Na 18F accumulates on the compressive side of peri-implant bone under immediate loading

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ABSTRACT
This study aimed to examine the dynamic change in bone metabolism by immediate loading in several sites around implants using high-resolution Na18F-PET scan. Two titanium implants (1.2 mm) were inserted parallel to each other in the right tibiae of Wistar rats (n = 4). The left tibia was set as control side. One day after insertion, closed coil springs of 4.0 N were attached to the expose superior portions of the implants to apply a continuous mechanical stress. The rats with fluorine-18 (18F) ion (5 mCi/rat) intravenously injected were scanned by PET scanner at 4, 7, 14, 28 days after load application. Round region of interests (ROIs) were set around the distal implant of the right tibia (loaded side) and same site (control) of the left tibia. Furthermore, four rectangular ROIs were set at the superior and inferior parts of traction side (mesial) and opposite side (distal) of the distal implant. Longitudinal dynamic changes in bone metabolism were evaluated by examination of the accumulation count of 18F ion at each ROI. The uptake values of ROIs (loaded side) initially increased until 7 days, and they gradually decreased from the peak level to the pre-loading level despite a static force being applied to the implants. In cancellous bone, the uptake values at the superior part of traction side and inferior part of opposite side showed significantly high value compared with those at other parts. In conclusion, immediate loading to the implant initially enhanced bone metabolism around it, especially at the part with compressive stress. Peri-implant bone metabolism varies according to different loading conditions.