UNDERSTANDING ATLANTO-AXIAL (AAI) & CRANIO-CERVICAL INSTABILITY (CCI)

ACCURATE DIAGNOSIS. TARGETED TREATMENT. LASTING RESULTS.

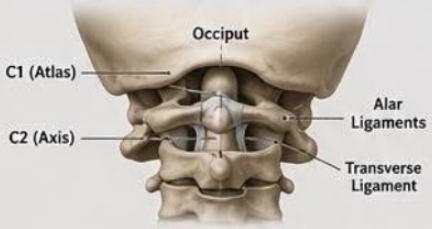
The cranium, atlas (C1), and axis (C2) work as a functional unit to protect the brainstem, support neurological function, and allow for dynamic motion.

When this system becomes unstable, it can impact the entire body.

CAUSES OF ATLANTO-AXIAL (AAI) & CRANIO-CERVICAL INSTABILITY (CCI)

- **Trauma** – Whiplash, MVC, sports injuries, falls, childbirth, physical abuse.
- **Microtrauma / Repetitive Stress** – Poor posture, chronic neck strain, heavy lifting, high-impact activities.
- **Connective Tissue Disorders** – Ehlers-Danlos Syndrome (EDS), Marfan Syndrome, etc.
- **Degenerative Changes** – Ligamentous laxity, facet joint degeneration, disc pathology.
- **Congenital Abnormalities** – Os odontoideum, Klippel-Feil, basilar invagination, transitional anomalies.
- **Iatrogenic / Post-Surgical** – Improper adjustments, surgical destabilization, excessive tissue removal.
- **Inflammatory / Autoimmune Conditions** – RA, lupus, ankylosing spondylitis, causing ligamentous attenuation.
- **Craniocervical Junction Abnormalities** – Chiari malformation, platybasia, syringomyelia.

THE UPPER CERVICAL COMPLEX



The transverse ligament stabilizes the dens against the anterior arch of C1.

The alar ligaments limit rotation and tilt.

When these structures are compromised, instability occurs.

SYMPTOMS OF AAI / CCI

- Chronic neck pain
- Headaches / Migraines
- Occipital neuralgia
- Dizziness / Vertigo
- Brain fog / Cognitive issues
- Visual disturbances
- Tinnitus / Ear fullness
- TMJ dysfunction
- Dysautonomia
- Heart rate variability
- Anxiety / Panic attacks
- Fatigue / Poor sleep
- POTS-like symptoms
- Facial pain / Numbness
- Difficulty swallowing
- Nausea
- Balance / Gait problems
- Numbness / Tingling in arms or hands
- Spasticity
- Bladder / Bowel dysfunction

THE VAGUS NERVE CONNECTION

The vagus nerve (CN X) exits the brainstem and innervates vital organs, influencing heart rate, digestion, inflammation, immune function, and emotional regulation. Compression or irritation at the cranio-cervical junction can contribute to dysautonomia, POTS, GI issues, anxiety, and more.

ADVANCED DIAGNOSTIC IMAGING: IDENTIFYING INSTABILITY WHERE OTHERS MISS IT

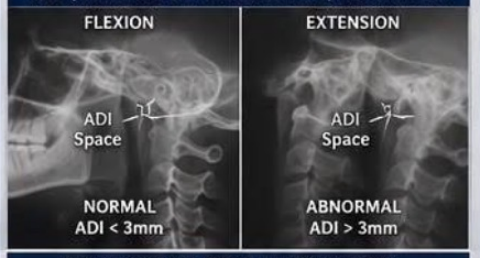
Upper cervical instability is dynamic. Static imaging alone can miss the diagnosis. These 3 advanced modalities reveal what truly matters.

1 DIGITAL MOTION X-RAY (DMX)

FUNCTIONAL. DYNAMIC. ESSENTIAL.

DMX captures real-time motion in flexion, extension, and lateral bending, allowing us to evaluate instability under physiologic load.

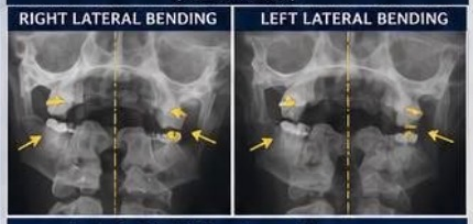
ADI (ANTERIOR DENTAL INTERVAL) ASSESSMENT



PATHOLOGIC ADI SPACE ABNORMALITIES

- Increased ADI in flexion or extension indicates transverse ligament incompetence.
- Indicates potential for spinal cord or brainstem compression during motion.
- May also see facet gapping, subluxation, or abnormal translation of C1 on C2.

