

# The Connection between Diabetes and Bone Health

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## **Through new technology, a recent study identified increased risk of bone fracture as a complication of Type 2 diabetes.**

In people with Type 1 diabetes, low bone density can be a symptom of the disease. However, those with Type 2 diabetes are also at an increased risk for bone problems, despite their relatively normal bone density.

“People with Type 2 diabetes have more fractures than those without diabetes, even when their bone density levels are average or above average,” says Mishaela R. Rubin, MD, MS, Assistant Professor of Clinical Medicine at Columbia University. “There’s a split between the bone mineral density measured with dual X-ray absorptiometry, or DXA, and the increased number of fractures that are reported. This suggests there is a compromise in bone quality.”

“People with diabetes have a higher risk of fracture than those without diabetes. In diabetics, sugar molecules are added to tissues in the body, including bone collagen. Those molecules can affect the strength of the bone collagen and how well bone cells are able to function. The process of replacing bone may also not work as well in a diabetic environment.”—  
*Mishaela R. Rubin, MD, MS, Assistant Professor of Clinical Medicine, Columbia University*

## **Bones and Metabolism**

Research showing an increased bone fracture risk in those with diabetes is the latest in a body of research that seeks to understand how skeletal systems interact with metabolism.

In research published in 2010, lead author Thomas L. Clemens, PhD, Lewis Cass Spencer Professor of Orthopaedic Surgery and Director of Research at the Department of Orthopaedic Surgery at Johns Hopkins University School of Medicine, found the connection between bone formation and insulin production. Subjects with osteoblasts, or bone-building cells, which could not respond to insulin had lower levels of osteocalcin and osteoblasts overall — and diminished bone development as a result. Over time, this led to symptoms of diabetes, including insulin resistance and a higher weight despite no changes in diet. This was explained by the lack of osteocalcin, a hormone released during the bone formation process. Osteocalcin also signals the pancreas to release more insulin.

“Bones make hormones that control the process of insulin release,” says Clemens. “The bone is a metabolic organ — it needs to communicate with other metabolic organs in order for the organism to best utilize nutrients.”

Perhaps most interestingly, injections with osteocalcin caused improvement in diabetes symptoms. More research is needed to determine the exact link between metabolism and bone growth in humans, as well as the implications for developing treatments for bone disease and diabetes.

New research published in the *Journal of Bone and Mineral Research* supports Dr. Rubin's statement, finding that the compromised bone strength of diabetic patients can be measured and demonstrated clinically.

## **Average Bone Density, Low Bone Strength**

The study, sponsored by the Mayo Clinic and led by senior author Sundeep Khosla, MD, endocrinologist at the Mayo Clinic, examined 60 postmenopausal women, with 30 age-matched, nondiabetic controls and 30 women who have had Type 2 diabetes for the past 10 years. Regional bone mineral density (BMD) was measured with DXA.

Rather than using just DXA scans to measure bone density, several new techniques were implemented to ensure a complete picture of the bone. Using OsteoProbe, bone material strength (BMS) was measured in the subjects' tibias — the deeper the probe was able to go into the bone, the lower the BMS. Cortical and trabecular bone microarchitecture were assessed with high-resolution peripheral quantitative computed tomography (HRpQCT).

“The HRpQCT imaging gives incredible detail of the bone that was previously only possible with a biopsy,” Dr. Rubin says. “This technology offers a noninvasive way of getting information that is not possible through conventional DXA imaging.”

After adjusting for controls, patients with Type 2 diabetes had an up to 10.5 percent decrease in BMS — a significant difference. Additionally, the average glycated hemoglobin level over the previous 10 years was negatively correlated with BMS. However, the bone microarchitecture and BMD in those with Type 2 diabetes were not significantly different from the controls.

### **The bottom line?**

“Decreased bone strength needs to be added to the list of diabetic complications,” Dr. Rubin says. “Increased bone fragility and compromise of bone quality are real risks for those with Type 2 diabetes.”

### **For the Physician**

“Preventive measures which detect bone loss are extremely important,” Dr. Rubin says. “We know that worse scores on DXA testing can still predict bone fractures in diabetics, even though it underestimates the fracture rate.”

By combining patient education with treatments such as vitamin D and calcium supplements, preventing fractures in those with diabetes is possible. As research in this area expands, more preventive treatments for bone health in diabetics may be developed.