Pattern analysis of osteoclastic bone resorption dynamics in vivo

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Osteoclasts are bone-resorbing giant polykaryons that differentiate from mononuclear macrophage/monocyte-lineage hematopoietic precursors. We have originally established an advanced imaging system for visualizing in vivo behavior of osteoclasts with an intravital two-photon excitation microscope. We also developed pH-activatable fluorescent probes to detect low pH areas on the bone surface and succeeded in visualizing areas where osteoclasts actually resorb bones in vivo. However, the spatiotemporal dynamics of acidification by osteoclasts remains unclear. In this study, we developed a novel image analysis system to evaluate the relationship between acidic regions and osteoclast dynamics. By means of this system, we found that the acidification by osteoclasts on the bone surface shows a characteristic pattern that is dependent on motility of osteoclasts. This approach would be beneficial for understanding the mechanism of osteoclastic bone resorption in vivo and would thus be useful for evaluating the efficacy of novel anti-bone-resorptive drugs.