drscholten@vitalposture.com

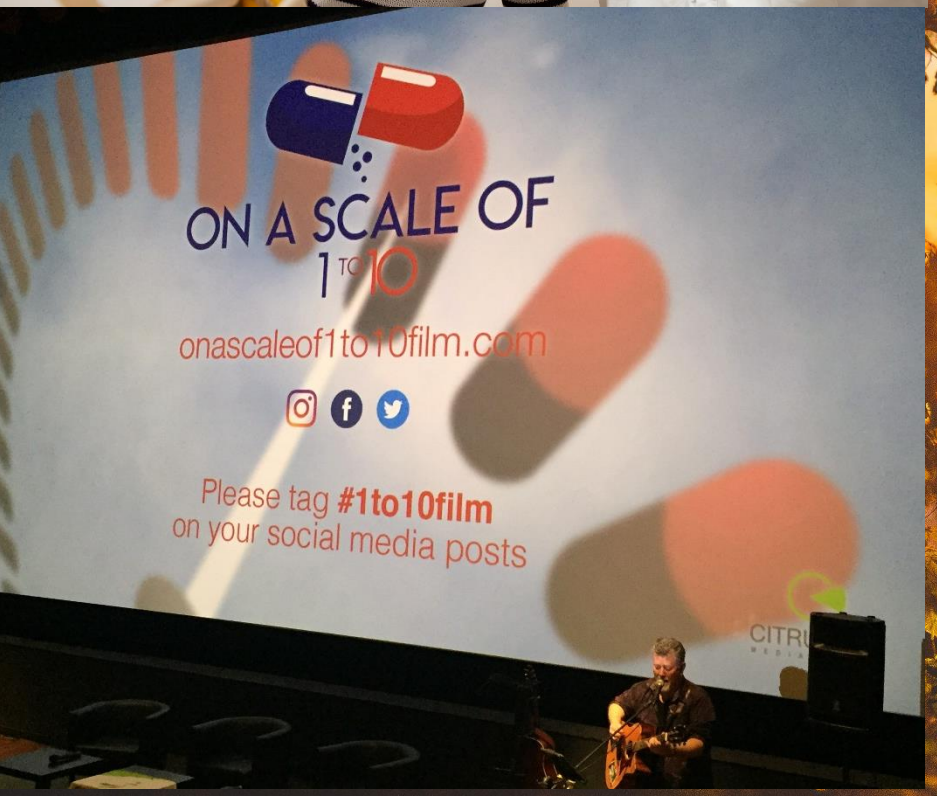
DC, DCCJP, FCCJP, BSc(kin), PgCPain

est. 2006

iPain

International Pain Foundation

International Pain Summit 2019 NERVEmber 14 - 16 Los Angeles, CA


ON A SCALE OF
1 TO 10
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Please tag #1to10film
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Conflict of Interest

LIFE CHIROPRACTIC COLLEGE WEST

Express your potential

I have no financial interest in the subject matter or materials discussed in this presentation.

NUCCA®

National Upper Cervical Chiropractic Association

ICA COUNCIL ON UPPER CERVICAL CARE

Least Potential Energy position

Do we stand on our bones?

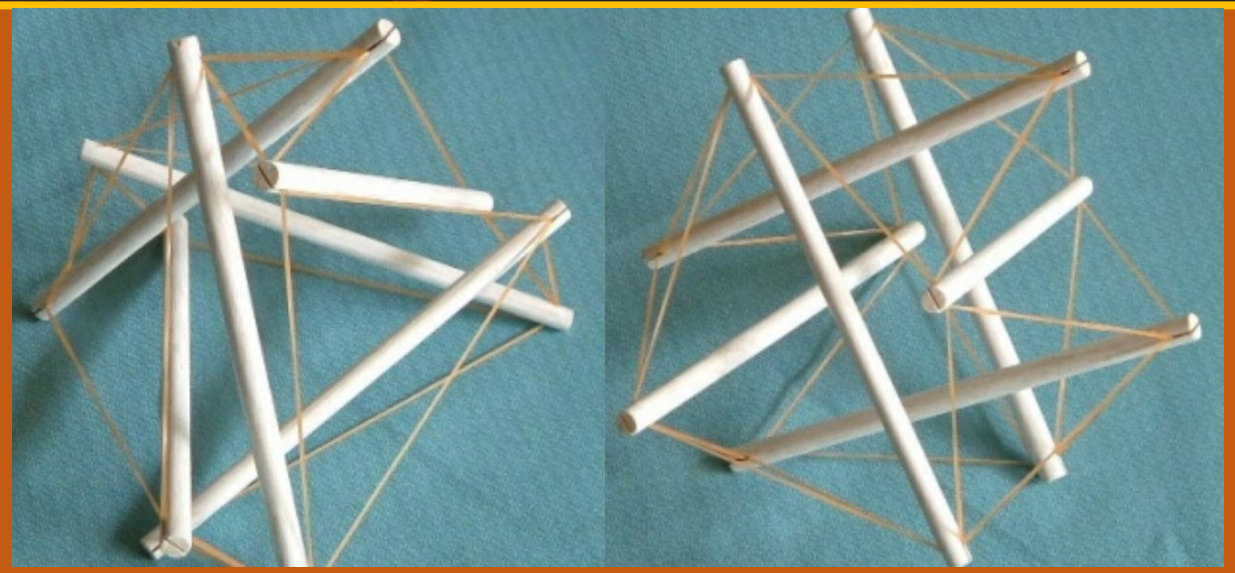
Tensegrity

Contiguous tension with isolated zones of compression

How a human stands

Least Potential Energy position

Shear is the enemy!



http://www1.ttcn.ne.jp/a-nishi/tensegrity/z_tensegrity.html

Do you care about Posture? How do you measure it?

Static vs Dynamic

Dynamic is the rule

sway speed, deviation considerations

Static is never truly static – so how can you measure

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COLLEGE WEST
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Clinical Research

