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Turning on adult stem cells may help repair bone

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The use of a drug to activate stem cells that differentiate into bone appears to cause regeneration of bone tissue and be may be a potential treatment strategy for osteoporosis, according to a report in the February 2008 *Journal of Clinical Investigation*.

The study – led by researchers from Massachusetts General Hospital (MGH) and the Harvard Stem Cell Institute (HSCI) – found that treatment with a medication used to treat bone marrow cancer improved bone density in a mouse model of osteoporosis, apparently through its effect on the mesenchymal stem cells (MSCs) that differentiate into several types of tissues.

“Stem cell therapies are often thought of as putting new cells into the body, but this study suggests that medications can turn on existing stem cells that reside in the body’s tissues, acting as regenerative medicines to enhance the body’s own repair mechanisms,” says David Scadden, MD, director of the MGH Center for Regenerative Medicine and HSCI co-director. “Drugs that direct immature cells to become a particular cell type, like in this study, could potentially be very useful.”

The study was designed to examine whether the drug bortezamib (Bzb), which can alleviate bone destruction associated with the cancer multiple myeloma, could also regenerate bone damaged by non-cancerous conditions. In their first experiments, the researchers showed that treating mice with Bzb increased several factors associated with bone formation. Similar results were seen when cultured MSCs were treated

with Bzb, but not when the drug was applied to cells that were committed to become particular cell types. Found in the bone marrow, MSCs have the potential to develop into the bone-building osteoblasts and several other types of cells – including cartilage, fat, skin and muscle.

Subsequent experiments supported the hypothesis that Bzb increases osteoblast activity and bone formation by acting on MSCs but not on more differentiated osteoblast precursors. Use of Bzb to treat a mouse model of menopausal osteoporosis produced significant improvements in bone formation and density. Since current treatments for osteoporosis – which target differentiated cells like osteoblasts and the osteoclasts that break down bone – have limitations, the ability to direct differentiation of MSCs could be a promising approach to treating osteoporosis and cancer-associated bone loss, the researchers note.

“If the paradigm displayed in this study holds true for other tissues, we may have options for repairing and regenerating sites affected by injury or disease with medications – that would be pretty exciting.” says Scadden, who is the Gerald and Darlene Jordan Professor of Medicine at Harvard Medical School.

Source: Massachusetts General Hospital