

Abstract Submission Form

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Osteoporosis – Controversies and Promising Treatment Options

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Teaching Objectives:

- Understand controversies in the prevention and treatment of osteoporosis.
- Understand bone density versus bone quality.
- Understand how biomarkers of bone metabolism are useful in clinical practice.
- Understand the use of an oral nutritional supplement that has been shown to significantly increase bone mineral density.
- Understand how pulsed electromagnetic field (PEMF) therapy may prove to be an effective treatment for osteoporosis.

Osteoporosis is controversial in that guidelines for prevention and treatment vary between institutions and different countries. Controversy also exists because different women with the same bone mineral density (BMD) value can have completely different fracture risks based purely on age. This is because bone densitometry reflects bone quantity and not necessarily bone quality. Further complicating this issue is that bisphosphonates commonly used to treat osteoporosis have cumbersome dosing requirements and have been associated with esophagitis, esophageal stricture, esophageal cancer, osteonecrosis of the jaw, and atypical femur fractures.

While bone densitometry is used to measure bone density, help assess fracture risk, and to diagnose primary osteoporosis, it does not measure bone quality. Bone quality determines bone strength and factors in cortical bone structural integrity and the rate of bone turnover or remodeling. It is thought that over time, bisphosphonates can suppress bone's natural remodeling process resulting in atypical femur fractures. One study showed that women with this type of femur fracture had reduced bone tissue heterogeneity, which is associated with reduced bone quality.¹

Bone's osteoid matrix consists of 90% collagen, the vast majority of which is type I collagen. Circulating peptides of type I collagen are derived from osteoclastic degradation and osteoblastic synthesis. Most biomarkers for bone resorption

measure the collagen degradation peptides such as urine deoxypyridinoline (Dpd) cross-links.²

Type I collagen are cross-linked by molecules such as Dpd, which provides rigidity and strength (bone quality) to bone. Dpd is unaffected by diet, easy to measure in a spot urine sample, and is unusually abundant in bone collagen making it a relatively selective bone marker. Dpd should be measured in the morning when levels of bone turnover are highest, and can be used to measure the efficacy of therapeutic interventions and document compliance.³ Medicare approves biochemical markers of bone turnover, and high levels correlate with fracture risk when used alone or when combined with bone densitometry measurements.⁴

For patients who are either intolerant of or refuse prescription drugs for treatment of osteoporosis, the next best option is using a combination of resistance training, an alkalinizing diet, and specific nutritional supplements that are known to support optimal bone health. There are studies showing the clinical efficacy of nutritional supplements for osteoporosis including calcium, vitamin D, strontium ranelate, and choline stabilized orthosilicic acid (ch-OSA).⁵

One study showed that when ch-OSA was added to calcium and vitamin D, bone mineral density of the femoral neck increased 2%.⁶ Side benefits of cho-OSA include reduced photo-aging of skin and reduced brittleness of hair and nails.^{7,8}

Pulsed electromagnetic fields (PEMF) have shown to be effective in the treatment and prevention of osteoporosis in clinical studies, and will one day prove to be an effective adjunct to therapies for osteoporosis.^{9,10} Studies reveal that PEMFs appear to mediate this process via cell signaling proteins including growth factors, cytokines, and prostaglandins. PEMFs are also shown to alter levels of Dpd, which theoretically could be used to monitor response to therapy.^{11,12,13,14,15,16}

¹ Gladnick, P, et. al. The effects of long-term bisphosphonate use on bone quality. 2010 Mar 11. American Academy of Orthopaedic Surgeons. 2010 Annual Meeting Podium Presentations.

² Calvo M, Eyre D, Gundberg C. Molecular basis and clinical application of biological markers of bone turnover. *Endoc Rev.* 1996 Aug; 17(4): 333-68. PMID: 8854049

³ Singer F, Eyre D. Using biochemical markers of bone turnover in clinical practice. *Cleve Clin J Med.* 2008 Oct; 75(10): 751-2. PMID: 18939390

⁴ Licata A. Biochemical markers of bone turnover: useful but underused. *Clev Clin J Med.* 2008 Oct. 75;(10): 739-50. PMID: 18939391

⁵ Reginster JY, Bruyère O, [Sawicki A](#), [Roces-Varela A](#), [Fardellone P](#), [Roberts A](#), [Devogelaer JP](#). Long-term treatment of postmenopausal osteoporosis with strontium ranelate: results at 8 years. *Bone* 2009 Dec; 45(6): 1059-64. Epub 2009 Aug 11. PMID: 19679207

