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Treatment with Tibolone partially Protects 3-D Microarchitecture of Lumbar Vertebral Bone Tissues and Prevents Ovariectomy-induced Reduction in Mechanical Properties

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Tibolone (Org OD14) is a tissue selective steroid with estrogenic effects on the brain, bone and vagina, without stimulating the breast and endometrium. A previous study has shown that long-term treatment with tibolone prevents ovariectomy (OVX) induced bone loss in rats. The aim of this study was to investigate the effects of tibolone on three-dimensional (3-D) microarchitecture and mechanical properties of rat lumbar vertebra. We hypothesized that tibolone might have significant effects on 3-D microarchitecture of vertebra, thus to preserve OVX-induced reduction in mechanical properties.

One hundred and sixty-six female 10-month-old rats were randomly allocated into one of the 13 groups. These groups included a baseline control group at experiment start-up and three groups (SHAM, OVX and OVX+tibolone) at each termination point – 4, 14, 34, or 54 weeks. The treated groups received tibolone 2 mg/kg/day, orally. After sacrifice, rat third lumbar vertebrae were removed and micro-CT scanned. Microarchitectural properties of the cancellous and cortical bones were quantified and the mechanical properties of the lumbar cancellous and cortical bones were determined separately.

Our data demonstrated that OVX lead to pronounced reduction in mechanical properties and bone mass. Treatment with tibolone increased mechanical properties and improved 3-D microarchitecture of both cancellous and cortical bone as compared to placebo treatment. Long-term treatment with tibolone for 54 weeks prevented OVX-induced reduction in the mechanical properties of both cancellous and cortical bone. Tibolone was shown to have relatively stronger microarchitectural compensation effect on trabecular bone than on cortical bone. Tibolone treatment did not prevent OVX-induced microarchitectural deterioration over the entire experimental period; there was only a statistically significant difference in microarchitectural parameters between OVX and tibolone groups after 34 weeks of tibolone treatment. This partially improved microarchitecture resulted in full recovery of mechanical properties to normal level, suggesting increased bone quality after long-term tibolone treatment. We concluded that long-term tibolone treatment completely preserved bone’s mechanical properties and partially protects OVX-induced microarchitectural deterioration.