

# Low-level laser therapy improves storage disorder associated with detrusor overactivity without impairing voiding function in a rat cystitis model

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## Background

- There are not a few patients with urinary urgency, detrusor overactivity (DO), bladder pain and so on associated with cystitis in the world.
- Some medications and invasive therapies have been established recently because of unmet needs in lower urinary tract dysfunction (LUTD) associated with cystitis.
- However, therapy for LUTD associated with cystitis has been limited yet because of adverse effect, insufficient effect and so on.
- Low-level laser therapy (LLLT) has been utilized for clinical practices such as relieving pain and inflammation.
- LLLT selectively controls the activity of the sensory nervous associated with A-delta and C fibers. In cystitis, hypersensitivity involving not only the afferent A-delta but also C fibers occurs and causes urinary urgency, DO and bladder pain.
- Thus, we think LLLT may be applicable to modulate central and peripheral neural control of lower urinary tract and normalize cystitis associated LUTD.

## Objective

To evaluate the effect of LLLT on LUTD in cystitis model rats.

## Materials and Methods

Eight-week-old Sprague-Dawley (SD) male rats (CrI:CD, Charles River Co., Ltd.) were used.

We prepared the rat cystitis model induced by intravesical 0.3% acetic acid infusion and the control.

Laser irradiation was applied to the skin on both sides of the L6 lumbosacral intervertebral foramen.

Changes in micturition reflex parameters were compared among three groups: normal saline infusion with sham irradiation, acetic acid infusion with sham irradiation, and acetic acid infusion with laser irradiation

The time-course of the experiment is shown in the following figure.

### Day 0

Preparation of bladder fistula

### Day 2

Instillation of normal saline (NS)

Instillation (4.0 mL/hr, 30 min) of 0.3% acetic acid (AcOH)

### Day 3

NS + Sham - Gr. (n = 3)

AcOH + Sham - Gr. (n = 8)

AcOH + Laser - Gr. (n = 8)

Pre - evaluation (40 min)  
Cystometry measurement

Sham irradiation

Laser irradiation

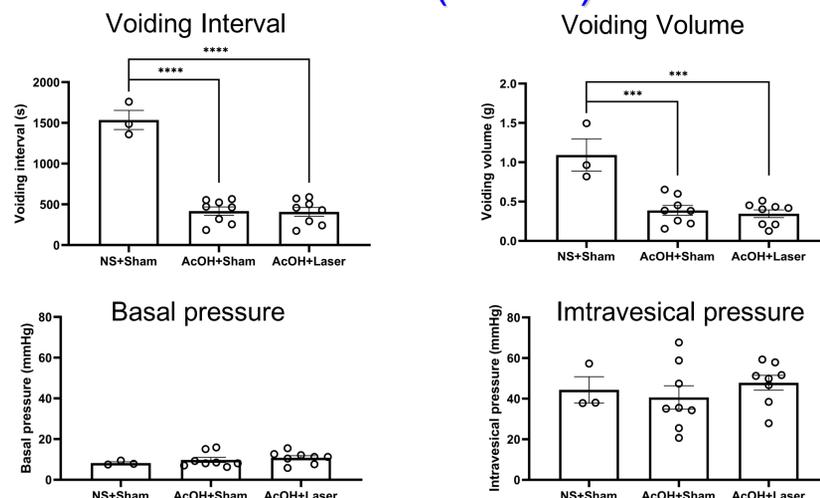
Post - evaluation (30-120 min after irradiation.)  
Cystometry measurement



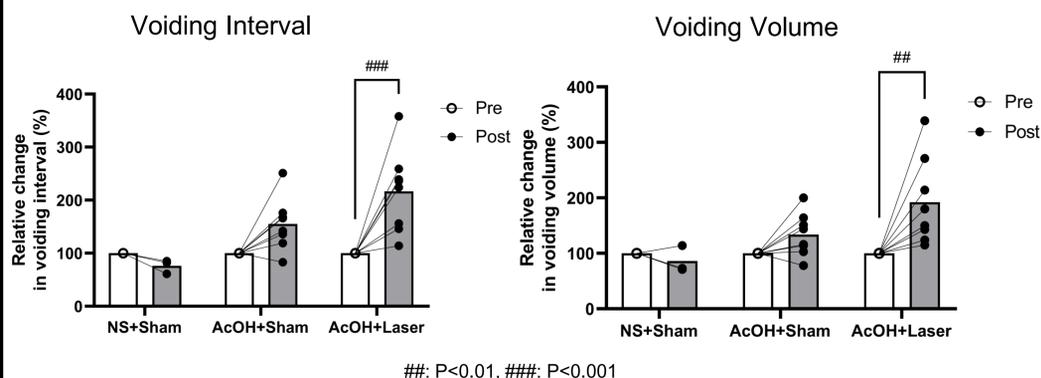
**Sheep (Unitac. Inc)**

Wavelength: 830 nm  
Pulse width; 20 ms  
Repetition rate: 5 Hz  
Pulse duty; 10 %  
Output Power: 1 W average (10 W peak)  
Irradiation area: 1.5 cm<sup>2</sup>

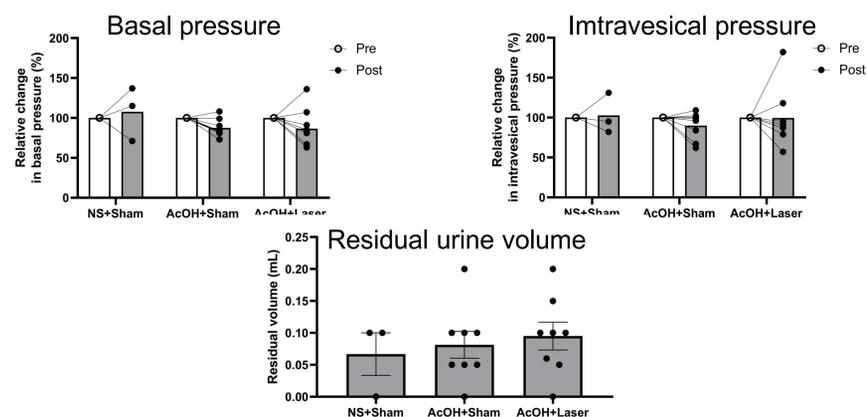
## Results (Before)



## Results (Relative change)



## Results (Relative change)



## Discussion

As well as anti-nociceptive mechanisms, LLLT to bilateral L6 lumbosacral foramen is thought to have some effects on parts of micturition reflex arc; 1) inhibition of A $\delta$ -/C- fiber nerve signals from the bladder (mainly due to depolarizing block), 2) inhibition of neuronal discharge in L6 dorsal root ganglion, and 3) activation of spinal or supra-spinal descending inhibitory system to lumbosacral micturition center, and may inhibit and relieve urinary urgency due to DO.

On the other hand, LLLT is reported to have no effect on efferent nerve condition and motor function generally. So voiding function may be unaffected by this LLLT.

## Conclusion

Lower level laser therapy (LLLT) to the skin on both sides of the L6 lumbosacral intervertebral foramen improves storage disorder associated with DO without impairing voiding function in cystitis.

LLLT may be a new device that improves LUTD associated with cystitis.

First Speaker: Tomoyuki Uchiyama

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