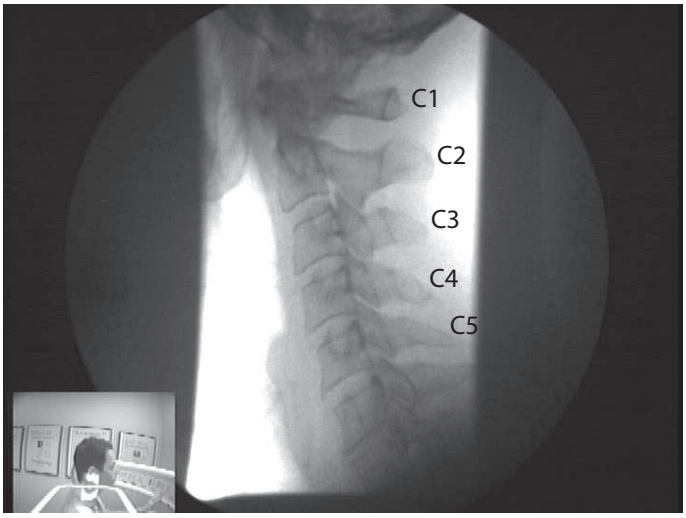
Digital Motion X-ray
Cervical Spine

1. In the neutral lateral projection: Shows reversal of the cervical lordosis, with the apex of the reversal at the level of C3-C4. There is disc narrowing and spurring at C6-C7. There is a spinous process avulsion fracture at C5 and C6.

The integrity of the cervical lordosis and overall condition of the cervical spine is evaluated. The loss of the cervical lordosis may be a result of damage to the posterior longitudinal, capsular or interspinous ligaments.



Neutral lateral projection

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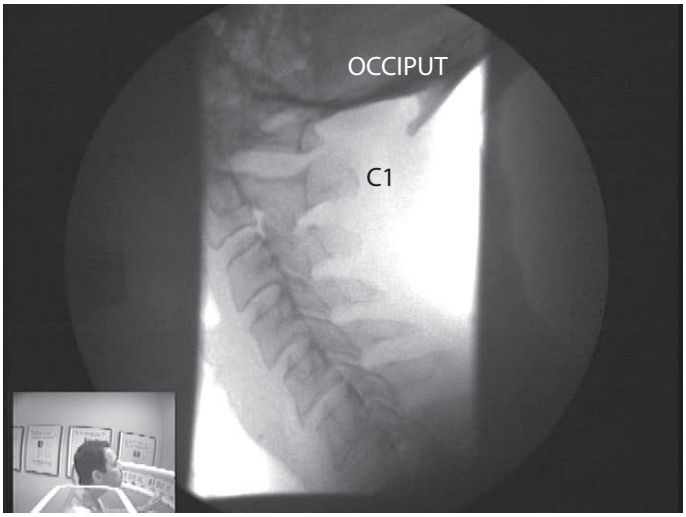
2. In the lateral nodding projection movement at the atlanto-occipital articulation: Is within normal limits.

This view examines the integrity of the transverse ligament which is responsible for preventing the anterior movement of C1 on C2. An increase of the Atlanto-Dens interspace (ADI) indicates damage to the transverse ligament.

Increased ADI space



Lateral nodding projection

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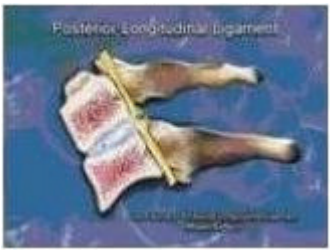
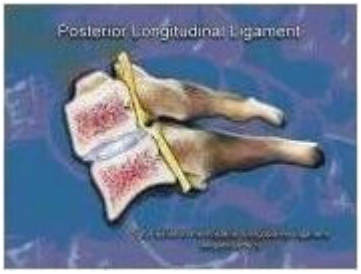
3. Motion in the neutral lateral projection to full flexion: There is an anterolisthesis of C3 on C4 (arrow).

This view examines the integrity of the posterior longitudinal ligament demonstrated by a forward (anterior) movement of one vertebrae over the vertebrae below or by the posterior widening of the intervertebral disc space (increased disc angle).

