

study that the life expectancy of the population remaining after removal of radium-induced malignancies was unaffected by radium burden.

### **Bone Changes**

Since the radium isotopes are deposited in bone mineral, seeing the effects of these radioactive isotopes in bone is not surprising. The bone sarcomas are the most obvious effect, but subtler effects are also well known. Martland (1929) pointed out some of the major effects on bone of internally deposited radium. Discussing five female dial painters still living at the time, he stated the following:

One girl has had a spontaneous fracture through the upper third of the femur producing extensive crippling.

The disease is now present in a milder form, undoubtedly as the result of the natural uninfluenceable decay of the mesothorium, which formed the largest percentage of the original deposits. There is a constant diminution in the amount of irritative radiation. The main symptoms now are crippling bone lesions, the result of radiation osteitis.

Today one might argue that the milder appearance of the disease was observed because the then living cases had lower total radium intakes than Martland's earlier cases, not because of the decay of mesothorium in the body. Nevertheless, bone changes were evidently taking place in these early, high-level radium cases.

Subsequently, Aub et al. (1952), in their review of 30 patients who had carried radium as long as 25 years, stated the following:

The fundamental lesion observed as a late effect of internally deposited radium (and presumably, to a lesser extent, mesothorium) occurs in the skeletal system. The bony changes, which can be visualized in roentgenograms before symptoms develop, correspond to the "radiation osteitis" described by Martland in his early reports of radium poisoning. The first abnormality of bone noted in roentgenograms is a coarsening of the trabeculae.

In later stages of the disease, this type of bone destruction can also be seen in the cortical portions of the bones.