IEEE ICCI*CC 2019 | APDM Wearable Technologies

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APDM WEARABLE TECHNOLOGIES

ABOUT | WEARABLE SENSORS | GAIT & BALANCE | KINEMATICS | CONTINUOUS RECORDING | CONTACT | SUPPORT

Your gait and balance solution

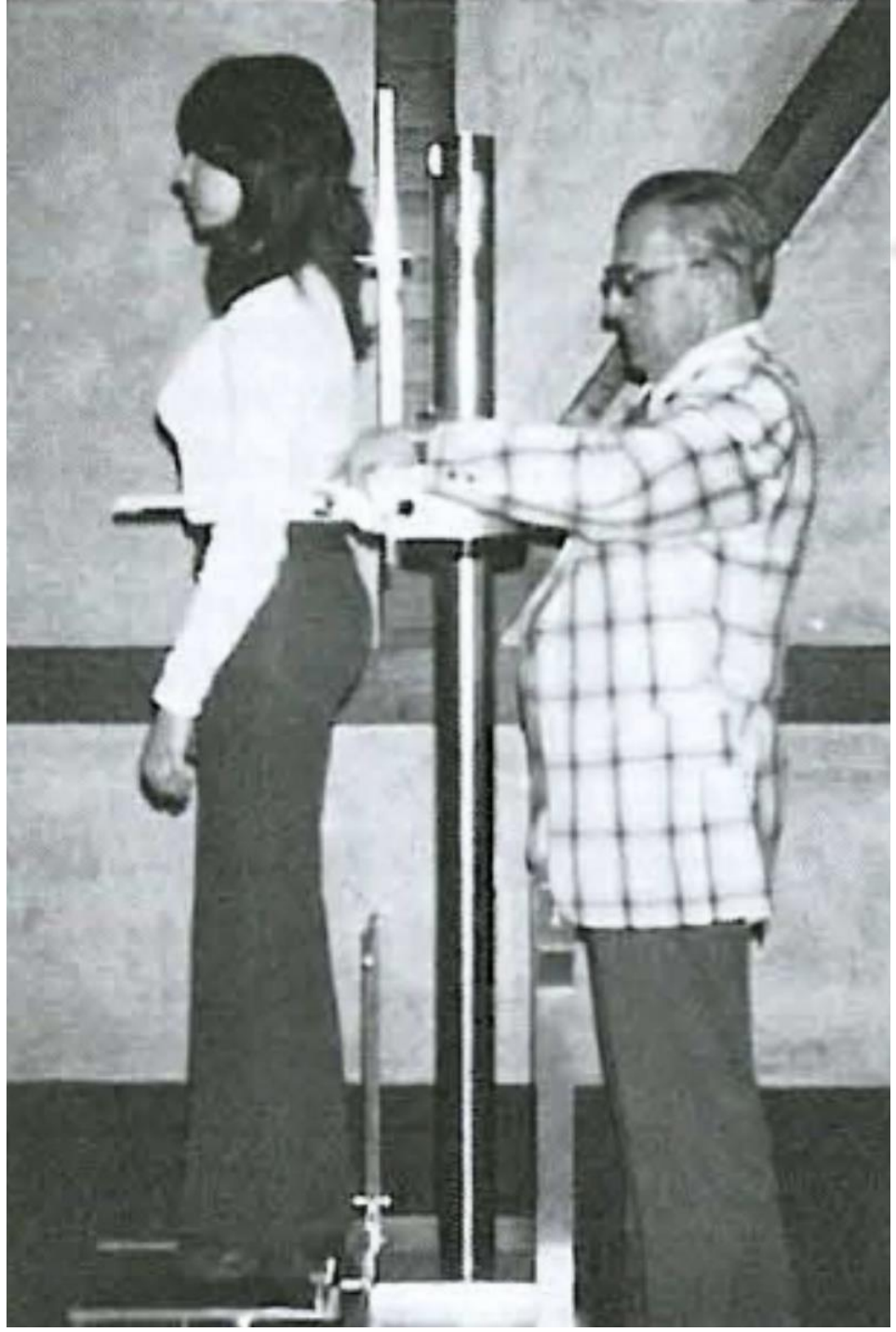
MOBILITY LAB

now being used in pharmaceutical clinical trials

LEARN MORE

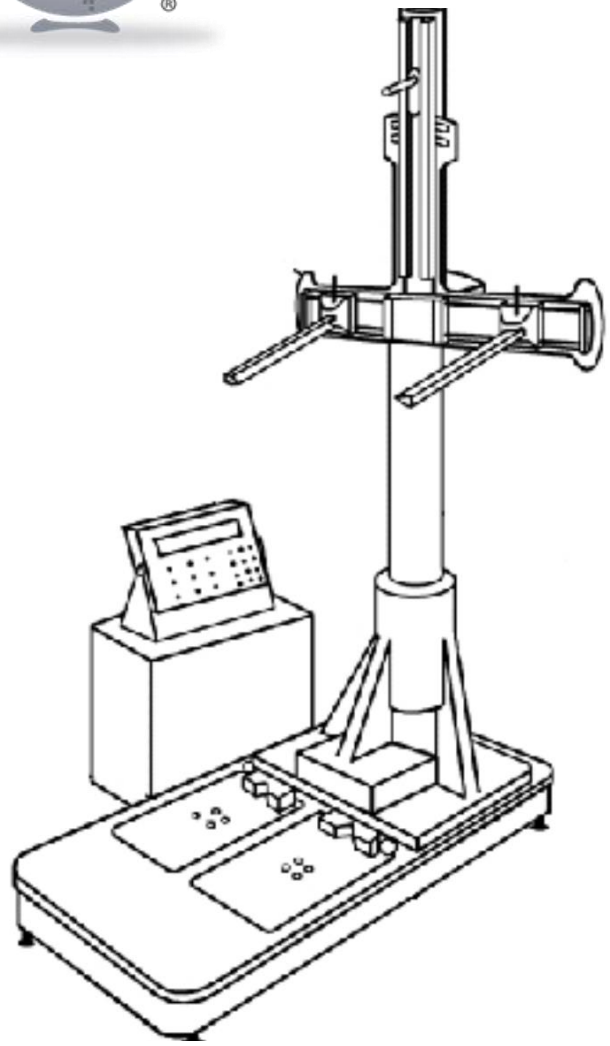
Start

8:49 PM



NUCCA

National Upper Cervical Chiropractic Association



Kalman Filter-Based Noise Reduction Framework for Posture Estimation Using Depth Sensor

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National Upper Cervical Chiropractic Association

UPPER CERVICAL RESEARCH FOUNDATION

In Eq. 7, M is the polynomial order, and a_k is the set of coefficients of the polynomial that must be approximated. Therefore, the overall objective is to minimize Eq. 8 as described in paper [30].

$$\begin{aligned} \xi_i &= \sum_{i=-N}^{N} (p(n) - y_i)^2 \\ &= \sum_{i=-N}^{N} (\sum_{k=0}^{M} a_k n^k - y_i)^2 \end{aligned} \tag{8}$$

where, N is the width of the approximation interval and N is less than or equal to $2M$.

D. Posture correction algorithm

Although smoothing filters alone significantly reduced the amount of random noise present in the motion capture data, there were still inconsistencies in the estimation of the skeleton

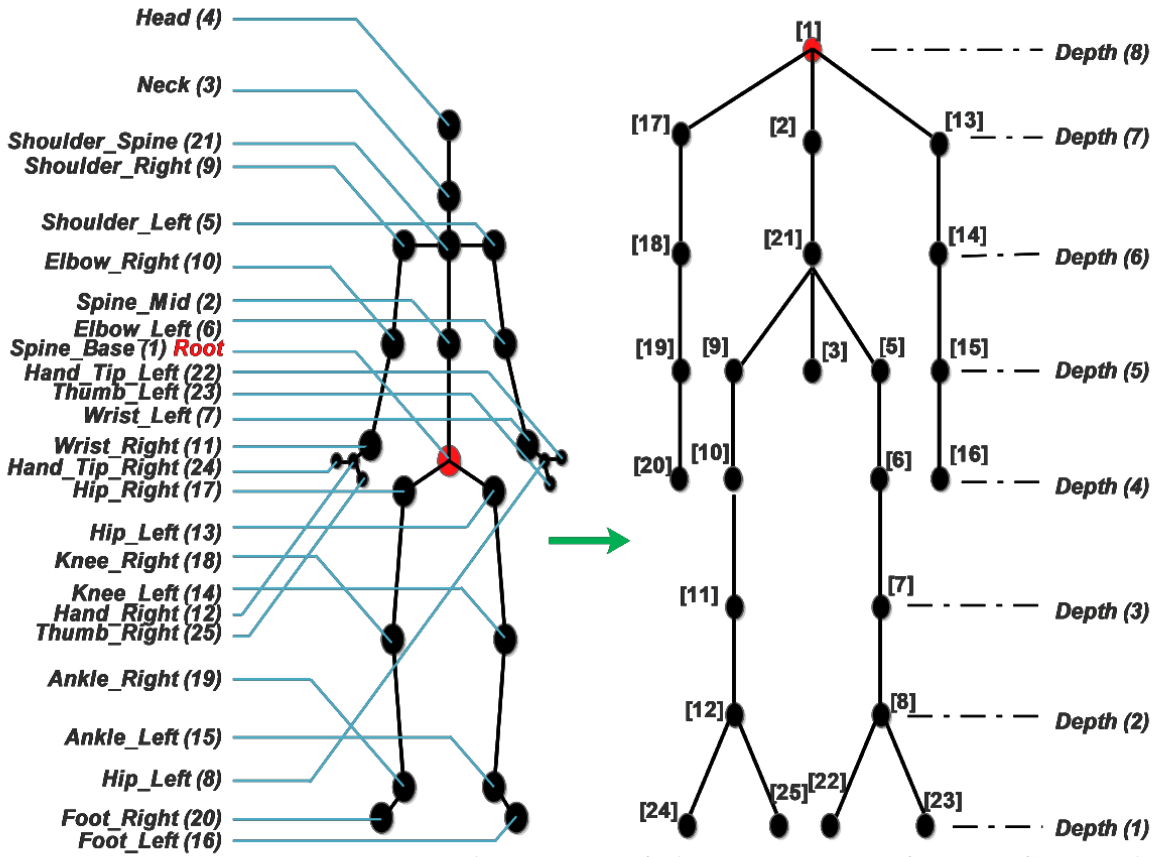

Fig. 2: Conversion of a skeleton model into an undirected acyclic graph.

Increased Moments of Force

Average weight of the human head 12 lbs (8-16 lbs)

FHP

Increased Moments of Force

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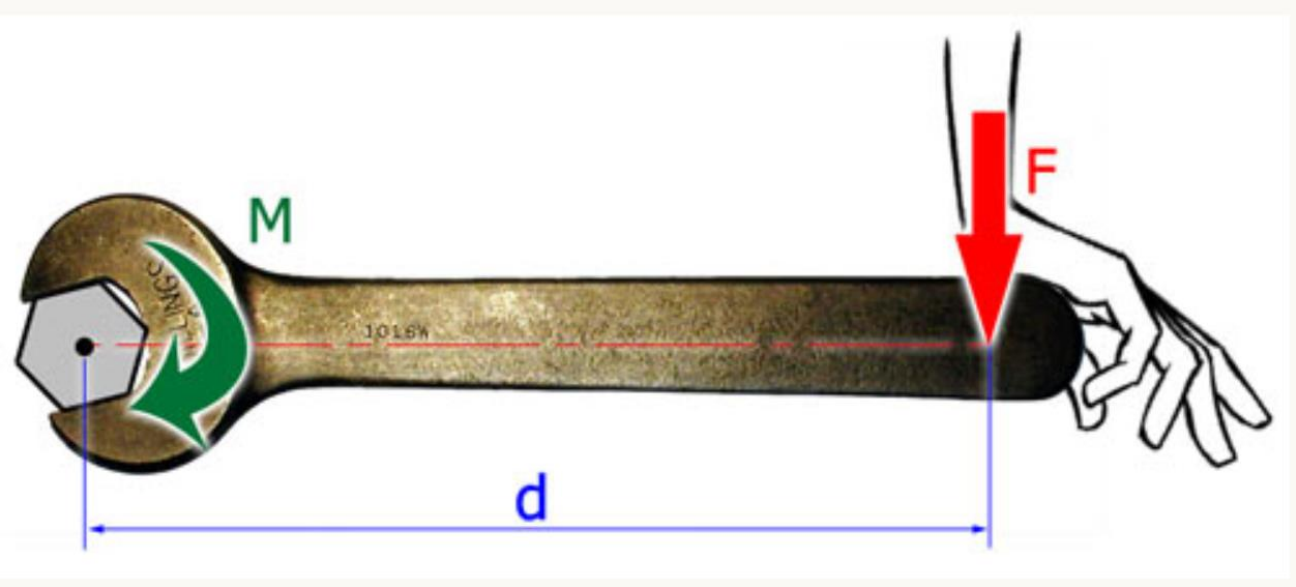
Increased lordosis in cervical spine as a function of **T1** anteroflexion (thoracic kyphosis)