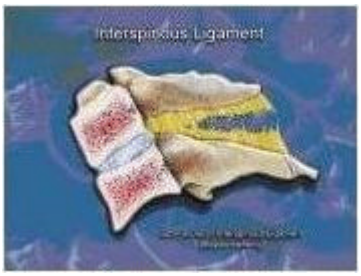


Widening of posterior disc space

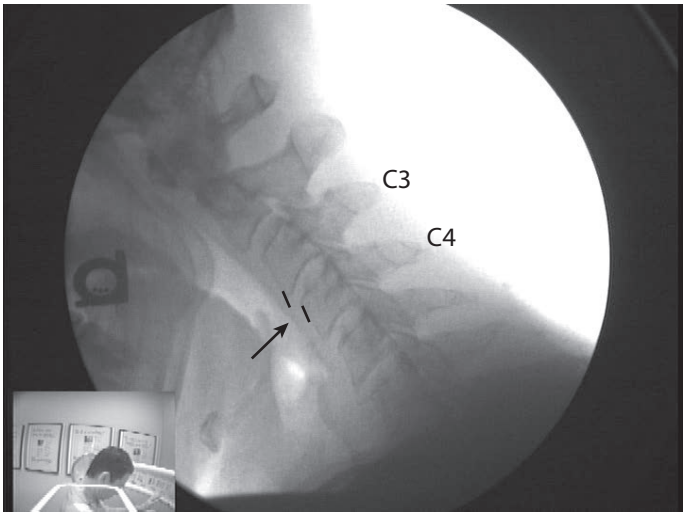


Anterolisthesis

The integrity of the interspinous ligament is evaluated in the lateral flexion view. Damage to this ligament results in increased separation of the spinous processes in flexion.



Damaged Interspinous Ligament



Full flexion projection

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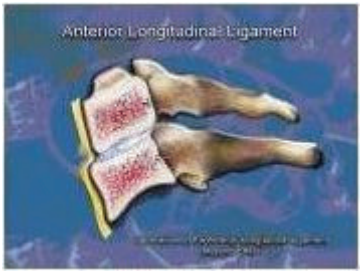
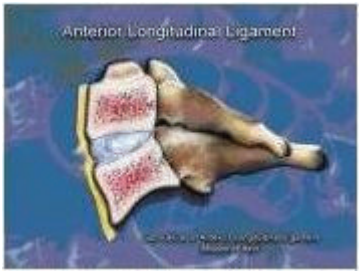
4. Motion in the neutral lateral projection to full extension: There is a retrolisthesis of C3 on C4. There is anterior widening of the intervertebral disc space at C4-C5 (arrow) and C5-C6.

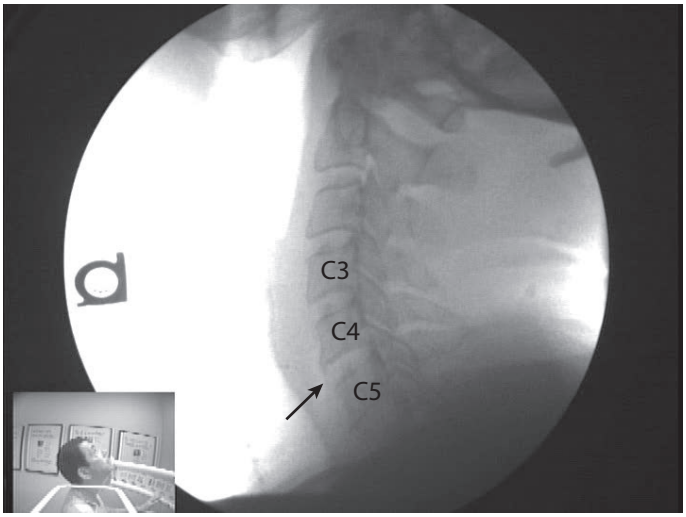
This view examines the integrity of the anterior longitudinal ligament demonstrated by a backward (posterior) movement of one vertebrae over the vertebrae below or by the anterior widening of the intervertebral disc space (increased disc angle).



