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Enhancement of Endogenous Opioids by the Remote Effects of Dry Needling at Distal Myofascial Trigger Spots in Rabbit Skeletal Muscle

在兔子骨骼肌的遠處肌激痛點上做乾針刺激可增強內源性類鴨片效應

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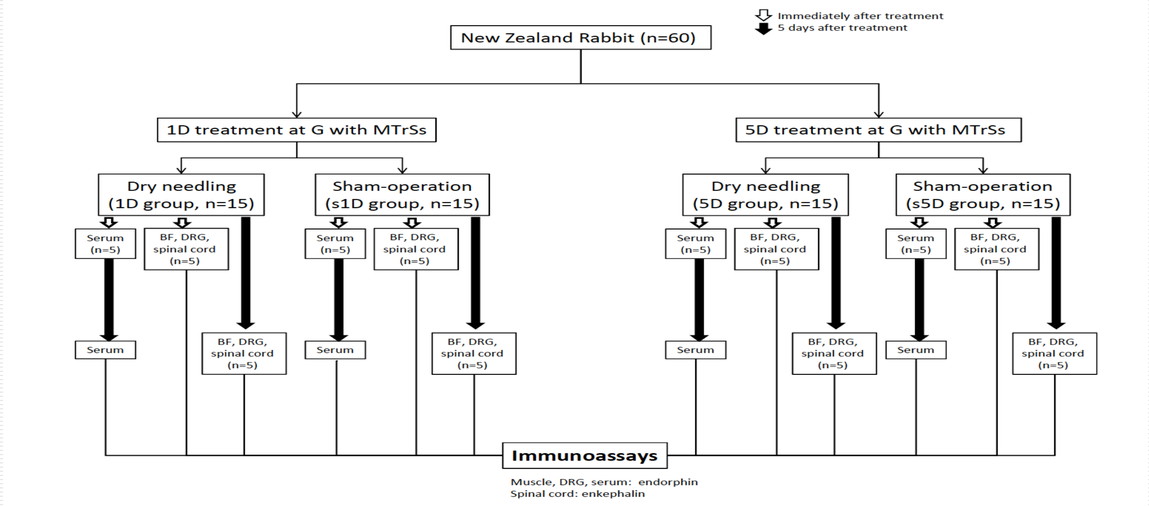
BACKGROUND AND PURPOSE

Dry needling at myofascial trigger points (MTrPs) of remote anatomical region reducing the pain in the region of patient's primary complaint is one of effective pain management strategy in patients with myofascial pain. However, the endogenous opioid-mediated analgesic effect of distal dry needling associated with pain relief is unclear. This study investigated the alterations of enkephalin and β-endorphin in serum, affected spinal dorsal horns, DRGs and biceps femoris after different dosages of dry needling at the myofascial trigger spots (MTrSs, similar to human MTrPs) of gastrocnemius in a well-established rabbit model to explore its underlying analgesic mechanism in relieving myofascial pain.

RESEARCH DESIGN AND METHODS

General design : 60 New Zealand rabbits (2.5 kg to 3.0 kg) were used. Treatments were performed either with one session (one dosage, 1D) or five daily sessions (five dosages, 5D) of dry needling into the MTrSs of gastrocnemius. Biceps femoris, serum, DRGs and spinal cords of L5-S2 were sampled immediately or 5 days after dry needling. The levels of enkephalin and β-endorphin were determined by immunoassays.



Identification of MTrS: Before anesthesia (by gas anesthesia with 4% isoflurane), the most tender spots of a hind leg at biceps femoris and gastrocnemius muscles in each rabbit were identified by finger pinch and the reaction was observed (withdrawal of the lower limb, turning head, screaming, etc). These painful regions contained the MTrSs and were marked on the skin with a marker; it was the area for dry needling.

Biochemical assessments:

(1) Enzyme-linked immunosorbent assay for serum β-endorphin
(2) Western blot analysis for β-endorphin
(3) Immunohistochemistry for enkephalin and quantitative analysis

Statistical analysis: ANOVA was employed to determine the differences in contents of β-endorphin in serum, DRGs and biceps femoris, as well as enkephalin in spinal cords among groups. Post hoc comparisons between groups were examined using Scheffe's method. A p value of < 0.05 was considered statistically significant.

RESULTS

Immediately after dry needling, both 1D and 5D dry needling significantly enhanced the spinal enkephalin expression and serum β-endorphin levels. Only 5D dry needling increased the β-endorphin levels in the biceps femoris and DRGs, but the 1D dry needling did not alter β-endorphin levels. However, 5 days after the dry needling, the prolonged effects on spinal enkephalin expression and serum β-endorphin levels were persisted only in animals with 5D dry needling.