Increased lordosis in lumbar spine as a function of **sacral base** angle



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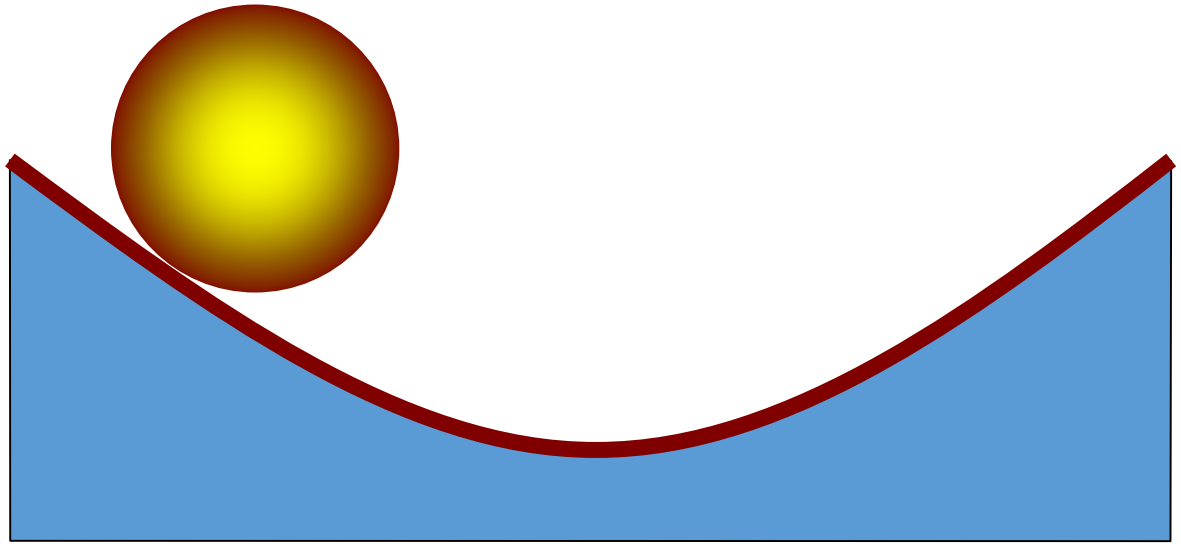

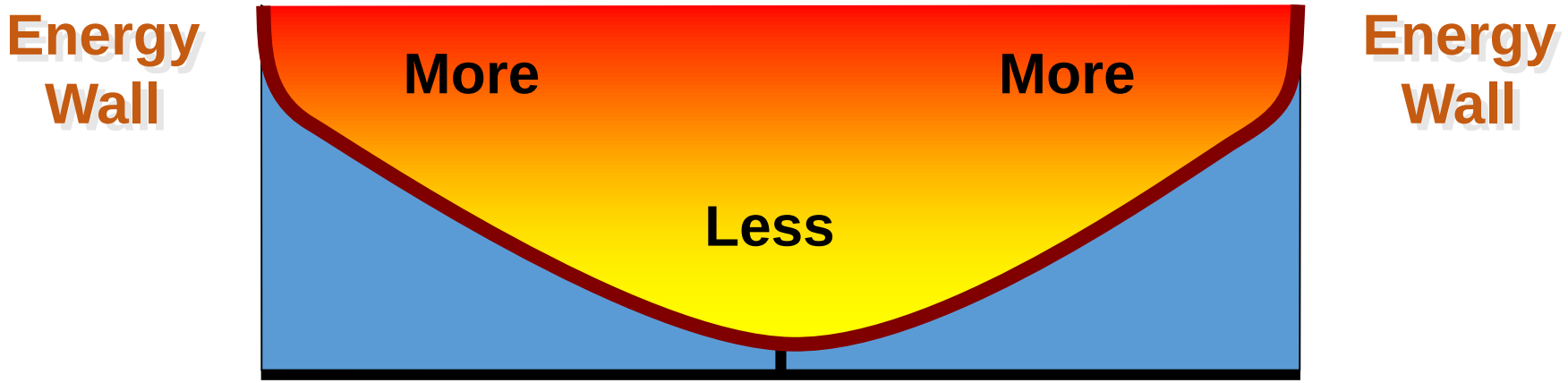

Moving away cost more…

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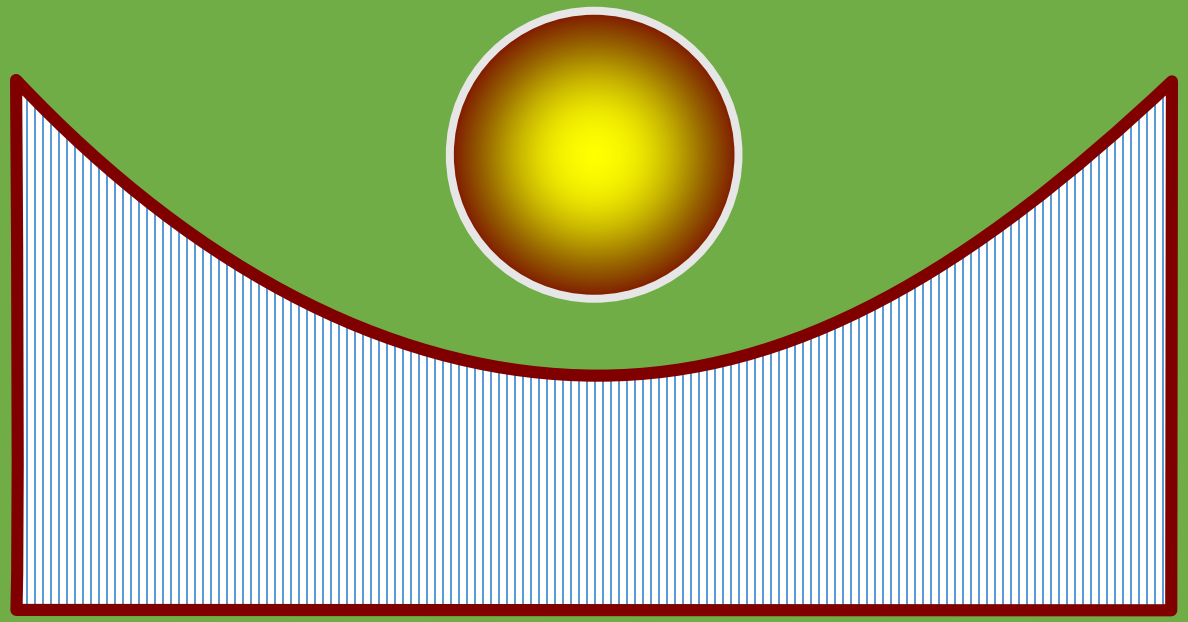
Material will deform

Collagen will stretch



Soft tissue deformation - Creep, Hysteresis

- Creep – soft tissue elongation over time under load
- Hysteresis – the amount of elongation the tissue will maintain

- A muscle held under slight tension for 20-40 minutes will take 24-48 hours to return to its previous length

- Elastic vs contractile elements of muscle

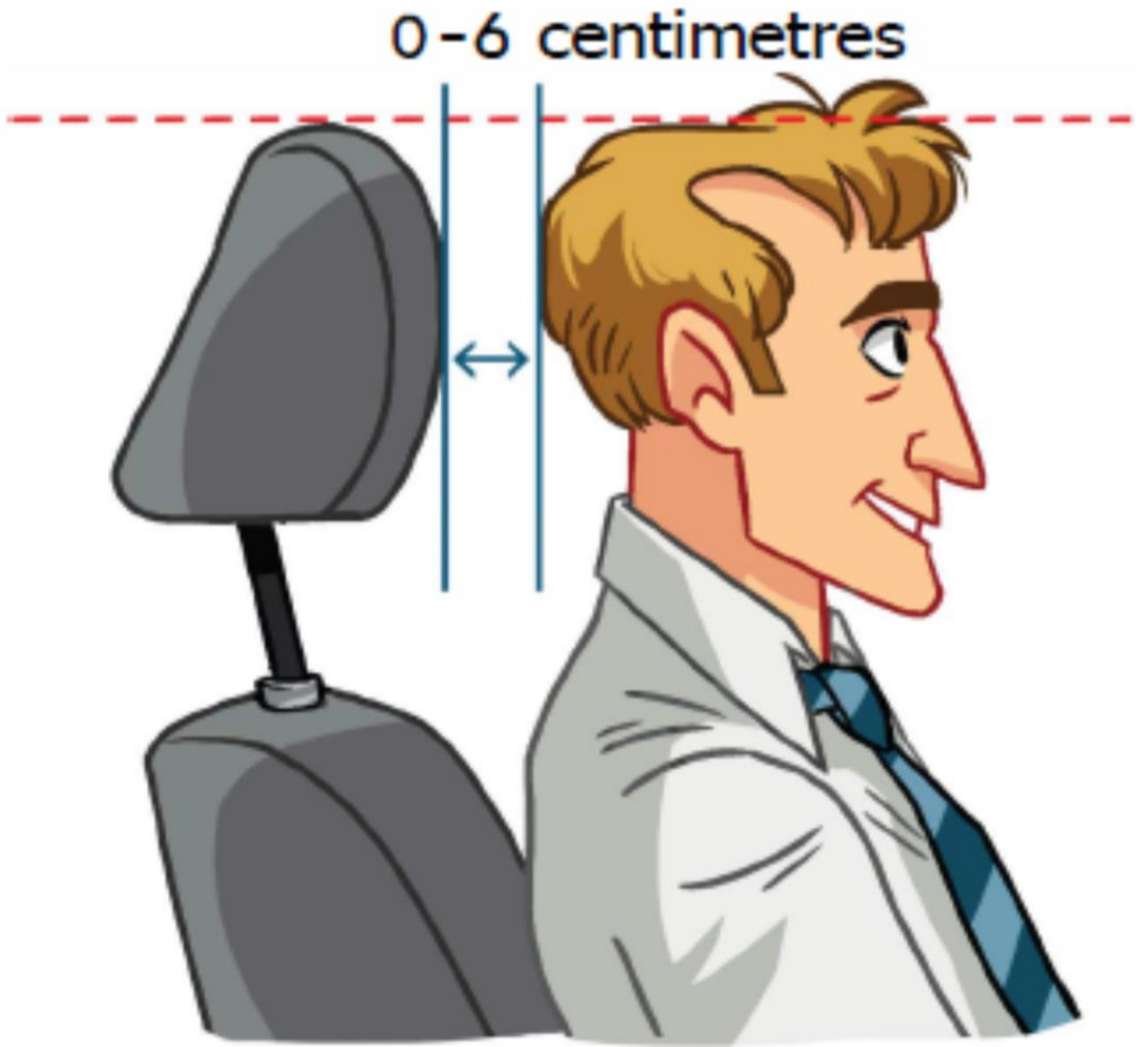
Whiplash

Compression, Tension, Sheer all within 50-120 milliseconds.

