**Dokkyo Medical University**

*Photo-stimulation using low reactive level laser can improve abnormal micturition reflex in spinal cord injury model*

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**Background**

- Micturition reflex, in particular storage reflex, is constructed by spinal reflex via peripheral Aδ-fibre afferent nerves, and which is controlled by central descending inhibitory system.
- On the other hand, abnormal micturition reflex is constructed by spinal reflex via peripheral Aδ- and C- fibre afferent nerves, and which is caused by dis-inhibition of central system.
- This abnormal reflex is well shown in the status of spinal cord injury (SCI).
- Photo-stimulation using low reactive level laser is reported to have some neurobiological effects, and which is clinically used to relieve pain in pain clinic.
- As these effects, inhibition of Aδ- and C-fibre nerve conductions in peripheral afferent nerve tract, activation of central descending inhibitory system via peripheral nerve stimulation, and suppression of local synaptic neurotransmission are reported1,3.
- Then, the photo-stimulation will be applicable to modulate neural control of lower urinary tract and normalize abnormal micturition reflex.

**Objective**

We investigate the photo-stimulating effect of low reactive level laser on lower urinary tract dysfunction (LUTD) in SCI.

**Subjects and Methods**

Experiments were performed on the adult male Sprague-Dawley rats (11-13 weeks old, weighing 250-350g) in standardized environmental conditions. The experimental protocol was approved by the Animal Ethics Committee, Chiba University Graduate School of Medicine.

**Surgical Preparation (SCI model)**

Several weeks before studies, total spinalization was performed at T8 level and intermittent voiding by Crede maneuver was continued until the establishment of independent voiding.

**Urodynamic Evaluation**

Under urethane anaesthesia (1.2 - 1.5 mg/kg s.q. + i.p.), a polyethylene catheter (PE-50) was inserted into the bladder from the bladder dome with midline abdominal incision. After the operation, animal was placed on a hand made cage for urodynamic study.

Urodynamic investigation was performed under remaining anesthesia. *Interval time between voids, urine volume per void, and maximum bladder pressure during voiding* were investigated under continuous saline infusion cystometry (0.04-0.2mL/min).

**General Protocol**

After the establishment of reproducible micturition cycle and 30 - 60 minutes’ baseline recording, sham stimulation and stepped up photo-stimulations using low reactive level laser were irradiated to bilateral L6/S1 intervertebral foramen transcutaneously via the probe contacted to the body. After the stimulation, recording was continued until micturition cycle returned to the baseline.

**Photo-Stimulation Protocol**

Photo-stimulation is operated by the gallium-aluminum-arsenide (Ga-Al-As, wavelength 810 nm) diode laser device. The output power used was 180 mW and the power at the probe was 100 mW. The irradiation periods were 10 sec, 30 sec, 60 sec and 180 sec.

**Results**

- **Interval time between voids**
  - In SCI model, *interval time between voids* decreased generally. Compared with the baseline record, in sham-stimulated groups, *interval time between voids* was not unchanged. In photo-stimulated groups, *interval time between voids* was significantly increased. These changes were stimulation-time dependent. And in any groups, maximum bladder pressure in voiding phase was unchanged.

- **Urine Volume per Void**
  - *Urine volume per void* decreased generally. Compared with the baseline record, in sham-stimulated groups, *urine volume per void* was not unchanged. In photo-stimulated groups, *urine volume per void* was significantly increased. These changes were stimulation-time dependent.

**Discussion**

- As well as anti-nociceptive mechanisms, photo-stimulation with low reactive level laser to bilateral L6/S1 intervertebral foramen inhibited abnormal micturition reflex during filling without decrease in bladder contraction during voiding in LUTD of SCI model.
- These effects were identified by indirect transcutaneous stimulation to the foramen.

**Conclusion**

- Photo-stimulation using low reactive level laser to bilateral L6/S1 root can improve storage disorder by abnormal micturition reflex without exacerbation of voiding disorder in LUTD of SCI model.
- This new device may be useful for the treatment of LUTD in SCI.

**Reference**