

## AOSkills Lab

for Operating  
Room Personnel



# Frequently asked questions (FAQs)

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## **What happens if I plunge?**

It means you have penetrated the soft tissue and can damage soft-tissue structures, such as vessels or nerves.

## **How do I avoid penetrating soft tissue?**

The most important step to reduce plunging is the use of sharp drill bits to reduce the amount of pressure you put on the power drill, and thus the drill bit. In addition, it might be helpful to use shorter drill bits, if available, or letting the K-wire protrude less from the collar chuck. Discuss if placing yourself in a different position or holding the drill with one or two hands has any effect on plunging. If time permits, try the exercise again, modifying these factors.

## **Why do the tips of blunt drill bits reflect light?**

Drill bits used in surgery fail first on the very tip and then, if at all, at the cutting edges. The worn off tip becomes round and the surface of this hemisphere reflects the light. Where the cutting edges can look perfect (do not reflect the light) the tip might already be blunt (reflects light).

## **How do drill bits become blunt?**

Drill bits not only become blunt by drilling through bone; they also become blunt with friction against other tools as they go through the cleaning/sterilization process and/or when they are inappropriately stored. An everyday example is your tool box at home where drill bits are separated into compartments in order that they are not in contact with each other. This is not only for presentation purposes but also to keep them sharp by avoiding contact friction.

## **When perforating metaphyseal or osteoporotic bone do you feel the second cortex?**

You may not feel when your drill bit passes through the second cortex, as metaphyseal and osteoporotic bone have very thin and delicate cortices. You should be particularly careful when drilling through these types of bone.

Test your surgical skill

## Soft-tissue penetration during drilling

### Tasks

- 1 Observe the difference between a sharp and a blunt drill bit
- 2 Drill hole through both bone cortices using sharp or blunt drill bits, or a K-wire; try to minimize soft-tissue penetration
- 3 Check degree of damage done by soft-tissue penetration

### Learning objectives

- Learn to differentiate between sharp and blunt drill bits
- Develop feeling for penetration of opposite bone cortex and compare results using blunt and sharp drill bits or K-wires
- Assess possible damage to soft tissues and neurovascular structures

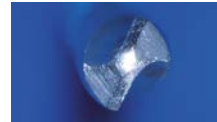
### Take-home message

- Use sharp drill bits to avoid uncontrolled penetration into muscles, nerves, and vessels
- Blunt drill bits must be replaced

### Observe the surface of the very tip of the drill bit

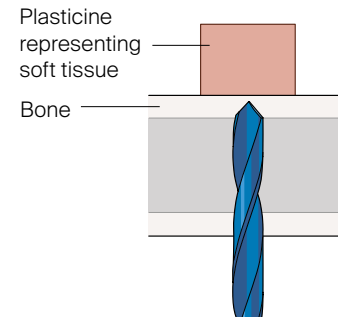


Sharp: no reflection of light on the tip

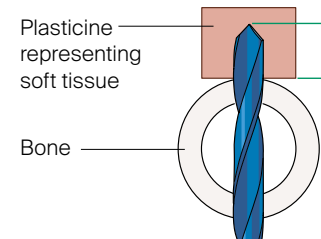


Blunt: light is reflected on the tip

### Method



### Measurement of depth of penetration



# Frequently asked questions (FAQs)

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## **Why do we have different reduction techniques?**

In order to understand reduction, one must also take into account what kind of fixation is required for the stability one wants to achieve. Different anatomical regions have different reduction requirements.

## **What is anatomical reduction and anatomical alignment?**

Anatomical reduction is the result of a technique whereby fracture fragments are placed in their original anatomical positions to establish the original shape and form of the fractured bone. Anatomical reduction is required for articular fractures. Anatomical alignment refers to reestablishing the original axis of the bone and pertains to metaphyseal and diaphyseal fractures.

**Please check the back of both cards for station E for a complete set of FAQs for this station.**

## Techniques of reduction (1)

# Direct and indirect reduction

### Tasks

Examine bone models; reduce fractures directly or indirectly, according to fracture pattern, location, and surgical approach

### Learning objectives

- Differentiate between direct and indirect reduction
- Relate both techniques to specific indications and bone segments

### Take-home message

#### Direct reduction

- Fracture reduction is achieved by direct manipulation with instruments and under direct or C-arm vision

#### Indirect reduction

- Fracture site is not exposed, reduction is performed by applying corrective forces and moments at a distance from the fracture utilizing distraction with soft tissues such as capsule, ligaments, periosteum, muscles, tendons
- Reduction is checked clinically or using image intensifier, x-rays

