

Bone Density Testing to Monitor Osteoporosis Therapy in Clinical Practice

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Dual-energy x-ray absorptiometry (DXA) is used to diagnose osteoporosis, assess fracture risk, provide input for the World Health Organization fracture risk assessment tool (<http://www.sheffield.ac.uk/FRAX/>), and monitor treatment effect. In addition, many clinical practice guidelines, including those of the National Osteoporosis Foundation,¹ the International Society for Clinical Densitometry,² the Institute for Clinical Systems Improvement,³ the American Association of Clinical Endocrinologists,⁴ and the North American Menopause Society⁵, recommend the use of DXA to monitor osteoporosis therapy. The suggested interval between baseline and follow-up BMD testing after starting therapy is typically one to two years, with subsequent intervals determined according to clinical circumstances. Such monitoring is a covered benefit of Medicare and most, if not all, health care organizations and insurance companies. DXA is the only technology recognized by Medicare for monitoring patients treated for osteoporosis.

The rationale for monitoring osteoporosis therapy is clear. Many factors that are not clinically apparent could lead to a suboptimal response to therapy. Long-term compliance and persistence with therapy is poor; only about 50 percent of patients who begin an osteoporosis drug continue therapy for at least one year.⁶ Some treated patients do not maintain a sufficient intake of calcium or vitamin D to achieve the full benefit of therapy. Malabsorption caused by a variety of gastrointestinal disorders, including asymptomatic celiac disease, may impair treatment effect. Other conditions with adverse skeletal effects, such as multiple myeloma or increased thyroid hormone levels, may be present but undetected before therapy, or may develop during therapy.

Monitoring of patients treated for osteoporosis should include regular contact with a health care professional to ensure that: (1) medication is taken regularly and correctly, (2) calcium and vitamin D intake are sufficient, (3) the patient has no adverse effects or fear of adverse effects that must be addressed, and (4) there are no comorbidities or other medications that might alter the expected treatment effect. BMD is a surrogate marker for bone strength and fracture risk; stability or



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a significant increase in BMD is an acceptable response to therapy and is associated with a reduction in fracture risk.⁷ A significant decrease in BMD suggests a suboptimal response to therapy and may require evaluation for factors contributing to bone loss and possibly changing treatment. In clinical practice, about 10 percent of patients started on an oral bisphosphonate have a statistically significant decrease in BMD on follow-up DXA,⁷ with many of those patients having a previously unrecognized medical condition that required a change in therapy.

A valid quantitative comparison of BMD measurements requires that measurements be made on the same DXA machine (or different machines that have been cross-calibrated) according to well-established quality standards that include precision assessment and calculation of the least significant change, the smallest change in BMD that is statistically significant.² If the least significant change has not been calculated, it is not possible to distinguish an apparent BMD change that is within the range of measurement error from one that is likely to be a genuine biologic change. If it is unclear whether the least significant change has been calculated at a DXA facility, the referring physician should ask.

The value of BMD testing to monitor the treatment of osteoporosis has been questioned by some. In a post-hoc analysis of two randomized, placebo-controlled clinical trials, the concept of regression to the mean was invoked to suggest that treatment should not be changed when there is bone loss after one year of therapy.⁸ In another post-hoc analysis of a single randomized controlled trial, it was concluded that BMD monitoring is unnecessary in the first three years after starting a potent bisphosphonate.⁹ However, the conclusions of both analyses have been challenged.^{10,11} Although regression to the mean is a valid statistical concept that is helpful in understanding apparent BMD changes in groups of patients in clinical trials, it does not indicate that serial BMD testing in clinical practice

is useless. Many of those reported to have BMD loss in clinical trials would have been classified as having no significant change or stability of BMD (an acceptable response to therapy) if they had been tested as individual clinical practice patients at a qualified DXA facility with a known least significant change.

I believe the bottom line in caring for patients with osteoporosis is that monitoring for treatment effect is appropriate and desirable. A statistically significant BMD loss may lead to further evaluation and possibly a change in treatment. The strategy of monitoring therapy with BMD testing is supported by the medical evidence, consistent with clinical practice guidelines, and makes good clinical sense.

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Author disclosure: Nothing to disclose.

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