

This Week's Citation Classic

Jowsey J, Kelly P J, Riggs B L, Bianco A J, Jr., Scholz D A & Gershon-Cohen J.

Quantitative microradiographic studies of normal and osteoporotic bone.

J. Bone Joint Surg.-Amer. Vol. 47-A:785-806, 1965.

[Mayo Clin. and Mayo Found., Rochester, MN & Albert Einstein Med. Ctr., Philadelphia, PA]

Quantitative microadiography permits comparison of stained sections of bone with a microradiograph depicting mineral distribution. Bone formation, resorption, abnormalities of mineralization, and differences in remodeling can be quantitated in metabolic bone diseases, and the early effects of therapy in bone disease can be evaluated. [The SC® indicates that this paper has been cited over 220 times since 1965.]

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"Twenty-five years ago there was much interest in radioactive isotopes that were produced by atomic fission. Many of the long-lived radioisotopes are concentrated in the skeleton, and some of the most hazardous, such as strontium and yttrium, are associated with the mineral phase of bone. It therefore became necessary to use a method of looking at bone that did not involve demineralization; microradiography was used. At that time I was working with a MRC (Medial Research Council) team in Oxford under the guidance of Dame Janet Vaughan. I later developed the method of quantitative microradiography. Bone formation and resorption can be recognized on the microradiograph, and if the corresponding stained section has good cellular detail, there is a correlation between the presence of bone cells and the appearance of the surface of mineralized bone on the microradiograph. The percentage of bone surface that is undergoing formation or resorption yields numerical values that are representative of bone remodeling.

"The first use of the method was to characterize the different metabolic bone diseases in terms of bone remodeling. Almost without exception, metabolic bone disease shows loss of bone. However, in hypercortisolism, for example, bone resorption is increased and bone formation

is decreased, while in osteoporosis bone resorption is increased but bone formation is normal. Almost no metabolic bone disease shows exactly the same bone remodeling features. This information has been useful in understanding some of the hormonal relationships in bone disease. It thus became possible for the first time to investigate the mechanism of bone loss and to evaluate deficiencies in mineralization. This, in essence, is what the paper describes.

"After developing the method, I became particularly interested in osteoporosis. I came to the Mayo Clinic fifteen years ago largely in order to collaborate with physicians in studies of this disorder. It is probably true to say that the major use of the method has been to quantitate the effects of the treatment of bone disease. By taking bone biopsies of patients before and after treatment with various substances that have promise in this disease, we can predict whether bone mass will increase or decrease more rapidly or less rapidly than in untreated patients. These changes can be seen many years before any change is evident by the more conventional techniques of x-ray or before there is symptomatic relief of pain. It is with the use of the technique of quantitative microradiography that the successful treatment of osteoporosis with fluoride and calcium was first documented, later to be confirmed by x-ray changes of increased density.

"I am now leaving the Mayo Clinic and, with my husband, an ophthalmologist, and two children, moving west to Healdsburg, CA. Having recently collected the long-term fluoride and calcium data for publication in the near future¹ a study that reconfirms our earlier work published in the same journal in 1972,² and having written two books, *Metabolic Diseases of Bone*³ and *The Bone Biopsy** which sum up my experience in these two fields, the time to leave is perhaps ripe. My time there has been very fruitful, and for patients with the miseries of bone-losing diseases, a successful form of treatment has been established.

1. Jowsey J, Arnaud C D & Johnson K A. Effect of combined treatment with fluoride, calcium, vitamin D and estrogen on osteoporosis. Unpublished paper.
2. Jowsey J, Riggs B L, Kelly P J & Hoffman D L. Effect of combined therapy with sodium fluoride, vitamin D and calcium in osteoporosis. *Amer. J. Med.* 53: 43-9, 1972.
3. Jowsey J. *Metabolic diseases of bone.* (Sledge C B. consulting editor.) W. B. Saunders, Philadelphia, PA: 1977. 312 p.
4. Jowsey J. *The bone biopsy.* (Aviolo L B, series editor). New York, NY: Plenum Medical Book Co. 1977, 158 p.