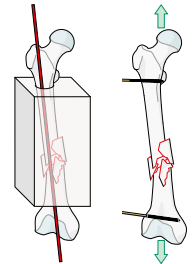
#### Metadiaphyseal segment

Indirect reduction to obtain

- Length
- Axial alignment
- Rotational alignment

A diaphyseal fracture is a black box

- No visualization
- No direct contact



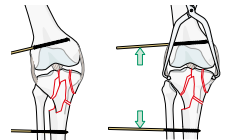
#### Articular segment

Anatomical reconstruction of the joint surface

Direct reduction



Indirect reduction, ligamentotaxis



# Frequently asked questions (FAQs)

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## **How is all this clinically relevant?**

The surgical treatment of a fracture comprises three main steps that should be included in a complete preoperative plan: surgical approach, fracture reduction, and fracture fixation. Reducing the fracture is one of the steps in this surgical process and its difficulty is often underestimated. Since there are many reduction techniques and reduction-aiding devices, getting to know the names and functions of instruments is important if you want to successfully reduce any kind of fracture. Developing a defined surgical reduction technique that respects the biological principles of fracture fixation (open, closed, or minimally invasive) is a major step in becoming an accomplished surgeon.

**Please check the back of both cards for station E for a complete set of FAQs for this station.**

# Techniques of reduction (1)

## Use of reduction clamps

STATION E

### Tasks

- 1 Examine a variety of reduction clamps/ forceps, including different locking mechanisms
- 2 Apply different tools at different anatomical sites

### Learning objectives

- Identify the degrees of freedom for each clamp
- Recognize difficulties in the application of the different devices
- Analyze biological advantages and shortcomings of different clamps

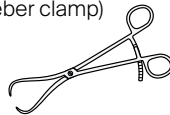
### Take-home message

Use proper tools according to the anatomical and technical conditions

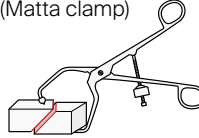
The term clamps and forceps are sometimes used interchangeably

#### Pointed reduction clamps

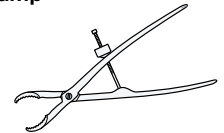
Pointed reduction clamp  
(Weber clamp)



Angulated reduction clamp  
(Matta clamp)



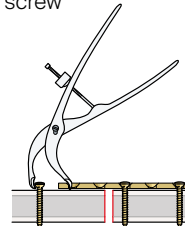
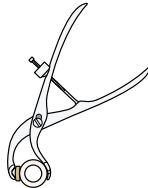
#### Standard reduction clamp



#### Plate holding clamp

##### Compression

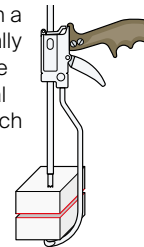
Pulling the plate end towards the screw



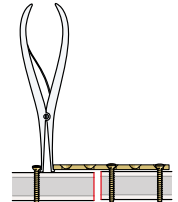
#### Other reduction tools

##### Collinear reduction clamp

Allows direct reduction through a minimally invasive surgical approach



##### Lamina spreader clamp



# Frequently asked questions (FAQs)

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## **What is meant by distraction?**

Distraction is the pulling force by which indirect reduction techniques achieve an approximate re-establishment of length and alignment of a fractured long bone and approximate shape of a joint.

## **What is involved when applying distraction forces for reduction?**

A distraction force puts soft tissue under tension as would a traction table for lower extremity use. The phenomenon is called “ligamentotaxis” and involves skin, muscles, periosteum, ligaments, tendons and capsular attachments in touch with fracture fragments. When applying distraction, the soft tissue attachments tend to edge fragments into their original spatial relationship to each other.



## Techniques of reduction (2)

# Distraction

STATION F

### Tasks

- 1 Connect the femoral distractor to the Schanz screws
- 2 Use alternative Schanz screws as joy sticks
- 3 Explore various functions of the femoral distractors, also in combination with joy sticks
- 4 Combine femoral distractor use with joy stick function

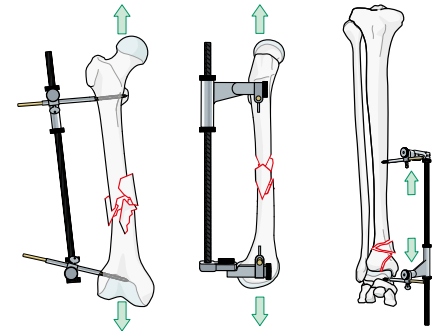
### Learning objectives

- Demonstrate use of a femoral distractor as a reduction tool
- List instances in which a distractor is indicated
- Explain use of external fixator for reduction

