

# Osteosynthesis and its principles

**Osteosynthesis** is the surgical treatment of open and complicated fractures. We use metal implants (plates, screws, wires, nails, external fixators) to connect bone fragments. When the bone fragments are immobilized, the free movement of the adjacent joints is preserved, which enables early mobilization. At the same time, we eliminate muscle forces causing the dislocation of fragments. Osteosynthesis is preceded by reduction under X-ray control and prophylactic ATB.

## Types of osteosynthesis according to the fixation approach

1. We use **internal fixation** for less complicated fractures. It is a surgical approach in which the implant is covered by soft tissues or embedded in the bone.

- intramedullary:
  - intramedullary nailing (the trend is undrilled secured nails);
  - K-wire bundle according to Hacketal;
  - Ender osteosynthesis.
- extramedullary:
  - plates and screws (AO osteosynthesis - precise open reduction + fixation with plates and screws);
  - separate screws;
  - traction cerclage.

2. We use **external fixation** in comminuted, open fractures with extensive damage to soft structures and in polytrauma. Fixation placed outside the skin cover consists of **Schanz screws**, **Steinmann nails**, or **Kirschner wires (K-wires)** inserted into the bone percutaneously or through small incisions and an external construct

- unilateral (clamp);
- bilateral;
  - single-plane (frame);
  - multi-plane (circular).

## Other types of osteosynthesis

- **biological osteosynthesis** - closed reduction + intramedullary osteosynthesis without pre-drilling
  - a special type is **minimally invasive osteosynthesis** - closed reduction + introduction of intramedullary implants (elastic wires) percutaneously or through a small incision
- **pre- drilling of the medullary cavity** - damage to the vascular supply (formation of the endosteal muscle), risk of fat embolism (especially in patients with polytrauma)
- **secured nailing** - screws passing through the bone and the hole in the nail perpendicular to the long axis
- **traction cerclage** - fixation of fragments with two Kirschner wires and a loop of flexible wire, which is placed on the surface of the bone (fractures of the clavicle or break-off of the olecranon ulnae)
- **stable osteosynthesis**
  - absolutely - there is no movement of the fragments due to the action of muscle force (traction cerclage, statically secured intramedullary nail, compression plates)
  - relatively - enables a certain defined minimum movement of fragments, which potentiates the formation of muscle (dynamically secured intramedullary nail, bridging plates)
- **adaptive** osteosynthesis - fragments stabilized in the required position, the movement of fragments is not defined, additional fixation is necessary to eliminate muscle force (external fixator, plaster cast, etc.)



Multi-level external fixation system designed by Taylor



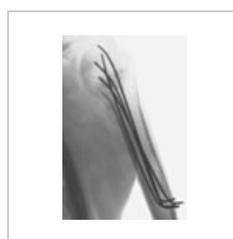
Single-plane external fixator



Schanz screw



Steinmann's nail



4 Kirschner wires placed in the humerus (X-ray)

K-Fuss-z2.jpg



Intramedullary nail  
osteosynthesis  
secured with  
screws, X-ray  
image of the tibia

Land 1

Land 2

## Indikace k osteosyntéze

- open fractures;
- intra-articular fractures with dislocation of fragments;
- closed fractures, primarily unstable;
- fractures with interposition of soft tissues;
- multiple fractures;
- fractures in old patients (early mobilization);
- fractures that failed primary reduction;
- fractures with simultaneous damage to blood vessels and nerves.

## Indications for external fixation

- open fractures;
- temporary fixation in polytrauma;
- juxtaarticular fractures;
- additional fixation in adaptive osteosynthesis;
- treatment of joint and bone infections;
- treatment of bone defects (lengthening - calotaxis).

## Advantages and disadvantages of osteosynthesis

- the advantage is the possibility of early mobilization (atrophy and contractures do not occur);
- the disadvantage is the risk of infection (both wound and bone) and prolongation of bone healing time.

## Links

### Related articles

- Types of fractures and their dislocations

### Source

- JAN, Pastor. *Langenbeck's medical web page* [online]. [cit. 2010]. <<https://langenbeck.webs.com/>>.