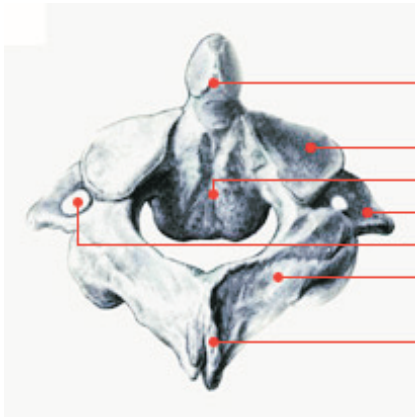


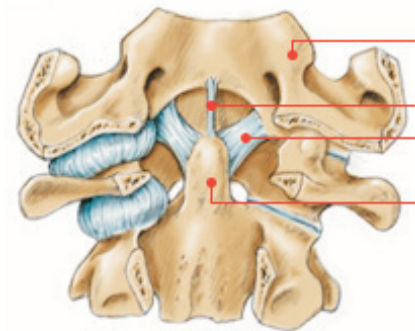
Fractures of the axis (C2)

- Axis, from the back



- Dens axis
- Articular surface to 1st cervical vertebra (atlas)
- Corpus axis
- Transverse process (processus transversus)
- Foramen transversarium
- Vertebral arch (arcus axis)
- Spinous process (processus spinosus)

- Ligamentous apparatus of the dens axis, from the back



- Occipital bone, os occipitale
- Apical odontoid ligament (ligamentum apicis dentis)
- Alar ligaments (ligamenta alaria)
- Dens axis

What types of fractures can occur in the 2nd cervical vertebra?

Three types can occur:

- Fractures of the dens axis
- Fractures of the corpus axis
- Fractures of the vertebral arches

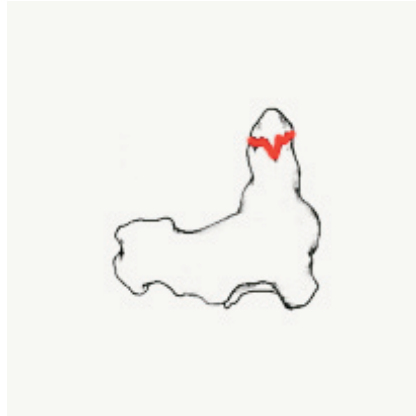
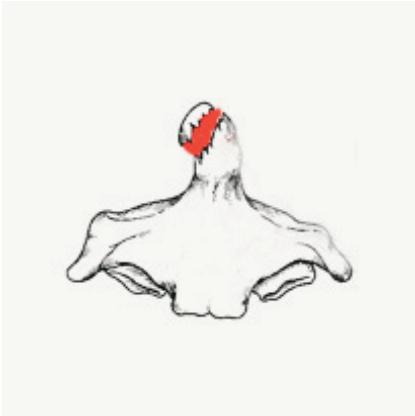
How are the fractures of the dens axis classified?

Fractures of the dens axis are among the most frequent types of fractures of the cervical spine. There are three fracture types according to Anderson-D'Alonso classification:

Type I

The tip of the dens axis is fractured at an angle above the transverse ligament (ligamentum transversum). With atlantooccipital dislocation, this fracture can result from a bony avulsion of the alar ligaments (ligamenta alaria).

- Anderson-D'Alonso dens fracture Type I

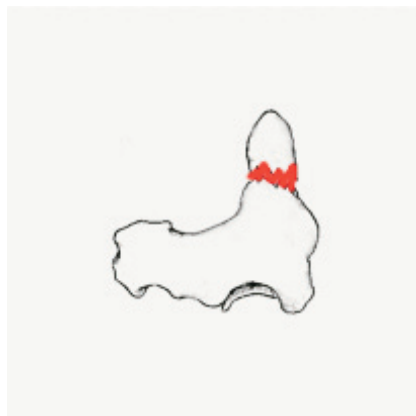
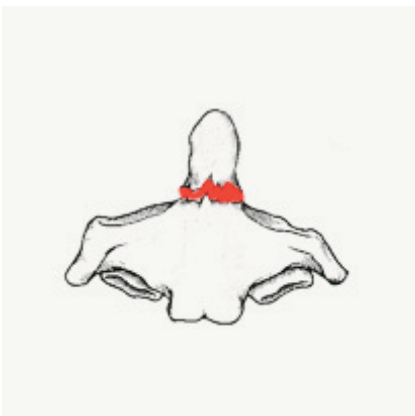


Type II

This fracture type runs along the base of the dens at the transition to the corpus of the axis.

