

# Limb reconstruction: The biology of bone lengthening

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Bone lengthening is performed to correct a limb length discrepancy. It can be an acute or gradual process, both of which are initially performed under general anaesthesia.

Acute lengthening involves the surgeon making a cut in the bone and sliding the bone into its new position. The bone is held in place with metal ware (plates and screws), also known as internal fixation.

Gradual lengthening is usually done on long bone. A controlled fracture of the bone (also known as an osteotomy) is made to break the long bone. This osteotomy is a low energy osteotomy, which means that there is no burning from the heat of the bone saw (which can cause destruction of the bone ends). The external fixation device (circular or monolateral) is then attached to the limb with metal pins and wires holding the broken bone in place.

The edges of the broken bone attract a lot of blood cells to the area, which bridge the fracture site and eventually form osteoblasts, the building blocks of new bone formation. The osteoblasts turn into a callus, which is new soft bone, seen on xray as the white fluffy edges around the osteotomy site (**Figure 1**).



**Figure 1**

During this time, 'turning' of the fixator is taking place, which is lengthening the distance between the osteotomy sites.

The tension placed on the bone from the distraction of the frame stimulates the callus to grow, filling the gradually enlarging gap with new bone (**Figure 2**). During this time, it is important to continue the physiotherapy plan that has been prescribed by your physiotherapist, as soft tissue and muscle are at risk of forming contractures if not stretched whilst lengthening is taking place

When the correction/lengthening has finished, the fixator is locked down. The period of time after this is known as consolidation. This is when the callus hardens and fills in with stronger bone (**Figure 3**).

Putting weight through the affected limb assists in bone healing, as this helps strengthen the callus and bone formation.



**Figure 2**



**Figure 3**

The fixator device is removed when the Xrays show that the bone is fully healed and strong. The general rule of thumb for how long the frame needs to stay on is 30 days for every cm of length gained. This includes 10 days of lengthening to gain 1 cm, and 20 days of consolidation for every cm gained. This is a rough guide, as every person forms new bone at varying rates, and many factors can influence the length of treatment. This should be discussed with your surgeon prior to treatment commencing, so you have an idea of how long treatment time will be.

When the fixator is removed, sometimes the surgeon will put a plaster or a splint on, to protect the bone for a little while longer. When all fixators/plasters have been removed, the child can resume gentle activities. Contact sports and rough play are discouraged until your surgeon gives the OK.

## References

- "Bone Lengthening" AAOS Online Service Fact Sheet Bone Lengthening. Sept 2001
- "Apley's System of Orthopaedics and Fractures" 7<sup>th</sup> Edition 1993