Retrolisthesis



Widening of the anterior disc

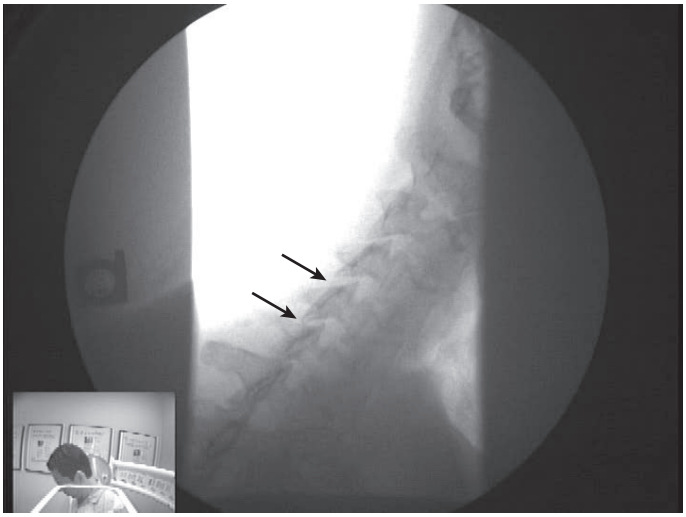


Full Extension

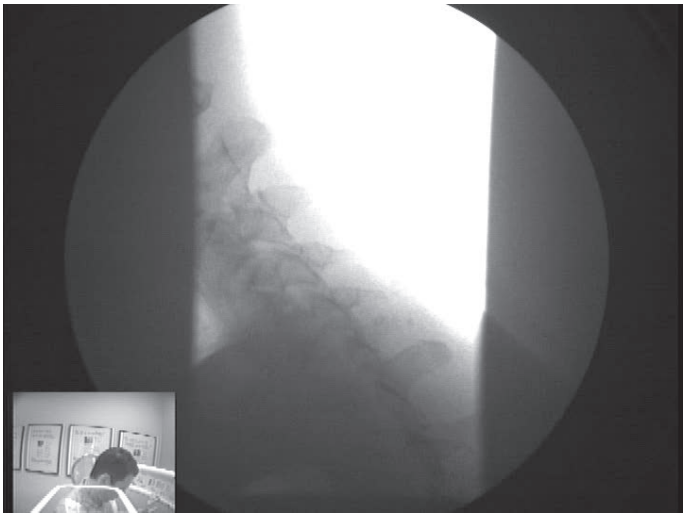
5. Motion in the oblique flexion projection: There is gapping of the facet joints (arrows) at C4-C5 on the left and C5-C6 on the left.

This view examines the integrity of the capsular ligaments by observing gapping of the facet joints, located on the posterior cervical spine (C2-C7), there are five capsular ligaments on the right and the left.

Capsular ligament damage



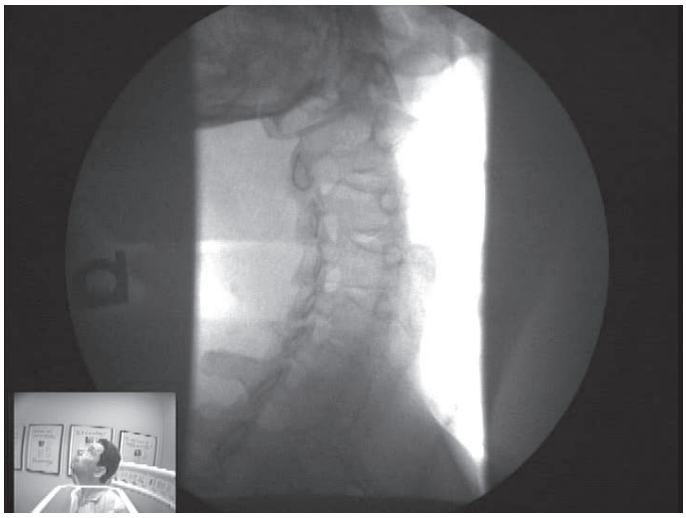
Left IVF flexion



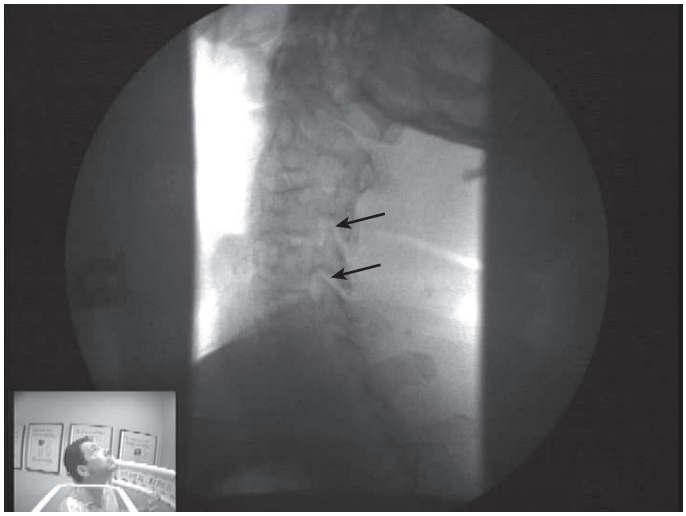
Right IVF flexion

6. Motion in the oblique extension projection: There is intervertebral foraminal encroachment of the facet joint (arrows) at C3-C4 on the right, C4-C5 on the right, and C5-C6 on the right.