“A 10 mile/hour collision is equivalent to catching a 200 lb bag of cement dropped from a second story window.”

Dr Scott Rosa

Protect Yourself With These Easy Steps:



- The centre of the headrest should be slightly above the top of the ear.
- The top of the headrest should be at least as high as the top of the head.
- Ideally, the distance between the headrest and the back of the head should be less than 6 centimetres.

70% of people injured in collisions each year report a soft tissue injury such as whiplash.

Are you protected?

Pay it Ahead Rest

Pay it forward with us and spread the word to your family and friends.

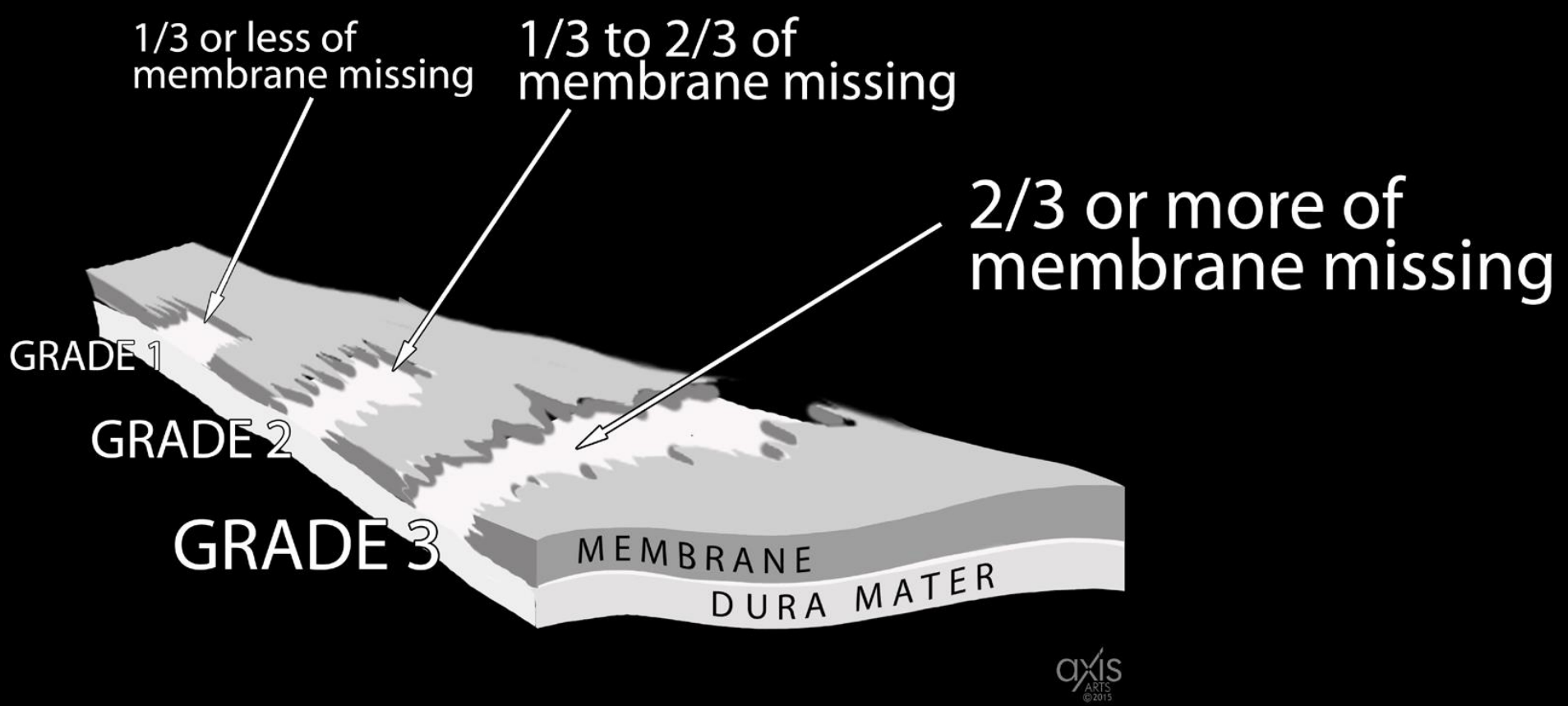
Whiplash Considerations

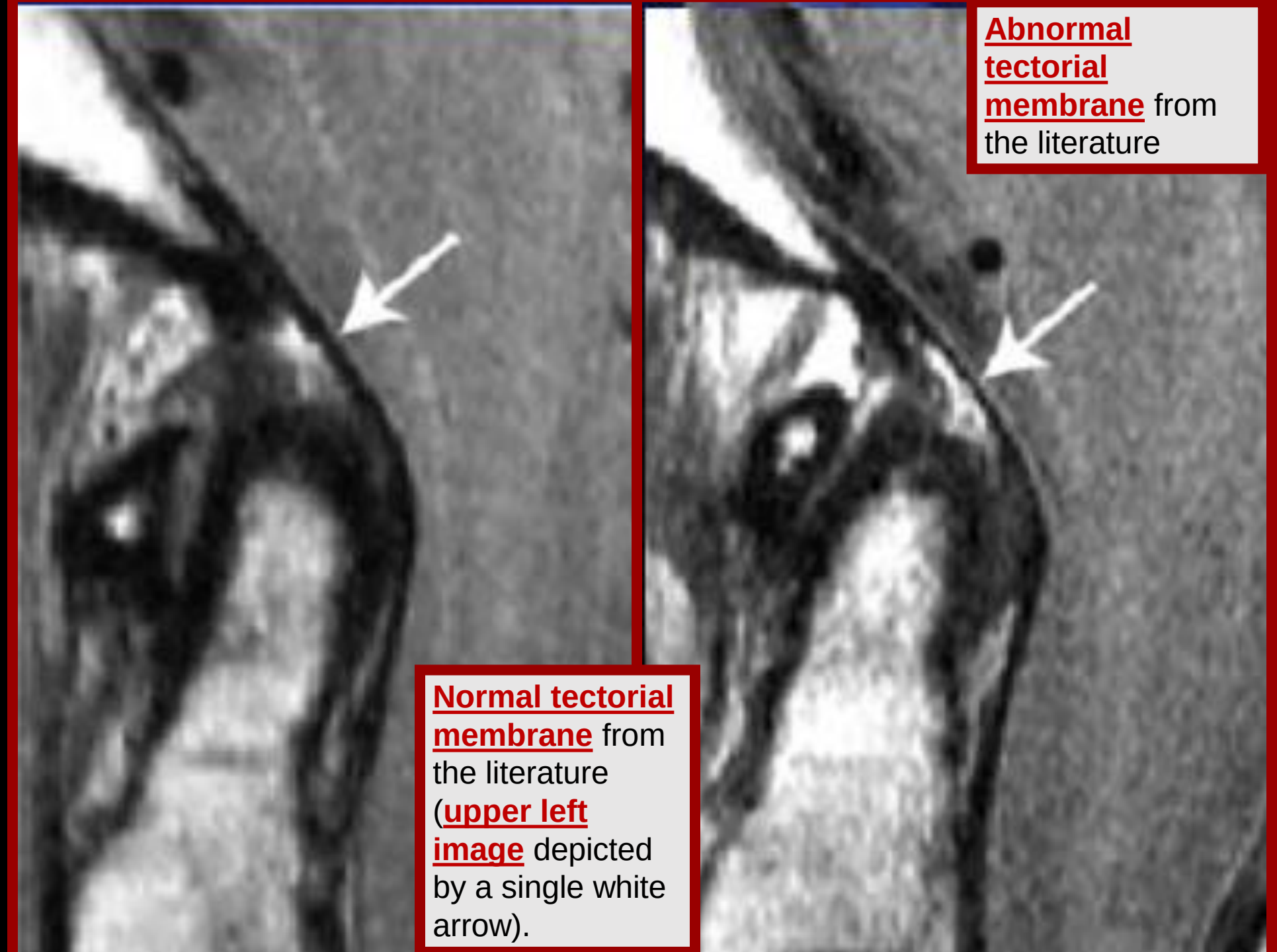
Ligaments

The ability, under physiologic loads, to limit patterns of displacement so as not to damage or irritate the spinal cord or nerve roots.

Newton’s of resistance

INJURY CLASSIFICATIONS





Abnormal tectorial membrane from the literature

Normal tectorial membrane from the literature (**upper left image** depicted by a single white arrow).

Beighton’s score

Joint Hypermobility

9-point scale

The joints assessed are:

1. Knuckle of the little/fifth/pinky finger
2. Base of the thumb
3. Elbow
4. Knee
5. Spine

Connective Tissue Disorder

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Whiplash Considerations

Radiologists tend to opine on pathological processes where as we consider biomechanical aberrancies