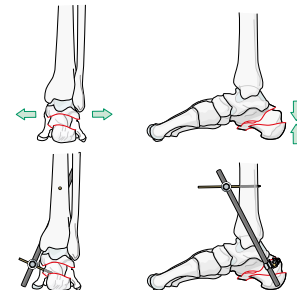
### Take-home message

- Distraction uses soft-tissue attachments to fragments for indirect reduction
- The femoral distractor is a powerful and versatile distraction/reduction tool
- Tools of reduction serve to preserve vascularity

#### Femoral distractor



#### External fixator as reduction tool



# Frequently asked questions (FAQs)

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## **How do you prevent coupling problems when removing a screw?**

The main way to prevent destroying the coupling mechanism of a screw is ensuring adequate screwdriver-screw coupling when placing and removing the implant. The surgeon must feel and see that the screwdriver has fully attached to the screw and has a good grip. When removing the implant, care should be taken to check that all tissue has been removed from the coupling hole to allow perfect matching between driver and screw. Turn the driver slowly with your hands while pushing it against the screw head. Feel if there is a good catch between the screwdriver and the screw. If it feels loose, recheck its position.

Ensure the adequate tools for removing the implant are available; that is, having a screwdriver that is the right size and shape. Do not use damaged screwdrivers. Finally, do not underestimate any surgical procedure. Always use a careful surgical technique and pay attention to every detail.

## **What should be done if a coupling problem develops or if a screw head breaks (or is broken)?**

Ensure all the necessary instruments are available for difficult implant removal. If no instruments are available, consider rescheduling the surgery or reconsider the necessity of implant removal. Always remember that the first rule of medical action is do no harm, so always carefully consider a harm/benefit analysis when faced with failed implant removal.

Finally, remember to explain to your patient before the removal surgery that there is a possibility of failure to remove the implant. That way he/she will know there is always a slight chance that, even after the procedure, the implant may not have been successfully removed.

## **Why not use a power drill with the hollow reamer?**

Be aware of the fact that a lot of heat is produced when drilling or reaming (see station "Heat generation during drilling"). The benefit in time you might gain when using a power drill will be devoured by the damage created to the bone by heat necrosis.

# Damaged implant removal

## Challenges and solutions (Option 1)

### Tasks

#### 1 Destroyed coupling mechanism

Insert conical extraction bolt (a) in screw head and try to remove screw

#### 2 Broken screw removal procedure

Remove bone around screw with appropriate sized hollow reamer (b)

Use extraction tube (c) to remove screw shaft

### Learning objectives

- Identify the function of different instruments to aid screw removal
- Remove screw with destroyed coupling mechanism
- Remove broken screw

### Take-home message

- Use undamaged screwdriver
- Clean hexagonal coupling mechanism of screw head
- Everything in the removal set is left threaded

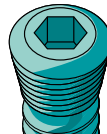


#### Problem 1

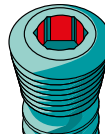
Destroyed hexagonal coupling mechanism of screw head



a



Intact



Destroyed

#### Problem 2

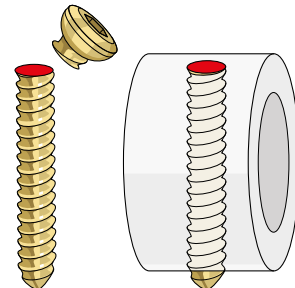
Broken screw, screw shaft stuck inside bone



b



c



# Damaged implant removal

## Challenges and solutions (Option 2)

### Tasks

#### 1 Destroyed coupling mechanism

Insert conical extraction bolt (a) in screw head and try to remove screw

#### 2 Broken screw removal procedure

Remove bone around screw with appropriate sized hollow reamer (b)

### Learning objectives

- Identify the function of different instruments to aid screw removal
- Remove screw with destroyed coupling mechanism
- Remove broken screw

### Take-home message

- Use undamaged screwdriver
- Clean hexagonal coupling mechanism of screw head
- Do not use a power drill

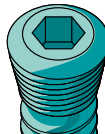


#### Problem 1

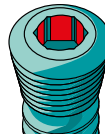
Destroyed hexagonal coupling mechanism of screw head



a



Intact



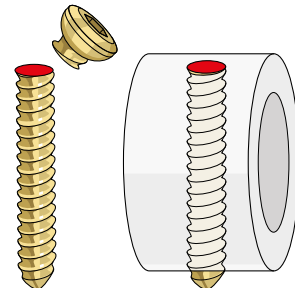
Destroyed

#### Problem 2

Broken screw, screw shaft stuck inside bone



b



This option is available in Europe and the Middle East only.

## Notes

## Notes

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