LATERAL BENDING – OPEN MOUTH VIEWS (OVERHANGS)



Look for C1–C2 Overhang > 2mm

Overhang indicates lateral instability and potential for cerebellar or brainstem compression.

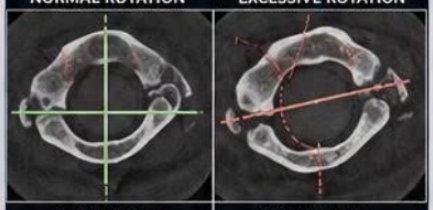
2 SUPINE ROTATIONAL CT (SRCT)

BONE. ROTATION. PRECISION.

SRCT is the gold standard for evaluating rotational instability of C1 on C2 without interference from muscle guarding or patient positioning limitations.

C1–C2 ROTATIONAL ANALYSIS

AXIAL CUT THROUGH C1–C2



< 16° Rotation (Within Normal Limits)	> 16° Rotation (Pathologic)

Normal rotation of C1 on C2 is < 16°.
> 16° suggests rotational instability.

OTHER SRCT OBSERVATIONS

- Facet joint asymmetry or subluxation
- Lateral mass overhang
- Posterior element translation
- Odontoid position and integrity
- Helps differentiate true bony rotation from positional artifacts

WHY THESE MODALITIES MATTER

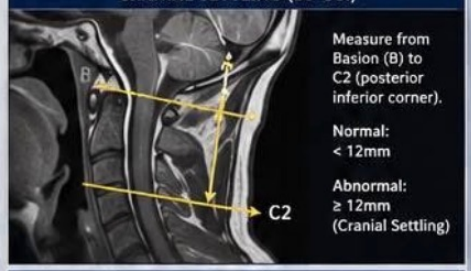
- Detect instability in multiple planes (sagittal, coronal, axial)
- Reveal dynamic pathologies not seen on static imaging
- Guide precise, individualized, non-surgical or surgical treatment plans
- Improve outcomes by addressing the true cause, not just the symptoms

3 UPRIGHT MRI

SOFT TISSUE. GRAVITY. FUNCTION.

Upright MRI allows us to assses the cranio-cervical junction in a weight-bearing position, revealing instability and neural compromise.

CRANIAL SETTLING (BS-CCI)



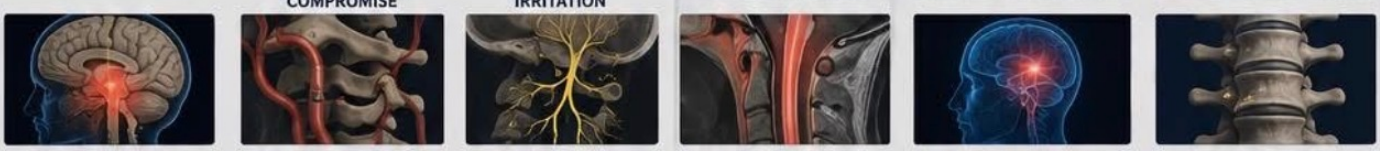
FLEXION / EXTENSION MRI

EVALUATE INSTABILITY & NEURAL COMPROMISE

Observe for:

- Anterior or posterior translation of C1 on C2
- Brainstem or spinal cord compression
- Effacement of CSF space
- Tethered cord / Syrinx
- Chiari malformation / Peg-like tonsils
- Disc herniation or retro-odontoid pannus

PATHOLOGIES & CONSEQUENCES OF UNDIAGNOSED INSTABILITY



BRAINSTEM COMPRESSION	VERTEBRAL ARTERY COMPROMISE	VAGUS NERVE IRRITATION	SPINAL CORD INJURY	CHRONIC PAIN SYNDROME	PROGRESSIVE DEGENERATION
May lead to autonomic dysfunction, respiratory irregularities, and neurological deficits.	Can result in dizziness, syncope, visual disturbances, and stroke-like symptoms.	Associated with POTS, GI dysfunction, anxiety, depression, heart rate variability, and more.	Even without major trauma, instability can cause chronic microtrauma and neurological decline.	Persistent pain, fatigue, and reduced quality of life often result from mechanical instability and inflammation.	Untreated instability can lead to accelerated degeneration and irreversible damage.

Cameron Hatam

Cameron Hatam DC - Specializing in diagnosing, treating, and researching upper cervical instability.