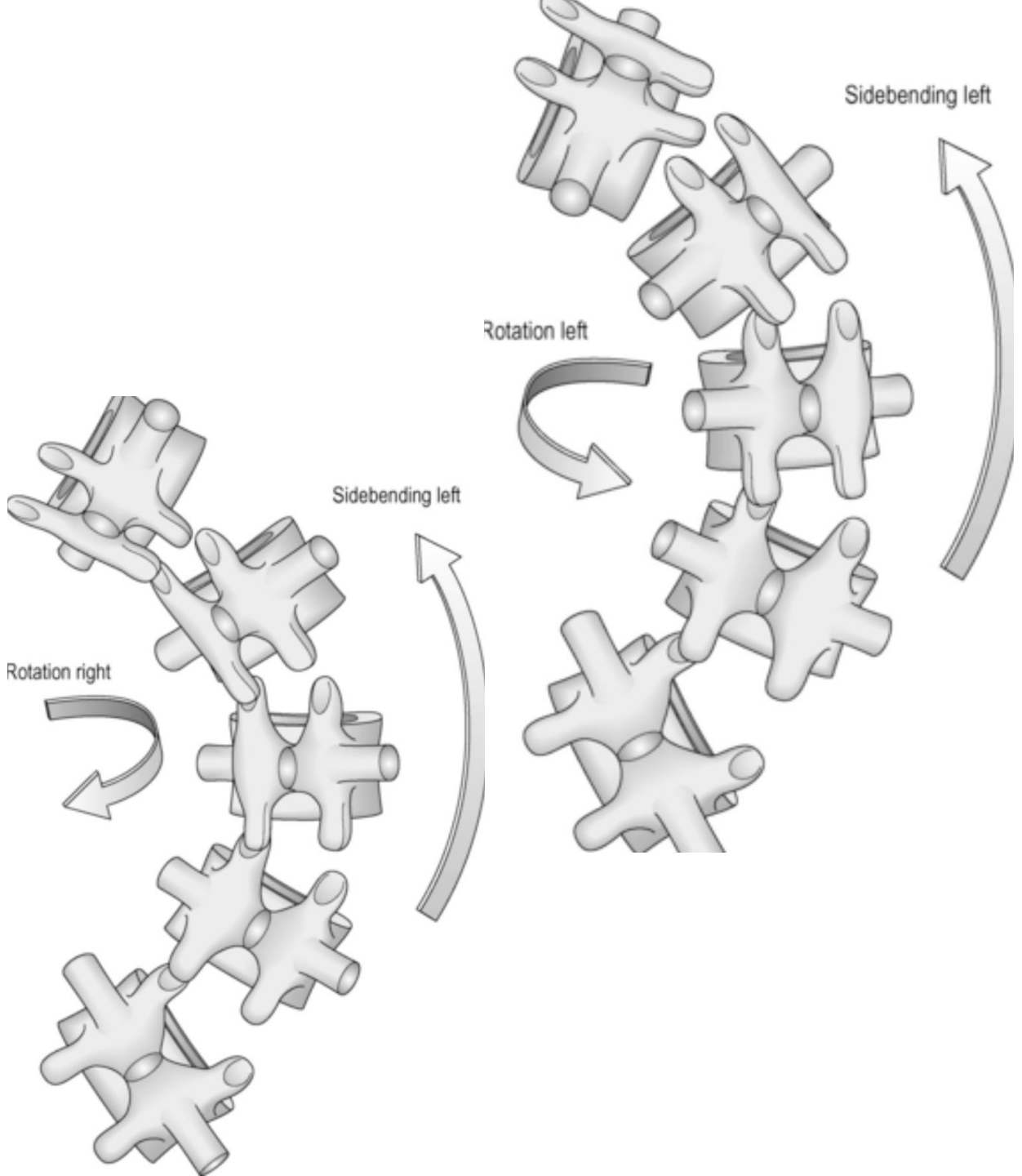
Coupled motion disturbances

est. 2006 IPAIN International Pain Foundation

Coupled motion

Motion about multiple axes that reduce stress in each other

Lack of appropriately coupled motion is **difficult to adapt to** both biomechanically and neurologically.



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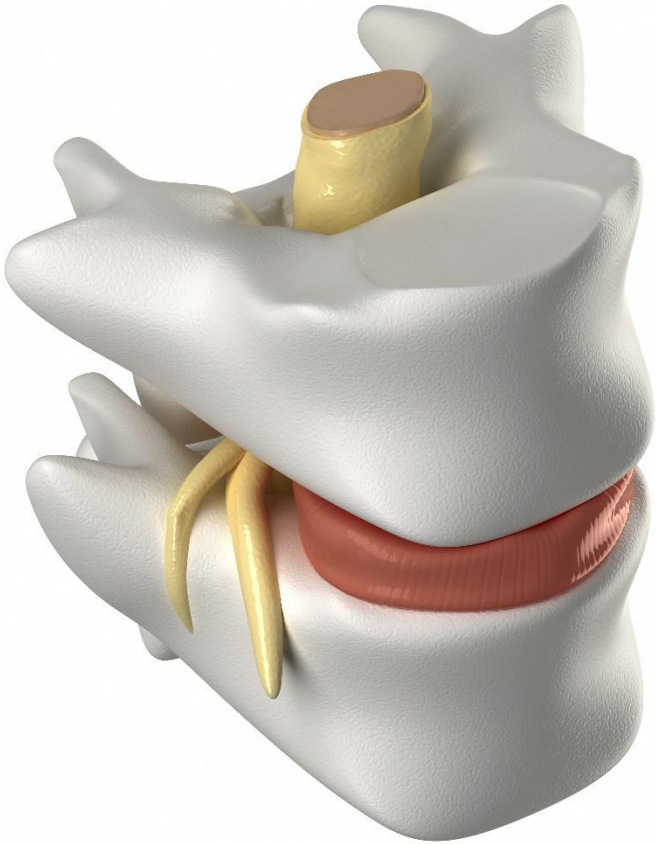
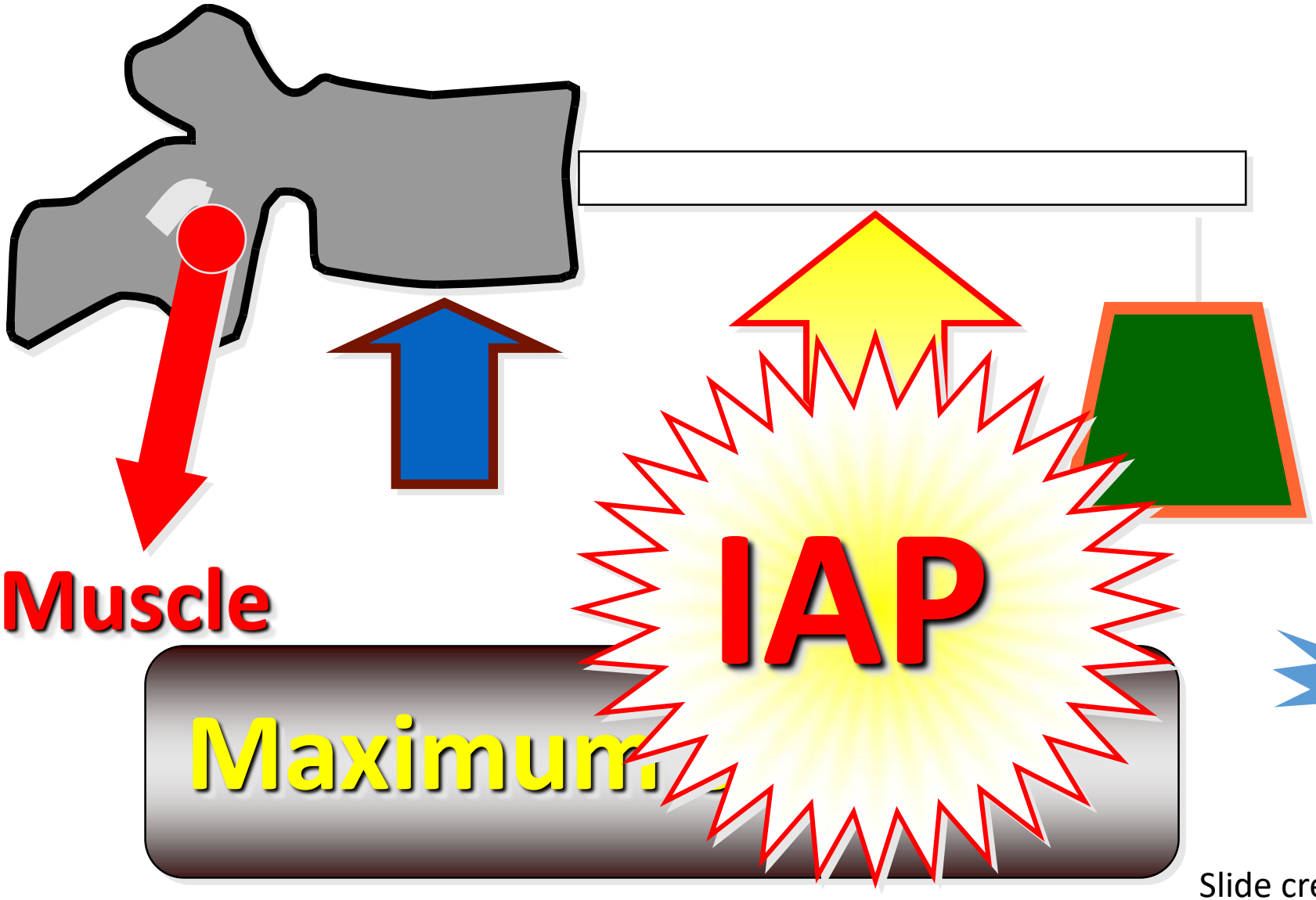
Instantaneous Axis of Rotation



Osteoarthritis is inherently caused by biomechanical dysfunction in joints caused by ligamentous insufficiency induced disruption of the instantaneous axis of rotation (IAR- motion) for each position.

