

# Bone Mineral Density Loss after SCI:

## Overview

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### FACT SHEET



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### *How much bone loss occurs after SCI?*

Bone declines rapidly after a SCI with the most bone lost in the first 6 months. After 2 years, the rate of decline decreases, but bone loss is still occurring. Of particular concern, about 40% of bone is lost in the first 2 years.<sup>1</sup> For comparison, women in early menopause lose about 1.4 - 2% of bone per year<sup>2</sup> with averages of 3 - 5% seen per year for post-menopausal women as a whole.<sup>3</sup> Less is known about the rates of loss with chronic SCI, especially when looking at bones that are common fracture sites. People post-SCI who regain the ability to walk lose less bone than people who use wheelchairs.<sup>4</sup>

After a SCI, the balance between bone resorption and bone formation is impacted with increased osteoclastic activity (resorption) and decreased osteoblastic activity (formation) seen. The imbalance is often called uncoupling of these two processes. Immobility and lack of weight bearing are only partially the causes. Neural and vascular effects as well as endocrine effects such as changes in testosterone or growth hormones also impact bone.<sup>5</sup>

The types of bone are impacted differently following a SCI. Bone loss is characterized by loss of trabecular or spongy bone and by cortical bone thinning. Recent studies have shown that the loss of trabecular bone is even greater than loss of cortical bone after SCI. Thus, the inner structure of bone weakens substantially and may be more related to fracture risk. For more information on trabecular bone, please go to

<https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0022808/>

### *What are the risks to people with SCI?*

People following SCI have an increased fracture risk with incidence of about 1% the first year after SCI, increasing to 4.6% per year when 20-29 years post-SCI.<sup>3</sup> Most fractures post-SCI occur in the distal femur and proximal tibia.<sup>3</sup> These fractures may occur after a traumatic event such as a fall or during basic daily activities such as twisting the leg when transferring or donning shoes. As people with paraplegia are more independent and active, they tend to have more fractures than people with tetraplegia. Fractures can lead to loss of independence, surgery, hospitalization, and psychosocial concerns. Significant skin issues can occur with casting, so a SCI specialist should be consulted about any immobilization needs. Temporary wheelchair and home adaptations are often needed.

### Risk Factors for Fractures after SCI<sup>3</sup>

<b>Non-Modifiable</b>	Increased time since injury
	More complete injury
	Female
	Pediatric SCI
	Previous fragility fractures <sup>†</sup>
	Paraplegia
<b>Modifiable</b>	Low Body Mass Index (BMI)
	>5 alcoholic beverages/day

<sup>†</sup>Fragility Fracture: any fracture that occurs after a fall from standing height or less

### Signs of Fracture after SCI<sup>6</sup>

Pain <i>*pain does <b>not</b> always occur due to sensory loss</i>
Limb deformity
Swelling
Hematoma
Increased difficulty with functional mobility
Increase in muscle spasms
Sweating
Autonomic Dysreflexia <sup>7</sup>

#### References:

1. Troy KL, Morse LR. Measurement of Bone: Diagnosis of SCI-Induced Osteoporosis and Fracture Risk Prediction. *Top Spinal Cord Inj Rehabil.* 2015;21:267-274.
2. Finkelstein JS, Brockwell SE, Mehta V et al. Bone mineral density changes during the menopause transition in a multiethnic cohort of women. *J Clin Endocrinol Metab.* 2008;93:861-868.
3. 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.
4. 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.
5. Bauman WA, Cardozo CP. Osteoporosis in individuals with spinal cord injury. *PM R.* 2015;7:188-201.
6. Schulte LM, Scully RD, Kappa JE. Management of lower extremity long-bone fractures in spinal cord injury patients. *J Am Acad Orthop Surg.* 2017;25:e204-e213.
7. Karlsson AK. Autonomic dysreflexia. *Spinal Cord.* 1999;37:383-391.