Appended form 4

# Abstract of Theses

| Report number | ☑ Ph.D. obtained through coursework and thesis No. **410**<br>□ Ph.D. obtained by research and thesis only No. | Name | KARIMA QURNIA MANSJUR |
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| Title of the thesis | The Effectiveness of Human Parathyroid Hormone and Low-Intensity Pulsed Ultrasound on the Fracture Healing in Osteoporotic Bones | | |


Introduction

Osteoporotic fracture has become a major public health problem, and until today, the treatments available are not satisfactory. While there is growing evidence to support the individual treatment of parathyroid hormone (PTH) and low-intensity pulsed ultrasound (LIPUS) exposure as respectively systemic and local therapies during osteoporotic fracture healing, their effects have not yet been investigated when introduced concurrently. This study aimed to evaluate the effects of combined treatment with PTH (1-34) and LIPUS on fracture healing in ovariectomized (OVX) rats.

Materials and methods

Thirty-two, 12-week-old female Sprague-Dawley rats were OVX to induce osteoporosis. After 3 months, bilateral mid-diaphyseal fractures of proximal tibiae were created. All animals were randomly divided into 4 groups of 8 each according to the treatment received (control/sham group as placebo, PTH group, LIPUS group, and combined group). PTH group had PTH administration at a dose of 30 μg/kg/day for 3 days/week for 6 weeks; LIPUS group received ultrasound 5 days/week for 20 min/day for 6 weeks; and the combined group had both PTH administration and LIPUS exposure for 6 weeks. Fracture healing was observed weekly by anteroposterior radiography and micro-CT. Five weeks after the fracture, the tibia were harvested to permit histological assessments and at week 6, for mechanical property of the fracture callus. All of the experiments performed were approved by the Ethics Committee of Tokushima University for Animal Research.

Results

The micro-CT results revealed that the PTH and combined groups exhibited significantly higher BMD and trabecular bone integrity than control group at weeks 4-6. Radiography, fracture healing score and mean callus area suggested that the combined group revealed better healing processes than the individual groups. From mechanical testing, bending moment to failure was significantly higher in LIPUS, PTH and combined groups than in sham group.

Discussion and conclusion

The micro-CT revealed that the PTH and combined groups demonstrated significantly greater BMD and trabecular bone integrity than sham groups at weeks 4-6. Radiography, fracture healing score and mean callus area suggested that the combined group exhibited better healing processes than the individual treatment groups. Mechanically, bending moment to failure was significantly higher in LIPUS, PTH and combined groups than in control group. These results suggest that the combined treatment of PTH and LIPUS have been shown to accelerate bone fracture healing and enhance bone mechanical properties rather than single agent therapy, and may be considered as a treatment remedy for fracture healing in postmenopausal osteoporosis.