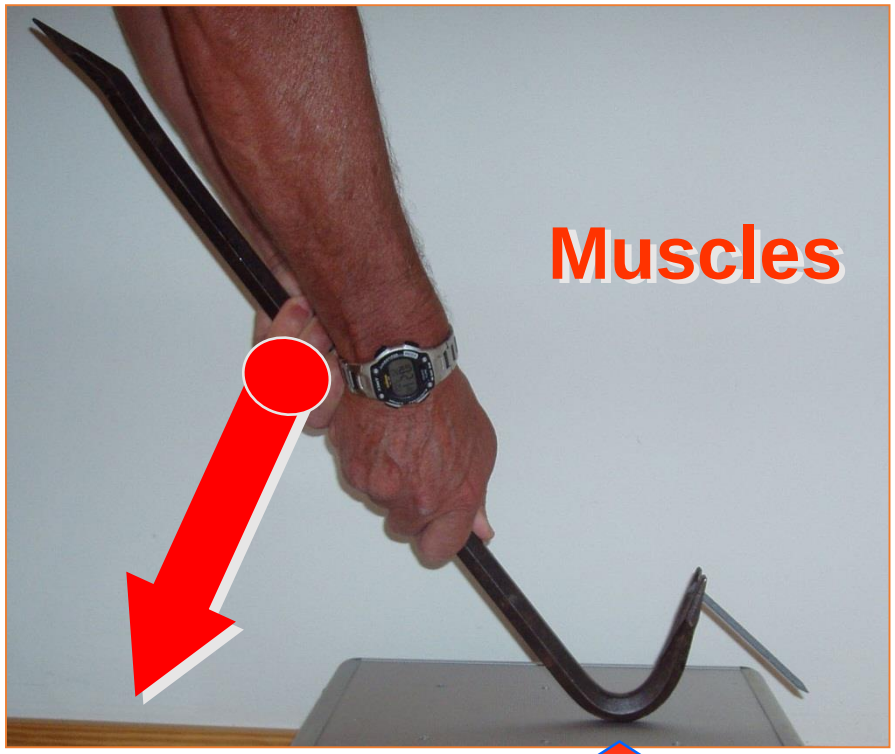
David Harshfield



Slide credit David Harshfield

The Crowbar

Shut down muscles to minimize stress

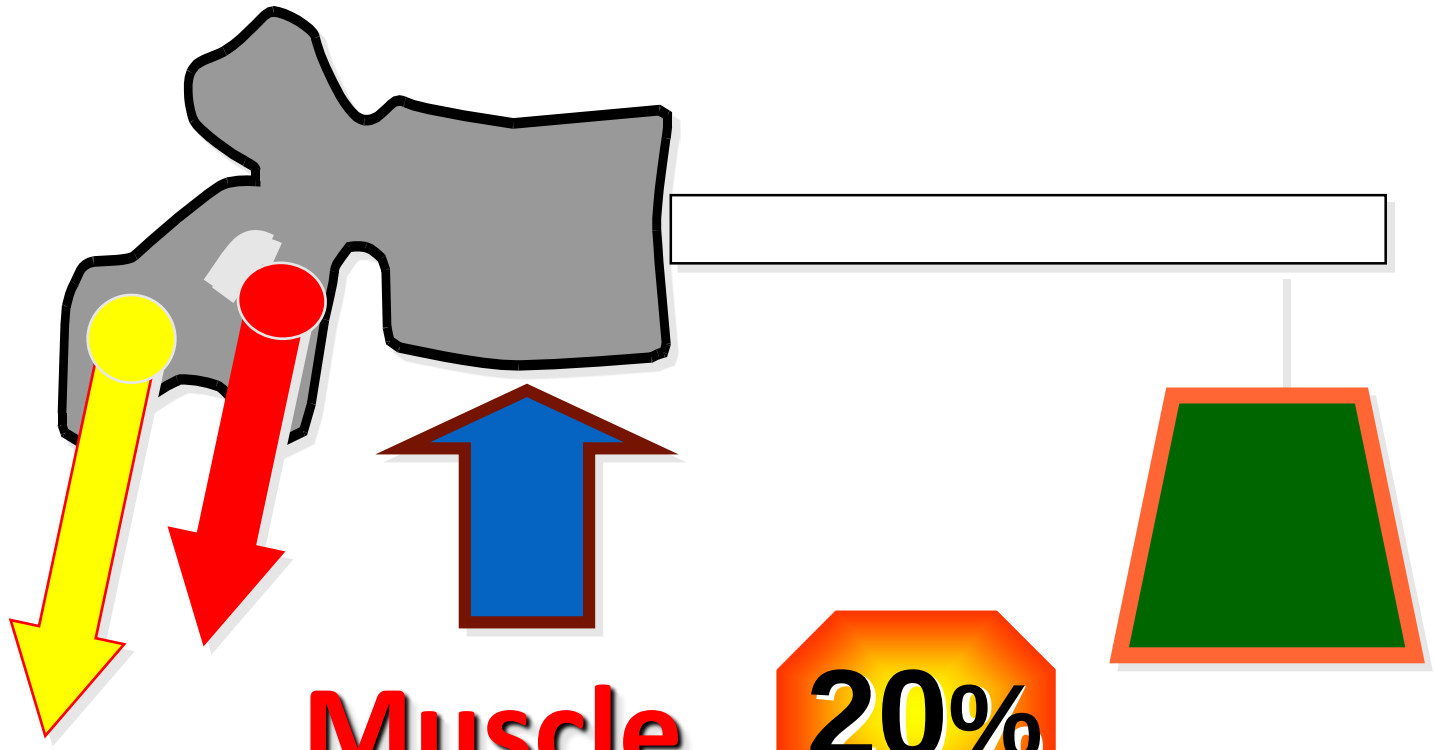


Less
(Compression)

More
(Compression)

