

STAGES OF BONE HEALING

There are three primary stages of bone healing:

1. the early inflammatory stage
2. the repair stage
3. the late remodelling stage

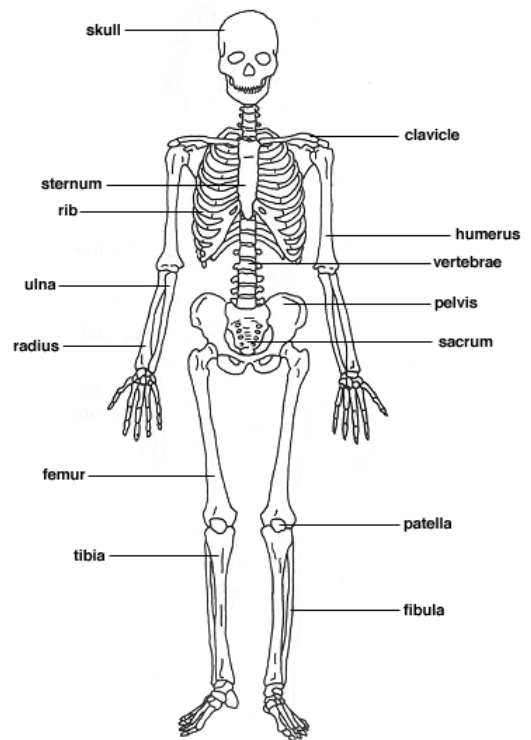
These stages are distinct, but there is overlap.

1. Inflammatory Stage

- a hematoma (localized blood collection) forms within the fracture site during the first few hours and days. Inflammatory cells infiltrate the bone, which results in the formation of granulation tissue (which is important in healing and repair), vascular tissue (for blood delivery to the new bone), and immature tissue (which will specialize to form a bridge of tough connective tissue).
- this stage can last 2 - 4 weeks after a fracture, and it overlaps with the next stage

2. Repair Stage

- this is the stage where the fracture gets 'healed'...that is, the bone ends become joined and stabilized. The cells of the body that are capable of changing into bone cells are activated or fired up to do so, and they start laying down new bone tissue. This tissue, called fracture callus, is weak; and has to be protected. The hardening of the cartilage begins at each end of the fracture and sweeps toward the center.
- during this stage, the new blood vessels for the new growth are also developed. But it's during this stage that nicotine from smoking can really slow down this blood vessel growth, which will impact, in a negative way, how the bone heals.
- this stage can last 1 - 2 months after a fracture



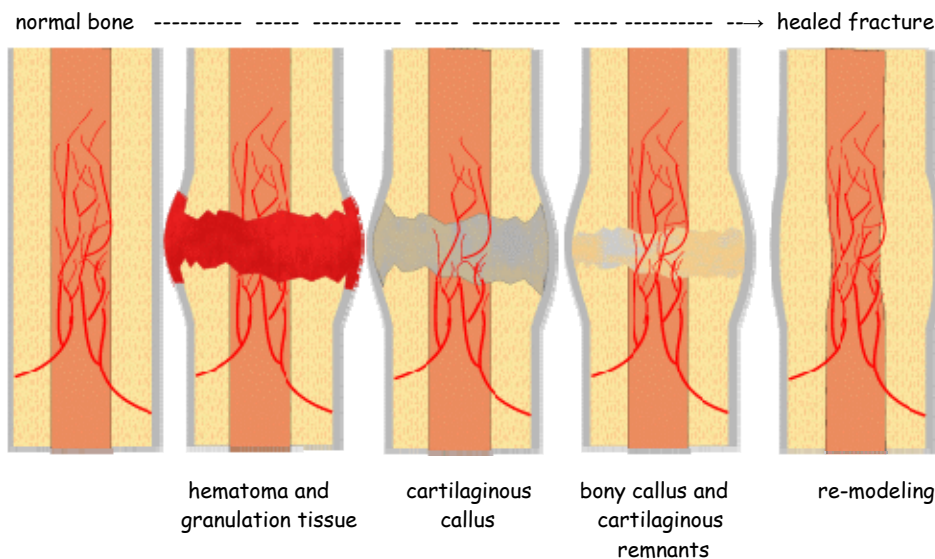
3. Remodelling Stage

- this is the stage where the body changes the weak bone material into strong bone material. Because this new material is so strong, the body does not need a lot of it, and it will remodel the fracture callus down to normal sized bone. The bone should be restored to its original shape, structure, and mechanical strength.

- remodelling of the bone occurs slowly over months to years and is helped along by mechanical stress (i.e. weight bearing) placed on the bone

In the picture below, the second section shows the hematoma formation of the inflammatory stage. The third and fourth sections show the callus and bone formation of the repair stage. The final section shows the remodelling stage.

Stages of Healing



References:

Stages of healing picture retrieved from www.gla.ac.uk/.../tutorial/generic/bone7.html

Skeleton picture retrieved from www.learning-connections.co.uk

Kalfas, I. (2001). Principles of bone healing. *Neurosurgical Focus*, 10(4), 1-4.

Normal Process of Bone Healing. Poster from EBI Medical Systems.

Developed November 2006: J. Mammel, Orthopaedic Trauma Clinical Nurse Specialist