This is the most common type of dens fracture. Since the fracture surface area is small, there is the danger of the fractures not healing well. Pseudoarthrosis formation is a frequent feature of the healing phase, i.e. a connective-tissue bridges the fracture gap forming a false joint with no healing of the bone.

- Anderson-D'Alonso dens fracture Type II

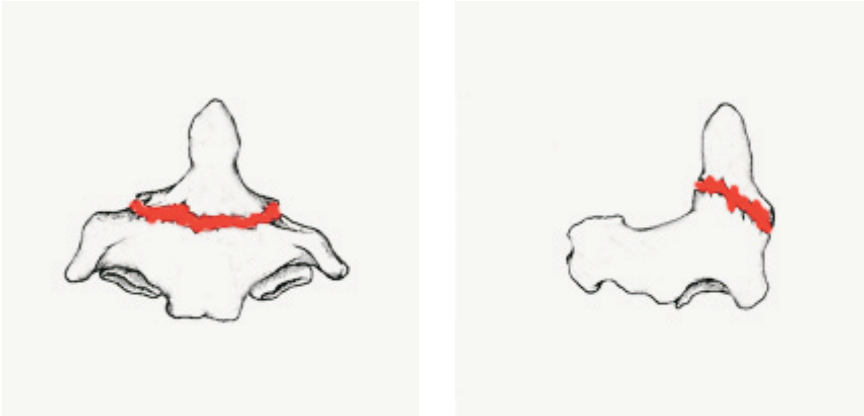


Type III

This fracture type runs through the corpus of the axis and is the result of a flexion trauma.

In this trauma, the applied massive flexion force is transferred to the ligamentum transversum of the atlas, which surrounds the dens axis. If this ligament does not rupture under this force application, the energy is transferred to the dens axis, resulting in this type of fracture.

- Anderson-D'Alonso dens fracture Type III



How do fractures of the dens axis occur?

Dens fractures may result from hyperextension trauma (massive bending backwards), resulting in a tendency of the atlas to luxate (dislocate) backward.

Dens fractures caused by hyperflexion trauma (massive bending to the front) result in a tendency of the atlas to luxate forward.

What are the symptoms of dens fractures?

- Neck pains
- Swallowing dysfunctions
- Neurological deficits

How are dens fractures diagnosed?

- X-rays of the cervical spine in 2 planes
- Transoral dens image
- Lateral functional image to assess stability as needed
- Conventional layered images
- Computer tomography

How are dens fractures treated?

The treatment of dens fractures depends on the type and stability of the fracture in each case.

Stable fractures can be treated conservatively by means of repositioning and immobilization in a halo brace for 16 weeks.

A halo brace is a special fixation and tension system used to immobilize fractures of the upper cervical spine that respond to conservative treatment.

In this process, the fracture is first repositioned. Then a head ring made of carbon or aluminum is fixed above the line of the tops of the ears onto the cranial bone with several screws. This halo ring is then solidly connected to a halo brace vest by rods. This system immobilizes the cervical spine with a residual mobility of approx. 30% and the fracture can heal in a stable position.

- Type I fractures with ligamenta alaria avulsions are treated with a fusion operation.
- Type II fractures undergo surgery using the following methods:
 - Classic surgical treatment with ventral screws using the Böhler method or
 - Osteosynthesis of C1/C2 with or without fusion, where ventral (anterior) access is a good option for young patients with good bone quality. Ventral surgical access is usually very difficult in the treatment of hyperextension fractures. For this operation, dorsal (posterior) access is indicated for older patients with poor bone quality and a hyperextension trauma.
- Type III fractures are normally treated by conservative immobilization in a halo brace.
We always recommend surgical repositioning with C1/C2 instrumentation using the Harms technique. Whether additional fusion (rigidification) is required depends on the possible damage to the upper cervical joints.

Fractures of the axis corpus

Axis corpus fractures are rarely observed as an independent type of fracture. What generally manifests in most cases is either an extension of a dens fracture, or fractures of the dens arches radiating into the corpus. Differentiating between them is often difficult.

Axis corpus fractures result from hyperextension or compression.

Genuine axis corpus fractures are normally hard to recognize in conventional x-ray images, which is why a CT scan should be done to exclude other possibilities.

Depending on the findings, therapy of an axis corpus fracture may involve conservative immobilization in a halo brace or invasive fusion surgery.