This view examines the integrity of the capsular ligament by encroachment into the intervertebral foramen, located on the posterior cervical spine (C2-C7), there are five capsular ligaments on the right and the left.



Left IVF oblique extension



Right IVF oblique extension

7. Motion in the A-P projection lateral bending: Is restricted bilaterally.

This view allows us to evaluate coupled motion of the spinous processes which examines facet joint integrity.

8. Motion in the A-P rotation projection: Is within normal limits.

This view examines the rotational range of motion between Occiput-C1-C2. Increased motion indicates damage to the alar and accessory ligaments.

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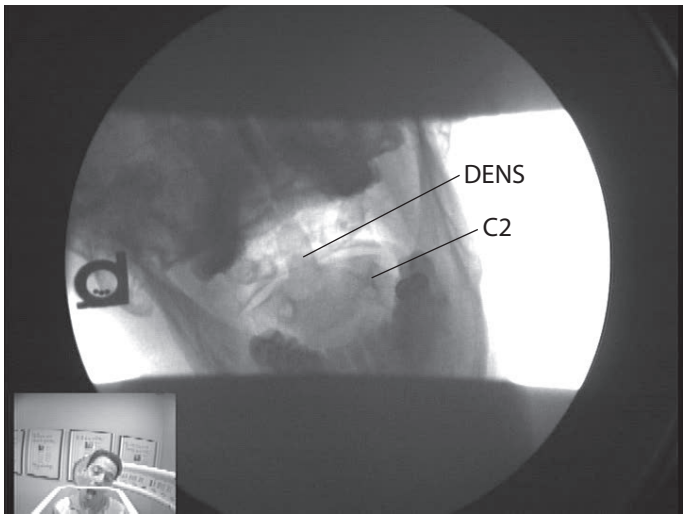
9. Motion in the A-P open mouth lateral bending projection: There is an abnormal lateral translation of C1 on C2 with an overhang to the left. There is a sigmoidal deviation of the mandible during opening and closing of the mouth.

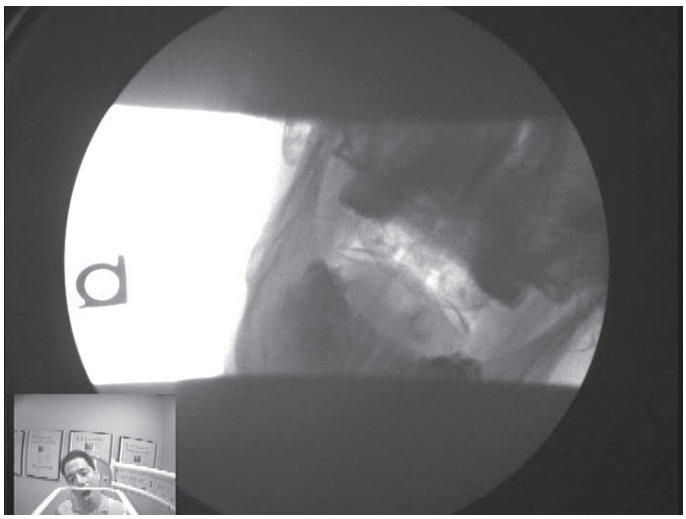
This view examines the integrity of the alar and accessory ligaments either by the lateral overhang of C1 on C2 or by the changes in the para-odontoid spaces.

C1 lateral mass overhang

Change in Para-odontoid space



Open mouth left lateral bending


Open mouth right lateral bending

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IMPRESSION for patient Ross Hauser:

- **Damage to the posterior longitudinal ligament is indicated by an anterolisthesis at C3 on C4.**
- **Damage to the anterior longitudinal ligament is indicated by a retrolisthesis at C3 on C4 and anterior widening of the intervertebral disc space at C4-C5 and C5-C6.**
- **Damage to the capsular ligament is indicated by gapping of the facet joint at C4-C5 on the left and C5-C6 on the left.**
- **Damage to the capsular ligament is indicated by intervertebral foraminal encroachment of the facet joint at C3-C4 on the right, C4-C5 on the right, and C5-C6 on the right.**
- **Damage to the alar and accessory ligaments is indicated by an overhang of the lateral mass of C1 to the left.**

Note: The term "Damage" as used in this report concerning any ligament represents a ligamentous laxity or instability due to excess stretching or tearing, and is therefore painful, progressive, and permanent.