Reduction techniques
Rodrigo Pesantez, Myriam Sanchez
Learning outcomes

• Define reduction and its types
• Understand the degrees of displacement of fractures
• Describe the reduction methods and the tools used

At the end of this lecture you will be able to:
  • Define reduction and its types.
  • Understand the degrees of displacement of fractures.
  • Describe the reduction methods and the tools used.
What is reduction?

- Realignment of a displaced fracture
- Returning the affected part of the body to its normal position

Reduction is the action of restoring a dislocation or fracture by returning the affected part of the body to its normal position.
There are two forms of displacement:

1. Translational displacement:
   - Medial or lateral and posterior or anterior
   - Shortening or lengthening

2. Rotational displacement:
   - Internal or external rotational malalignment
   - Valgus or varus malalignment
   - Flexion or extension malalignment
Why fracture reduction?
Here we can see a fracture fixed with an intramedullary nail that looks reduced on the lateral view. On the AP view however we can see that there is some valgus angulation of the distal fragment.
Why fracture reduction?
This fracture was not treated operatively and has healed with varus, antecurvatum, and shortening malunion.
Aim of reduction

- Anatomical reduction
  - Perfect restoration of bone morphology
- Functional reduction
  - Restoration of anatomical relationships of proximal and distal main fragments:
    - Length
    - Alignment
    - Rotation

Some fractures are reduced perfectly to restore the bony anatomy and others to restore the relationship between the proximal and distal main fragments, setting the scene for recovery of the function of the limb.
The decision, which reduction method should be used, depends on the location of the fracture:

2. Joint fractures need anatomical reduction.
In diaphyseal fractures:

- The functional anatomy is restored (length, alignment, and rotational axis).
- The load-bearing axis of the extremity is restored (especially important in the lower limb).
An exception is the forearm. The forearm works as a joint (radiohumeral joint, and proximal and distal radio-ulnar joints for pronation and supination).

Image courtesy: Professor Christopher L Colton.
Reduction of articular fractures

- Anatomical reduction of the joint surfaces:
  - Avoid steps
  - Avoid gaps

- Restore axial alignment

In articular fractures:
- The joint surface is restored anatomically. Gaps and steps in the articular surface must be avoided.
  - “Steps” means that there is a difference between the levels of two main articular fragments.
  - “Gaps” means that there is some space between two adjacent main articular fragments.
- The axial alignment is restored.
There are two reduction methods:
• Direct reduction where every fragment under direct vision is restored.
• Indirect reduction where the direction is done without direct view on the fracture.
There are different techniques of direct direction.

**Methods of direct reduction**

- Direct clamp application:
  - Joint
  - Shaft
- Push-pull technique
- Direct application of an implant
- “Shoehorn technique”
On this slide you can see how the distal femoral and distal humeral fractures are reduced with a pointed reduction clamp.
Direct clamp application: joint (example 3)

Reduction of proximal tibia/tibia plateau using a distractor in combination with a pointed reduction forceps.
Also here the distractor is used to gain normal length. The forceps then reduces the main fragments.
Additional Material

The next four slides (slides on reduction tools) are additional to the core knowledge but may be incorporated in any presentation, in which it is required.

Information for faculty: All slides on reduction tools can be used and explained. An possible alternative is a discussion of these instruments during hands-on exercises (eg, AO Skills Lab). In that case you may wish not to show these slides.
Information for faculty: All slides on reduction tools can be used and explained. An possible alternative is a discussion of these instruments during hands-on exercises (eg, AO Skills Lab). In that case you may wish not to show these slides.

Commonly used reduction tools are:
- Pointed reduction forceps
- Toothed reduction forceps
Information for faculty: All slides on reduction tools can be used and explained. An possible alternative is a discussion of these instruments during hands-on exercises (eg, AO Skills Lab). In that case you may wish not to show these slides.

Commonly used reduction tools are:
  • Bone-holding forceps, Verbrugge type
  • Bone spreader
  • Colinear reduction clamp
Information for faculty: All slides on reduction tools can be used and explained. An possible alternative is a discussion of these instruments during hands-on exercises (e.g., AO Skills Lab). In that case you may wish not to show these slides.

Reduction tools for osteosynthesis of the pelvis are:
- Pelvic reduction forceps
- Angled pelvic reduction forceps
Information for faculty: All slides on reduction tools can be used and explained. An possible alternative is a discussion of these instruments during hands-on exercises (eg, AO Skills Lab). In that case you may wish not to show these slides.

Reduction tools for osteosynthesis of the pelvis are:

- Faraboeuf
- Yungbluth
In diaphyseal fractures fixed with a plate, the plate is attached to one fragment: then a bone spreader, placed between the end of the plate and an independent screw in one main fragment, can be used to distract the fracture for reduction. A loosely applied reduction forceps helps to maintain the alignment of the main fragment with the plate.

In a next step, in order to maintain the reduction using the same independent screw, preliminary axial compression can then be obtained by pulling the plate end towards the independent screw with a small Verbrugge clamp.
The articulated tension device (ATD) can be used to serve the push-pull principle, as illustrated on the previous slide.

The push stage is achieved by reversing the hook on the articulated tension device (see circle and next slide).

*Image courtesy: Professor Christopher L Colton.*