Click

Slide credit David Harshfield

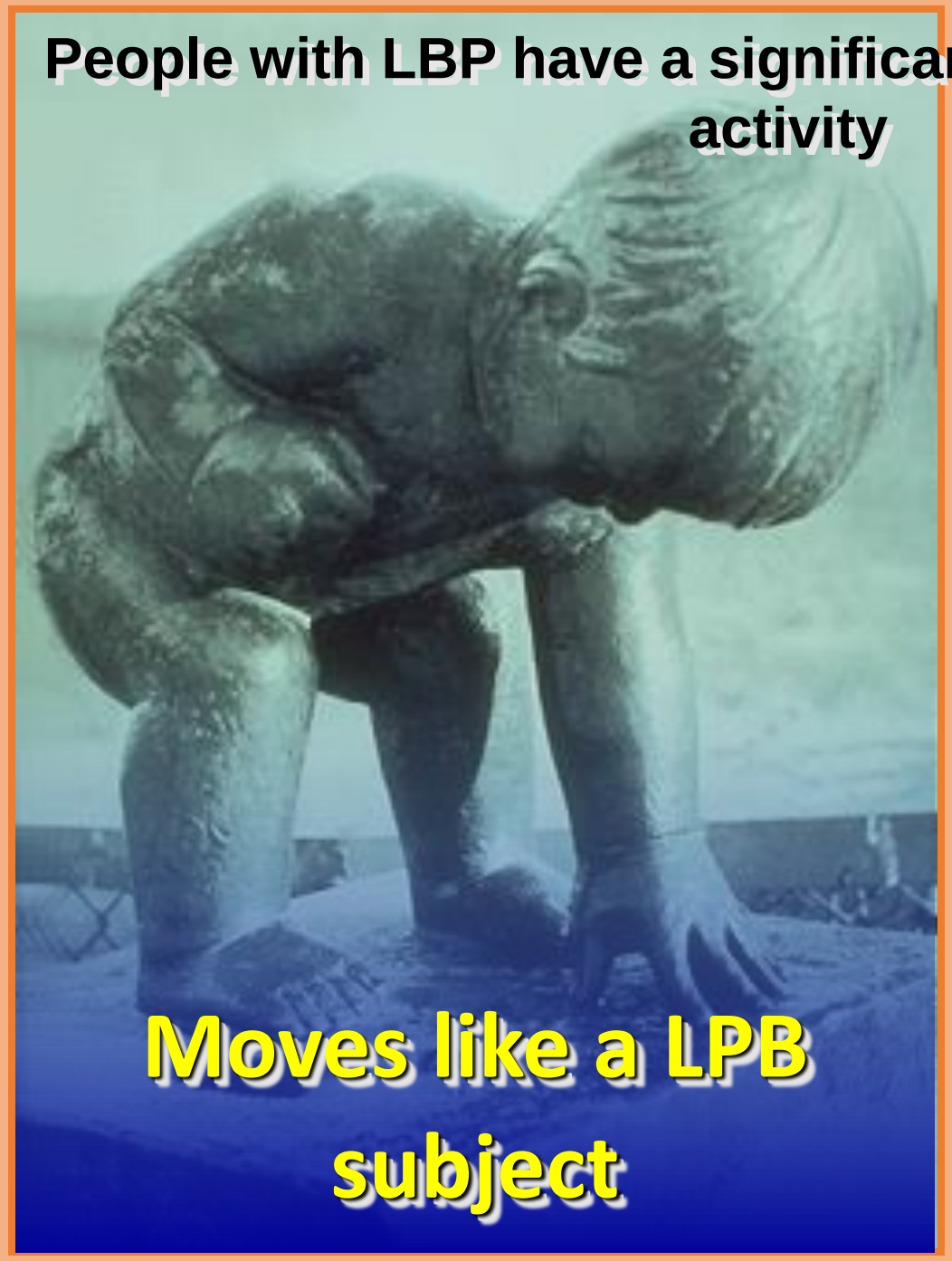


Muscle 20%

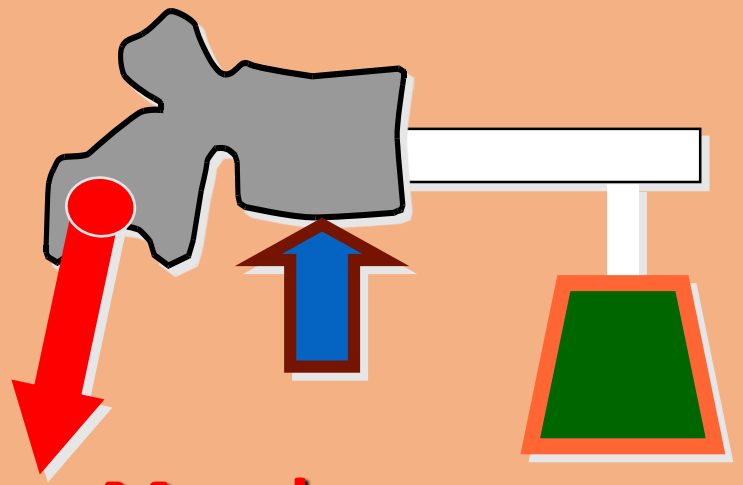
Fascia 80%

Slide credit David Harshfield

People with LBP have a significant increase in muscle activity



Immature fascia

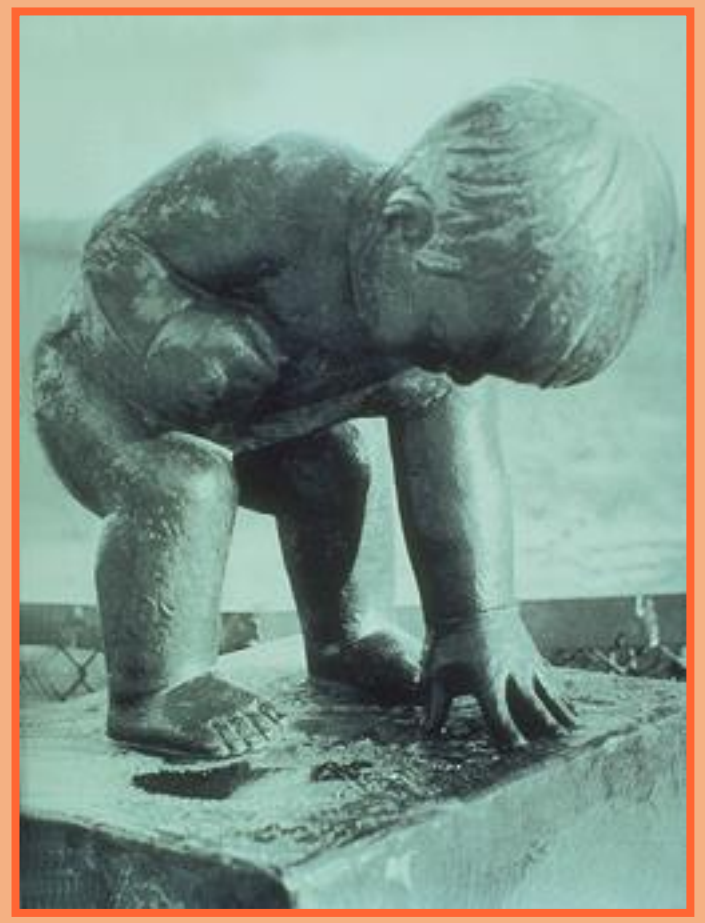


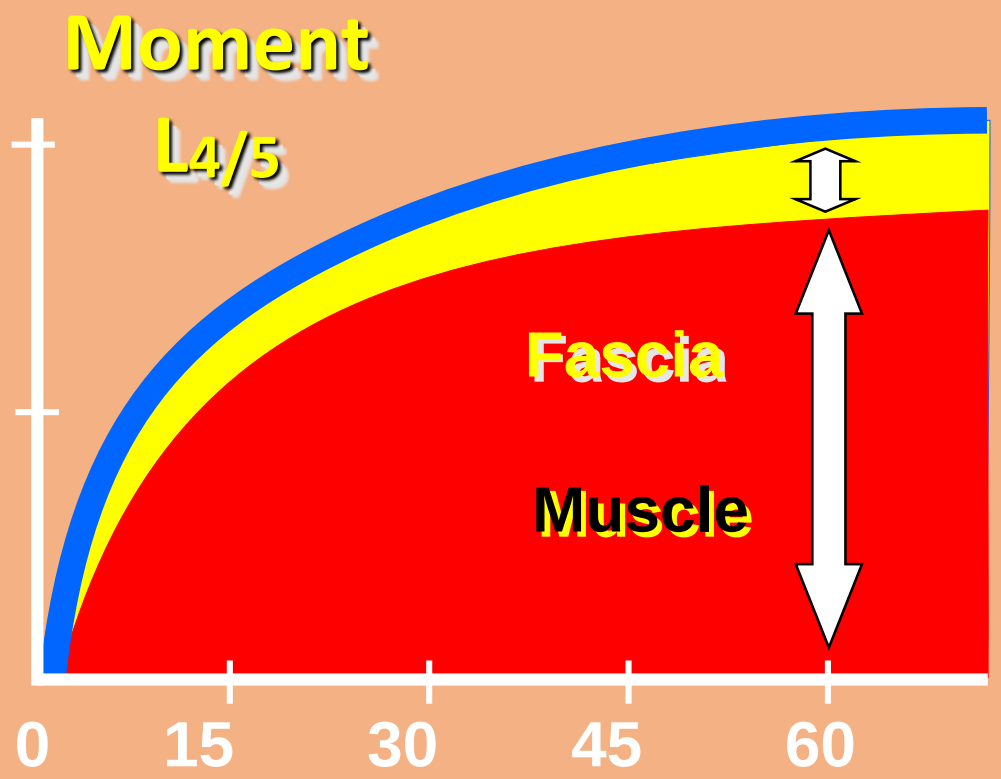
Muscle

Click

Slide credit David Harshfield

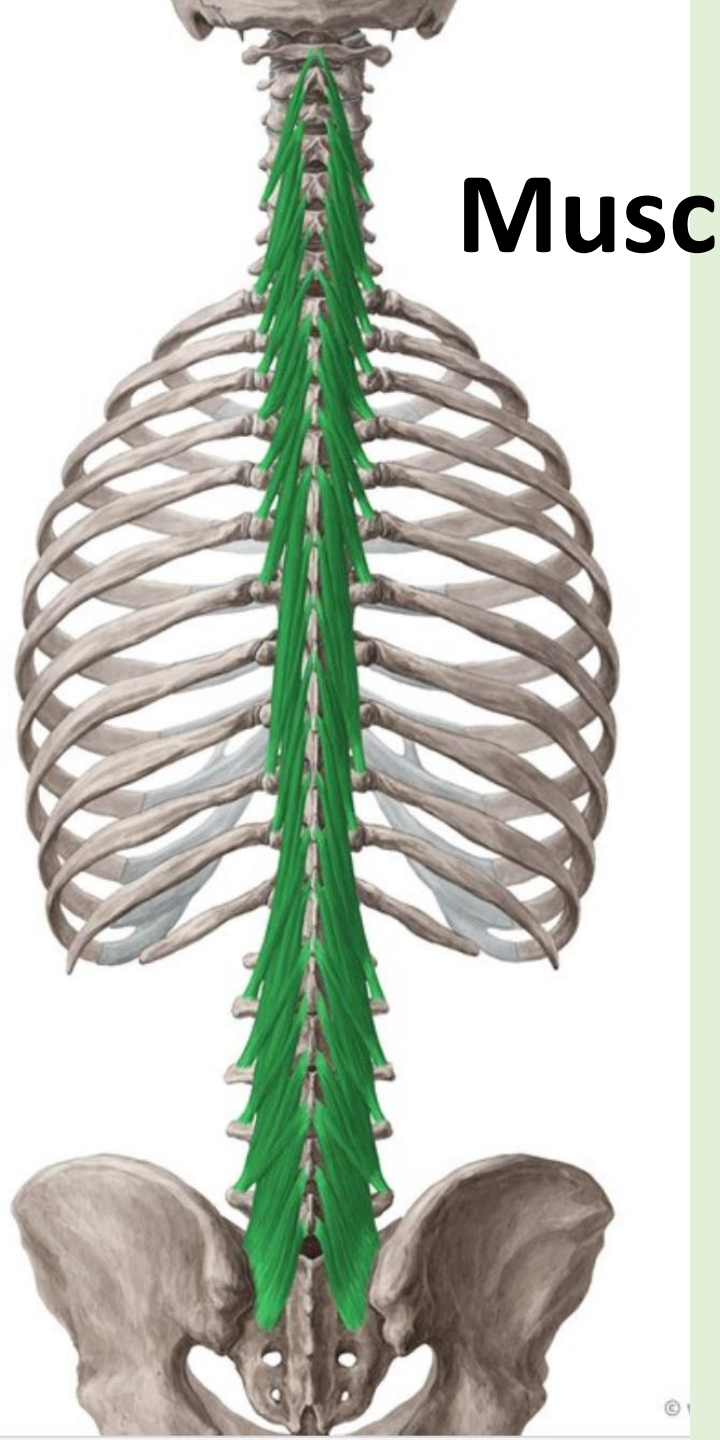
Coordination spine / pelvis





Changes – resting length, tone, NM control

- What influences levels of muscle tone?
  - Active (isotonic concentric)
  - Habitual (isotonic eccentric)
  - Reflexive (isometric)



