs. 32 NPS1; 51 SPS vs. 38 NPS2) were included. No differences in sex, age, body mass index, stone localization and stone composition were found, except for preoperative stone size (133±95 [SPS] vs. 197±139 [NPS1] mm^3; p=0.023) and (348±298 [SPS] vs. 525±429 [NPS2] mm^3; p=0.042). Regarding the primary endpoint, a significant increase in laser efficiency could be detected for the NPS1 and NPS2 groups compared to the SPS groups (Figure 2). In terms of mean operative time, there was a trend in favor of the NSP1 and NPS2 groups, which required lesser operative time compared to the standard groups.

▲ *Figure 2: Operating time (min) and laser efficiency (mm^3/operating times (s)) for the standard and the two pulse shape groups NPS1 and NPS2.*

In terms of recovery rate, there were no statistically significant differences between the tested laser settings (Figure 3). With regard to the laser time required to disintegrate the stones and the stone-free rate, both settings showed a better result than the standard mode of the laser device, even though the results were not significantly different (Figure 3).

▲ *Figure 3: Recovery rate, laser time (s), and stone-free rate (%) for the standard and the two pulse shape groups, NPS1 and NPS2.*

Conclusion

The findings of the study highlighted that different pulse shapes influence the disintegration of stones in the upper urinary tract. Modified laser pulse shapes, such as those offered by the Ho:YAG Dornier Medilas H Solvo 35 laser, can **improve efficiency and reduce operating time**. Thus, with the availability of such laser pulse shapes, the surgeon has the advantage of an additional pulse variable, ultimately affecting the planning of the lithotripsy session.

Glossary

NPS1 - Advanced Mode of Dornier Medilas H Solvo 35

NPS2 - Fragmenting Mode of Dornier Medilas H Solvo 35

SPS - Standard Mode of Dornier Medilas H Solvo 35

References

1. Alghamdi, A., Kretschmer, A., Stief, C. G., & Strittmatter, F. (2020). *Influence of the laser pulse shape in the treatment of stones in the upper urinary tract.* Investigative and clinical urology, 61(6), 594–599. https://doi.org/10.4111/icu.20200130