

# Fracture Healing

## Objectives

- Learn the terminology associated with the healing of fractures.
- To know the five stages associated with fracture healing.
- To have some fun.

- Healing begins as soon as the fracture occurs.
- ✂ Healing of bone goes through a number of stages.
- ✂ Repair of tubular bone differs from repair of cancellous bone.

## Result of Injury

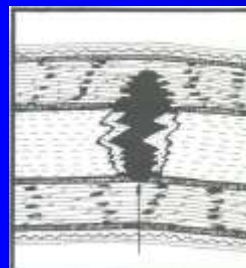


- 1 Periosteum ruptures
- 2 Haversian system ruptures
- 3 Muscle tearing
- 4 Skin breach

## STAGE OF HAEMOTOMA

- Blood seeps from the fracture site immediately.
- The ensuing haemotoma is contained by the periosteum.
- The periosteum may be stripped from the bone.
- Small capillaries may be divided stopping the blood supply.

## Stage of Haemotoma



- Bleeding contained by the periosteum.  
Blood clots closing the fracture.  
Revascularized by in-growth of new vessels.

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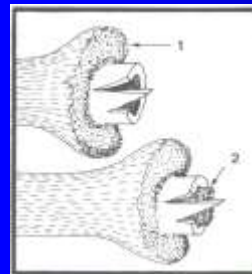
## STAGE OF SUBPERIOSTEAL AND ENDOSTEAL CELLULAR PROLIFERATION

- Cell growth from the deep surface of the periosteum begins.
- Precursors to osteoblasts deposit intercellular substance.
- Collar of active tissue encircles the site.
- Bridges of tissue grow towards each other.

## STAGE OF CALLUS

- Cell tissue grows from each fragment and matures.
- Osteoblasts develop to form bone.
- Chondroblasts form cartilage.
- Immature bone forms a callus - 'woven bone'.
- Visible mass can be seen on radiograph.

## Callus Formation



- 1 Primary callus formation active for a few weeks.
- 2 Less vigorous formation from the medullary canal.

## External Bridging Callus



If the periosteum is not torn and bony apposition is intact, external bridging callus formation begins.

## STAGE OF CONSOLIDATION

- Woven bone is transformed by osteoblasts to form mature bone.
- Large mass of woven bone becomes hardened by deposits of calcium salts.

## STAGE OF REMODELLING

- Bulbous collar of hardened bone surrounds the fracture site.
- Collar is larger when periosteum has been stripped.
- Callus is usually large in children.
- Bone strengthens along lines of force and excess bone is reabsorbed.

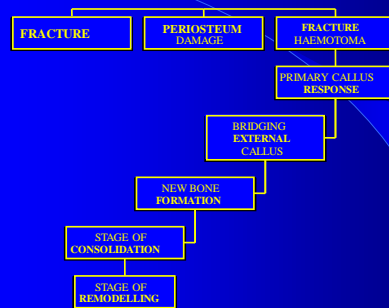
## REPAIR OF CANCELLOUS BONE

- Broad area of contact between fragments.
- Open network of trabeculae affords easier penetration by bone forming tissue.
- External callus not always present.
- Haematoma -> Cell Proliferation -> Woven Bone.

## RATE OF UNION

- Union is usually quickest in children with callus visible on X-ray within 2-3 weeks.
- Consolidation can occur within 4-6 weeks in children.
- Long bone fractures in adults may take up to 3 months to reach consolidation.

## SUMMARY OF THE HEALING PROCESS



## Further Reading

- <http://boneandspine.com/fractures-dislocations/bone-fracture-healing-occur/>
- <http://www.casscellsorthopaedics.com/fractures.php>
- <http://www.mate.tue.nl/mate/pdfs/4771.pdf>