

by compact bone (**Fig 1.3.3-3e**). The mineralization of fibrocartilage progresses from the fragment ends toward the center of the fracture gap. This pattern of fracture healing results in a rapid gain of mechanical strength that can be attributed to the increasing amount of bone material formed. In cases of too much motion, this healing cascade can be interrupted and may then end in nonunion or pseudarthrosis.

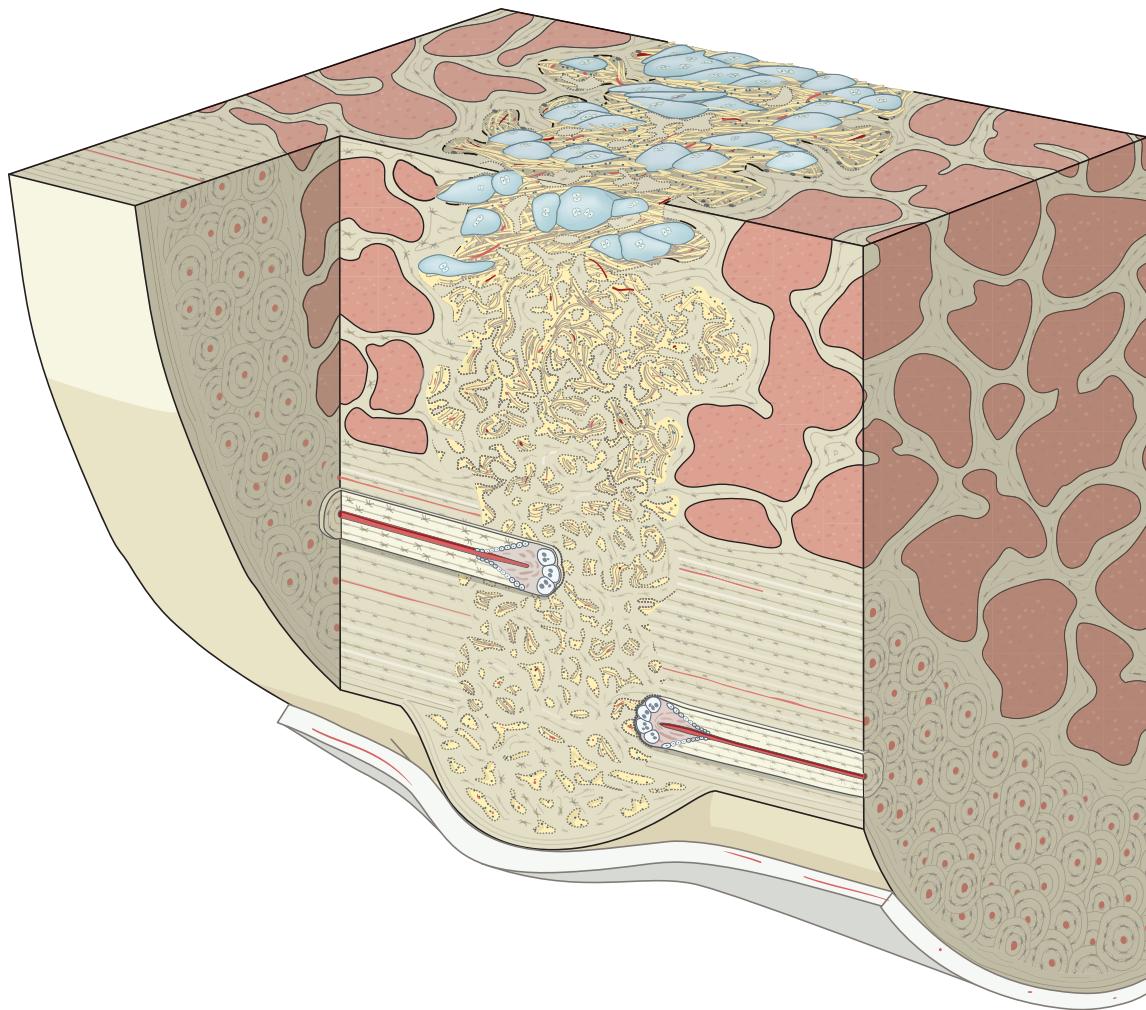


Fig 1.3.3-3e Same section of (a) as in (b). Secondary bone healing, phase 4: woven bone replaced by lamellar bone through Haversian remodelling.

4 Nonunion

Nonunion exists when repair is primarily not possible and surgery is required to bring about union. In those cases in which either the distance in between the fragment ends is too wide, or there is too much unfavorable motion in between the fragment ends, or biological factors like vascularization are unfavorable, or infection occurs, complete healing may be impossible and nonunion will occur. Unphysiological mobility will then be the result. Nonunion and pseudarthrosis (in German terms) are the same, while in the English literature a pseudarthrosis is only the condition which shows a true false joint and therefore is considered as the end point of a nonunion.

Nonunions in the craniofacial area are rare. In most instances the correct treatment is sufficient stabilization with a plate.

5 Delayed union

Delayed union is primarily a clinical term describing a prolonged healing period, while the histological healing cascade is similar to regular healing. Delayed union can result from a biologically difficult environment (eg, reduced blood supply, irradiation).