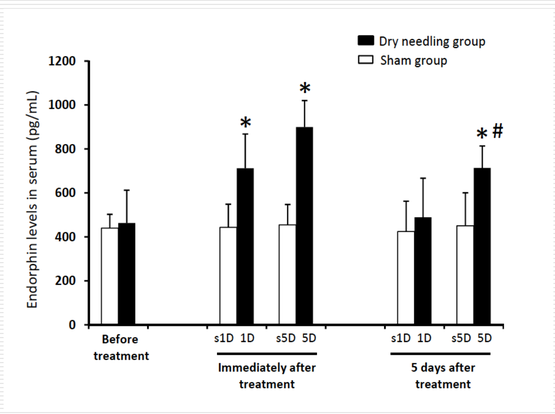


Figure 1. Effects of one- and five-dosage (1D and 5D) of dry needling on β-endorphin expression in serum performed by ELISA.

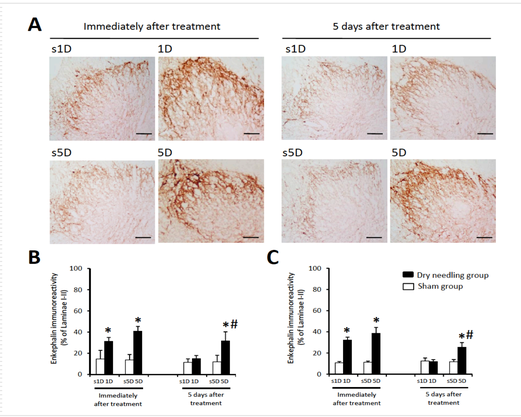


Figure 4. Alterations of enkephalin levels at superficial laminaes of L5-S2 after one- (1D) and five-dosage (5D) of dry needling at gastrocnemius (1D and 5D groups) and sham operation (s1D and s5D groups).

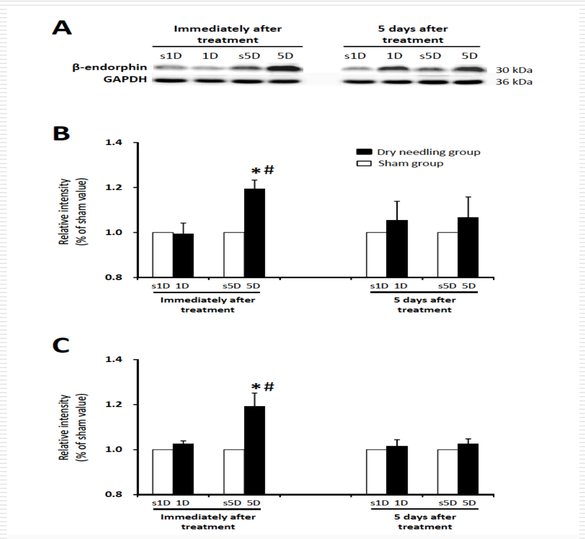


Figure 2. Effects of one- and five-dosage of dry needling (1D and 5D) on β-endorphin expression in bilateral DRGs of L5-S2.

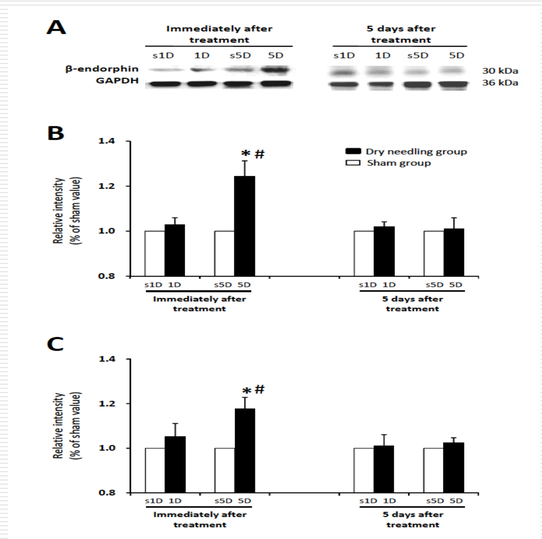


Figure 3. Effects of one- and five-dosage of dry needling (1D and 5D) on β-endorphin expression in bilateral biceps femoris muscles.

DISCUSSION

The remote effect of dry needling by treating the distal sites to produce an extremely potent effect on pain relief associated with reduced irritability of the MTrPs has been demonstrated in both clinical trials and animal models for myofascial pain researches. These findings analogue the traditional acupuncture of treating distal acupoints to influence anatomically remote pain. In the present study, we demonstrated that the mechanism for the potent antinociceptive effect of distal dry needling was mediated through the stimulation of endogenous opioid inhibitory neuropeptides in the spinal cord and peripheral tissues. The finding is consistent with the data from the biochemical assays for exploring the mechanism of acupuncture, which suggests involvement spinal and peripheral opioid system.

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