(MP-7642) Does Foot Pedal Illumination Improve Speed, Efficiency and Accuracy During Urologic Surgery?

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Objectives
To compare speed, accuracy, dark adaptation, and surgeon preference for pedal activation in 4 different lighting conditions, including conventional OR illumination, a dark OR, a dark OR with glowstick foot pedal illumination, and a dark OR with blacklight foot pedal illumination.

Methods
- **During a simulated percutaneous nephrolithotomy (PCNL), pedals for fluoroscopy (c-arm), holmium laser, and ultrasonic lithotripter (USL) were randomized to 3 different positions.**
- Twenty participants activated pedals in a randomized order in 4 settings: Light OR with overhead lights on, Dark OR with no foot pedal lighting, Dark OR with glowstick illumination, and Dark OR with blacklight illumination.

Endourologic procedures frequently use instruments that require pedal activation in a low-light operating room (OR).

- Foot pedal activation in low-light conditions risks incorrect pedal activation, which may increase radiation exposure, cause patient burns, or start operating room (OR) fires.
- Our previous study demonstrated foot pedal illumination improved speed and accuracy of pedal activation. In addition, surgeons subjectively felt that illuminated foot pedals were beneficial for endourologic procedures.

Introduction

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- Endpoints included time to pedal activation, number of attempted, incomplete, and incorrect presses, dark adaptation, and surgeon preference.

**Analysis** was performed using a Mann-Whitney U Test, p<0.05 considered significant.

**Results**

- Compared to no illumination, the glowstick (6.7 vs. 8.4, p < 0.001) and blacklight fluorescent illumination (5.34 vs. 8.47, p<0.001) were both associated with decreased combined and individual pedal activation times (p<0.05 for c-arm, laser, and USL). (Table 1)
- The blacklight resulted in a significant decrease in attempted (0.39 vs. 3.45, p<0.001), incomplete (0.23 vs. 1.75, p<0.001), and incorrect presses (0.33 vs. 1.25, p<0.001) compared to the dark setting, while demonstrating no difference compared to having room lights on. (Table 2)
- Dark adaptation was significantly improved with blacklight illumination compared to having the room lights on (134.5 vs. 140.5 luminance units, p<0.001).
- Subjectively, 100% of participants preferred illuminated pedals compared to the dark OR, with 90% preferring the blacklight. (Figure 2)

**Discussion**

- During a simulated PCNL, blacklight foot pedal illumination significantly improved accuracy and efficiency of instrument activation compared to the conventional dark OR, while also maintaining surgeon’s dark adaptation.
- This study demonstrates that the use of blacklight foot pedal illumination may reduce errors in the operating room due to inadvertent foot pedal activation.
- Dark adaptation refers to the eyes ability to adjust in the dark after being exposed to bright lights. 1 The Ultraviolet-A light emitted from blacklight lamps causes minimal disruption to dark adaptation. 2
- Our study demonstrates the use of blacklight foot pedal illumination allows surgeons to maintain visual acuity while operating in low-light settings.

![Figure 1](image_url)

**Figure 1.** A- c-arm, Laser and USL activating foot pedals; B- Light OR with overhead lights; C- Dark OR with no foot pedal lighting; D- Dark OR with glowstick illumination; E- Dark OR with blacklight illumination.

### Table 1

<table>
<thead>
<tr>
<th>Glowstick vs. Dark OR</th>
<th>Mean Glowstick vs. Mean Dark OR</th>
<th>Mean Blacklight vs. Mean Dark OR</th>
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<tbody>
<tr>
<td>5.34s vs. 8.47s</td>
<td>p &lt; 0.001</td>
<td>p &lt; 0.001</td>
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### Table 2

<table>
<thead>
<tr>
<th>Z</th>
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<th>p value</th>
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<tr>
<td>Attempted</td>
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<td>Incorrect</td>
</tr>
<tr>
<td>Blacklight</td>
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<td>1.25</td>
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<tr>
<td>Dark OR</td>
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<td>7.75</td>
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<tr>
<td>Glowstick</td>
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<td>1.6</td>
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</table>

**Mean Blacklight vs. Mean Dark OR**

![Figure 2](image_url)

**Figure 2.** Surgeon preference for pedal illumination. Comparison between Dark OR (0%), Glowstick (10%), and Blacklight (90%).

**Conclusion**

During a simulated PCNL, blacklight foot pedal illumination significantly improved accuracy and efficiency of instrument activation compared to the conventional dark OR, while also maintaining dark adaptation for the surgeon.

**References**


**Participants**

- Light OR with overhead lights;
- Dark OR with no foot pedal lighting;
- Dark OR with glowstick illumination;
- Dark OR with blacklight illumination.