

# Bone Mineral Density Loss after SCI: Intervention

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## FACT SHEET



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## *Medical Interventions for Bone Loss After SCI*

The use of medical interventions varies across centers and physicians. One line of attack may involve over the counter supplements. Vitamin D levels tend to run low (<32ng/mL) in people with SCI, with studies reporting these low levels in 81-96% of people with chronic SCI.<sup>1</sup> As vitamin D is essential to bone health, blood work to assess vitamin D levels is recommended but not routinely performed. It is recommended that people with SCI coordinate with their physician to determine the need for supplements such as vitamin D and/or calcium. There are potential risks for people with SCI, especially with calcium supplementation due to the risk of hypercalciuria (elevated calcium in the urine) and/or hypercalcemia (elevated calcium in the blood).<sup>1</sup>

People with SCI may receive prescription medication to address bone resorption and/or formation, but these are prescribed much less commonly than in post-menopausal osteoporosis. Bisphosphonates are the most common medications and work by decreasing bone resorption. Denosumab is another anti-resorptive agent but has a different mechanism of action than do bisphosphonates.<sup>1,2</sup> There is one drug, teraparotide, that targets bone formation but is much less prescribed in people with SCI and research is lacking. All of these medications have side effects that may not be tolerated by people with SCI. More studies are needed on their effectiveness. Finally, statins can also have a positive impact on bone.<sup>3</sup>

## *Physical Therapy Interventions for Bone Loss After SCI*

In order to build bone, there has to be a load placed on that bone. But standing passively in a standing frame is not enough. An active component is needed. Recently electrical stimulation delivered while standing has been shown to have a positive impact on bone.<sup>4</sup> The literature is mixed in regards to the benefits of functional electric stimulation (FES) cycling on bone. However recent studies that provide greater resistance cycled against and/or cycling more days per week are showing greater effects and are showing improvements around the knee.<sup>5,6</sup> Earlier studies focused on hip and spine bone density and did not attempt to modify the standard FES cycling protocol of the early FES cycles. Current FES cycles provide more options to allow the greater forces to potentially be generated.

The effects of locomotor training on bone have only recently begun to be studied. Evidence is suggesting that locomotor training alone does not slow bone loss after an acute motor incomplete SCI. It has been suggested that adding FES to obtain cyclical muscular contractions may lead to a positive effect, and research in this area is in process.<sup>2</sup>

## *Safety of Other Physical Therapy Interventions*

Physical therapy after a SCI often involves intense loading activities such as locomotor training, walking with an exoskeleton or other robotic device, or cycling with FES. These interventions may place extra stress on the bone, and questions arise around fracture risk with such activities that load the bones of the lower extremities.

The research literature does not provide definitive guidelines for the determination of optimal or safe levels of bone loading for people with SCI with bone density loss. Individual centers may use their own guidelines to determine bone safety for these interventions. Some devices, especially exoskeletons, have their own exclusion criteria based on bone status, as recommended by the manufacturer. In clinical practice, people with SCI who have osteoporosis and/or recurrent lower extremity fractures may be excluded from participating in some interventions. These decisions should be made based on the clinical team's assessment of the person's entire medical picture (including any concomitant medical conditions in addition to the SCI) as well as the potential benefits and risks of the intervention. As with all medical decisions, the person with SCI should be a part of this decision-making process.

### **References:**

1. Bauman WA, Cardozo CP. Osteoporosis in individuals with spinal cord injury. *PM R*. 2015;7:188-201.
2. Ciriigliaro CM, Myslinski MJ, La Fountaine MF, et al. Bone loss at the distal femur and proximal tibia in persons with spinal cord injury: imaging approaches, risk of fracture, and potential treatment options. *Osteoporos Int*. 2017;28:747-765.
3. Morse LR, Nguyen N, Battaglino RA, et al. Wheelchair use and lipophilic statin medications may influence bone loss in chronic spinal cord injury: findings from the FRASCI-bone loss study. *Osteoporos Int*. 2016;27:3503-3511.
4. Dudley-Javoroski S, Shields RK. Active-resisted stance modulates regional bone mineral density in humans with spinal cord injury. *J Spinal Cord Med*. 2013;36:191-199.
5. Johnston TE, Marino RJ, Oleson CV et al. Musculoskeletal Effects of 2 Functional Electrical Stimulation Cycling Paradigms Conducted at Different Cadences for People With Spinal Cord Injury: A Pilot Study. *Arch Phys Med Rehabil*. 2016;97:1413-1422.
6. Frotzler A, Coupaud S, Perret C et al. High-volume FES-cycling partially reverses bone loss in people with chronic spinal cord injury. *Bone*. 2008;43:169-176.