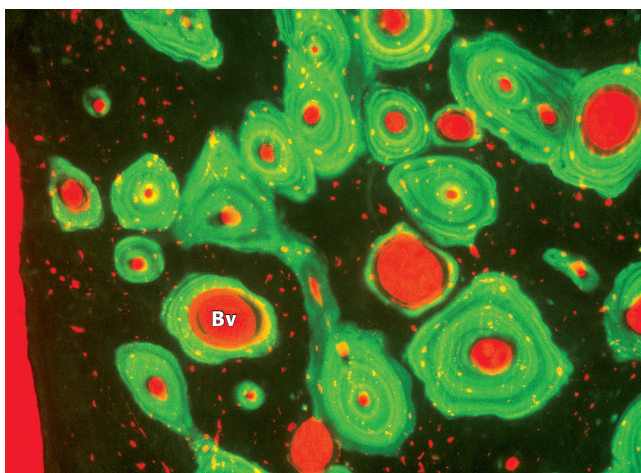


subsequently, osteoblasts fill the widened canals with new bone (**Fig 1.3.2-3**). Usually this remodeling is limited to the zone in which circulation was jeopardized. Since old, non-perfused bone has to be removed before new bone can be built, there is a transitional period in which a healing bone, especially in the fragment ends, appears less dense on x-rays.

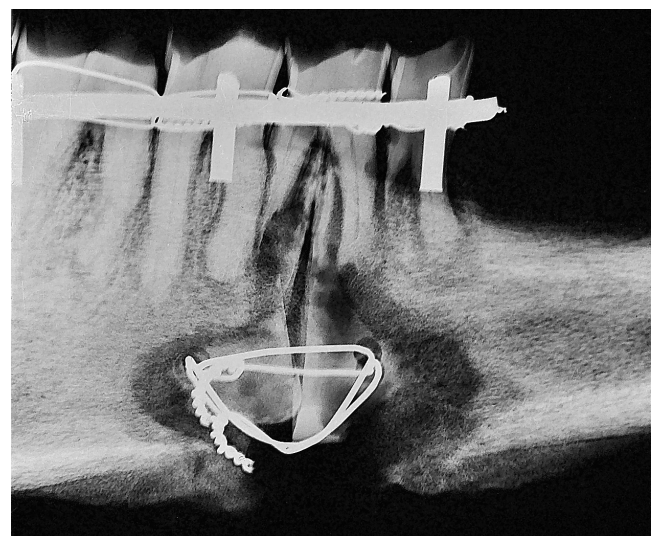
The trauma of the fracture leaves a hematoma between the fragment ends. There is some evidence that this hematoma could be a source of precursor cells involved in tissue differentiation. Vascular invasion of the fracture hematoma is a prerequisite for the start of the differentiation cascade (see chapter 1.3.3 Biological reaction and healing of bone), which finally leads to a bony bridging of the fracture. During this process the interfragmentary space remains without vessels across the fracture plane as long as there is significant interfragmentary motion. A reconstruction of major intracortical and medullary vessels only becomes possible after the

fracture has united and remodeling toward the original shape of the bone has started. A disadvantage is that a hematoma offers excellent conditions for bacterial growth. This increases the susceptibility to infection, since natural defence mechanisms do not get access to the nonperfused areas. An osteitis will result, and osteoclasts attempt to remove the dead bone, resulting in the formation of sequestra (**Fig 1.3.2-4**).

Operative treatment interferes with bone blood supply in addition to the damage produced by the initial trauma. Manipulation for alignment and the drilling of screw holes directly damage cortical circulation, and plates disturb the efflux on the periosteal side. On the other hand primary operative stabilization offers certain advantages. Rapid recovery of the intramedullary circulation becomes possible, and a direct crossing of capillaries from one fragment end to other permits a union in exactly the position in which the fragments were aligned.



**Fig 1.3.2-3** Partially remodeled compact bone. Black indicates old bone; green indicates new bone; and red indicates blood vessels (Bv).



**Fig 1.3.2-4** Sequestration of nonperfused areas (status after wire osteosynthesis of an experimental mandibular fracture in a sheep). The circulation is disturbed in the fragment ends and the area where the operative procedure took place. Osteoclasts attempt to remove the dead bone, resulting in the formation of sequestra.