⁶ Spector TD, Calomme MR, Anderson SH, Clement G, Bevan L, Demeester N, Swaminathan R, Jugdaohsingh R, Berghe DA, Powell JJ. Choline-stabilized orthosilicic acid supplementation as an adjunct to calcium/vitamin D3 stimulates markers of bone formation in osteopenic females: a randomized placebo-controlled trial. *BMC Musculoskelet Disord.* 2008 Jun 11; 9-85. PMID: 18547426

⁷ Wickett RR, Kossmann E, Barel A, Demeester N, Clarys P, Vanden Berghe D, Calomme M. Effect of oral intake of choline-stabilized orthosilicic acid on hair tensile strength and morphology in women with fine hair. *Arch Dermatol Res.* 2007 Dec; 299(10): 499-505 Epub 2007 Oct 25. PMID: 17960402

⁸ Barel A, Calomme M, Timchenko A, De Paepe K, Demeester N, Rogiers V, Clarys P, Vanden Berghe D. Effect of oral intake of choline-stabilized orthosilicic acid on skin, nails, and hair in women with photodamaged skin. *Arch Dermatol Res.* 2005 Oct; 297(4): 147-153 Epub 2005 Oct 26. PMID: 16205932

⁹ Rubin CT, McLeod KJ, Lanyon LE. Prevention of osteoporosis by pulsed electromagnetic fields. *J Bone Joint Surg Am.* 1989 Mar; 71(3): 411-7. PMID: 2925715

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- ¹⁰, Tabrah F, Hoffmeier M, Gilbert F Jr, Batkin S, Bassett CA. Bone density changes in osteoporosis-prone women exposed to pulsed electromagnetic fields (PEMFs). *J Bone Miner Res.* 1990 May; 5(5): 437-42. PMID: 2195843
- ¹¹, *Bioelectromagnetics* 2010 Feb; 31(2): 113-19. Pulsed electromagnetic fields stimulation affects BMD and local factor production of rats with disuse osteoporosis. Shen WW, Zhao JH. Department of Orthopaedics, Third Affiliated Daping Hospital, Research Institute of Surgery, Third Military Medical University, Chongqing, PR China. PMID: 19670410
- ¹², *Bone* 2010 Feb; 46(2): 487-95. Epub 2009 Sep 25. Circadian rhythm affects the preventive role of pulsed electromagnetic fields on ovariectomy-induced osteoporosis in rats. Jing D, Shen G, Huang J, Cai J, Xu Q, Wu X, Luo E. Faculty of biomedical Engineering, Fourth Military Medical University, 17 West Changle Road, Xi'an 710032, China. PMID: 19782781
- ¹³, *Osteoporos Int.* 2010 Oct 26. The preventive effects of pulsed electromagnetic fields on diabetic bone loss in streptozocin-treated rats. Jing D, Cai J, Shen G, Huang J, Li F, Li J, Lu L, Luo E, Xu Q. Faculty of biomedical Engineering, Fourth Military Medical University, 17 West Changle Road, Xi'an, 710032, China. PMID: 20976595
- ¹⁴, *Electromagn Biol Med.* 2007; 26(3): 153-65. Cytokine release from osteoblasts in response to different intensities of pulsed electromagnetic field stimulation. Li K, Lin JC, Liu HC, Chang WH. Bone Engineering Research Lab, Center for Nano Bioengineering, Chung Yuan Christian University, Chung Li, Taiwan, Republic of China. PMID: 17886003
- ¹⁵, *J Orthop Res.* 2007 Jul; 25(7): 933-40. Pulsed electromagnetic fields rapidly modulate intracellular signaling events in osteoblastic cells: comparison to parathyroid hormone and insulin. Schnoke M, Midura RJ. Department of Biomedical Engineering and The Orthopedic Research Center, Lerner Research Institute, ND20, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, Ohio 44195, USA. PMID: 17427956
- ¹⁶ *Bioelectromagnetics* 2003 Apr; 24(3): 189-98. Pulsed electromagnetic fields prevent osteoporosis in an ovariectomized female rat model: a prostaglandin E2-associated process. Chang K, Chang WH. Department of Biomedical Engineering, Chung-Yuan Christian University, Chung-Li, Taiwan, Republic of China. PMID: 1266930