Muscular Reactivation

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4 layers

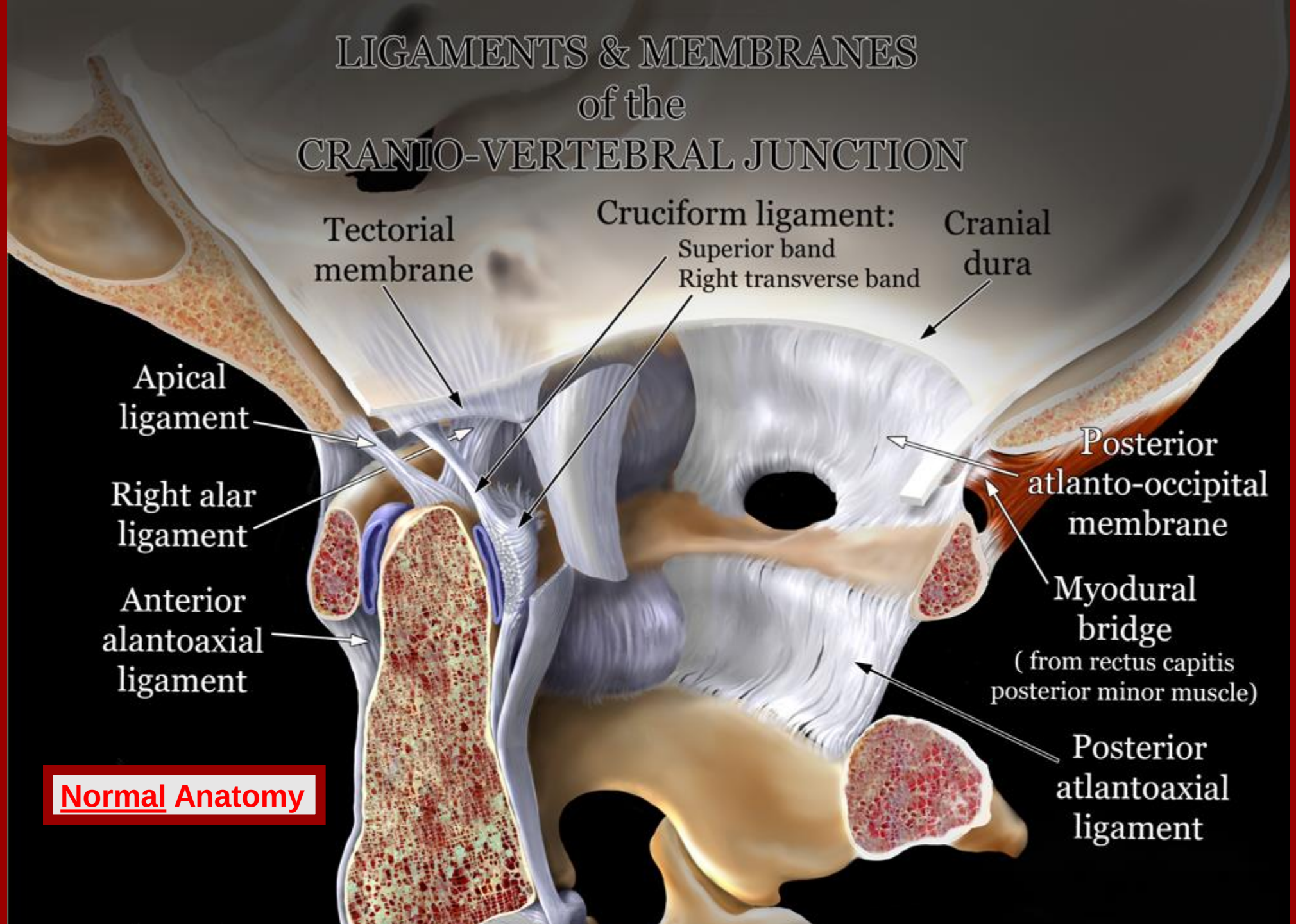
- Deepest layer contains multifidus (rotator(s) brevis, longus, & semispinalis)

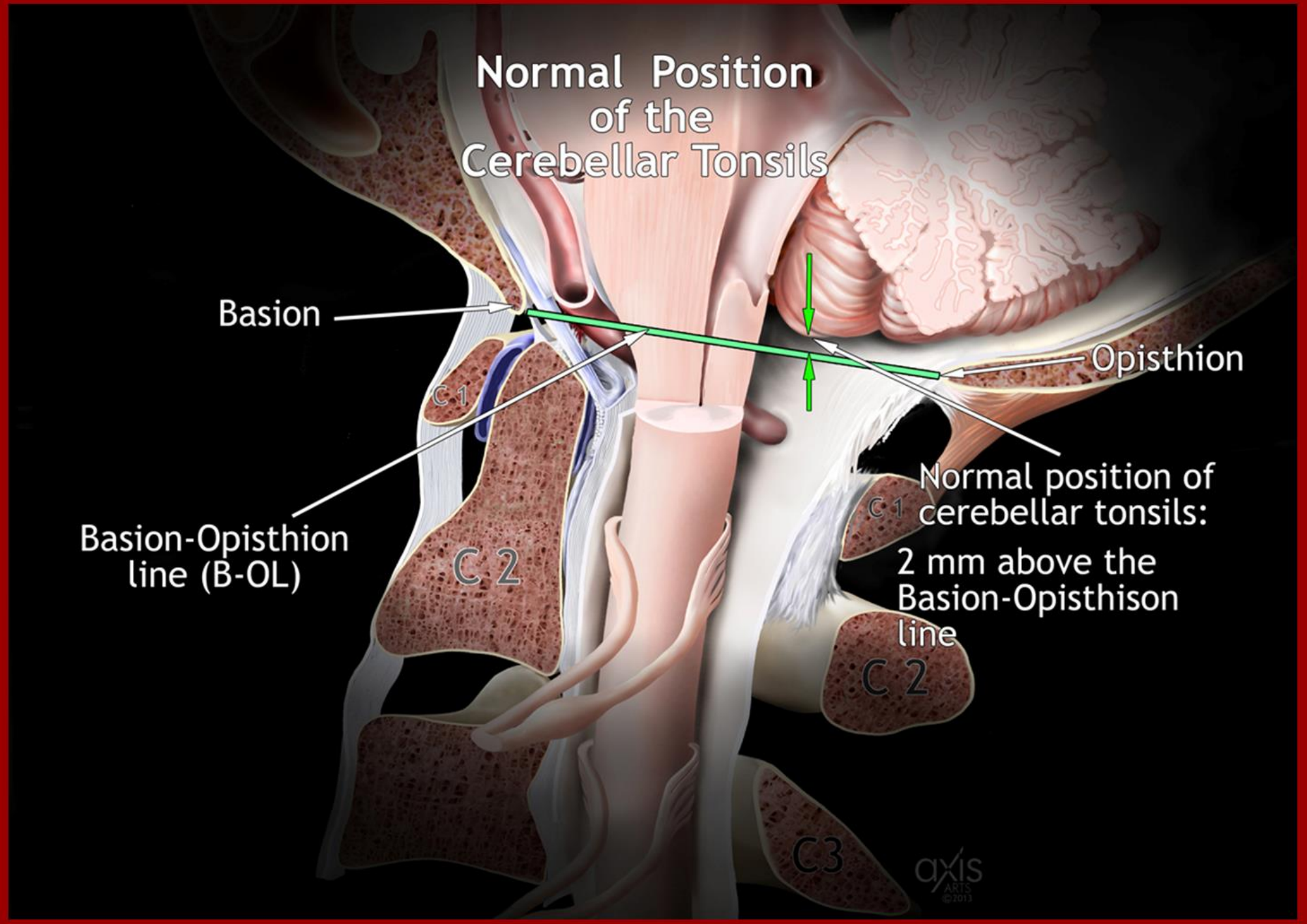
3 K

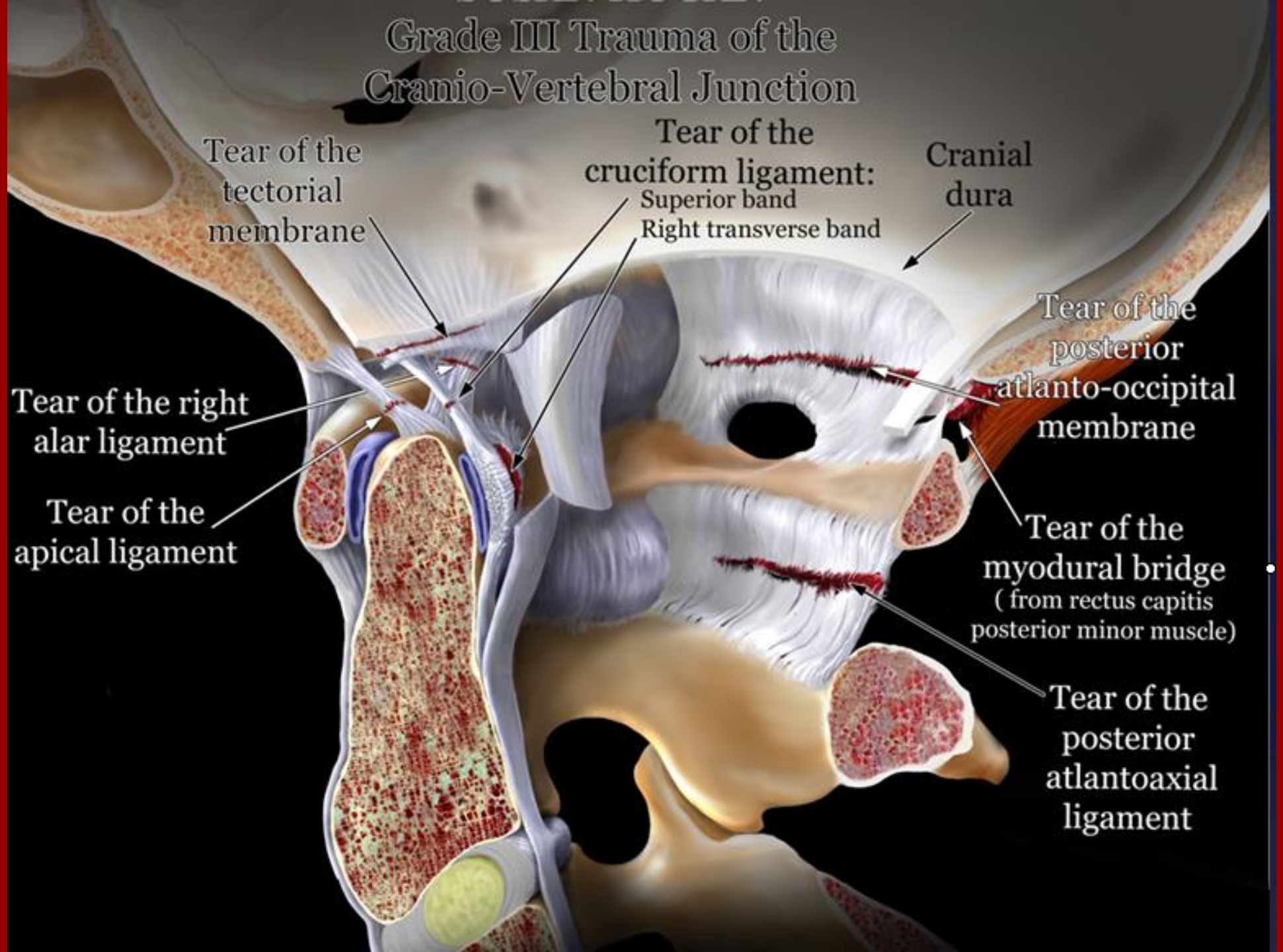
- 25-100 per day

L,T,C regions

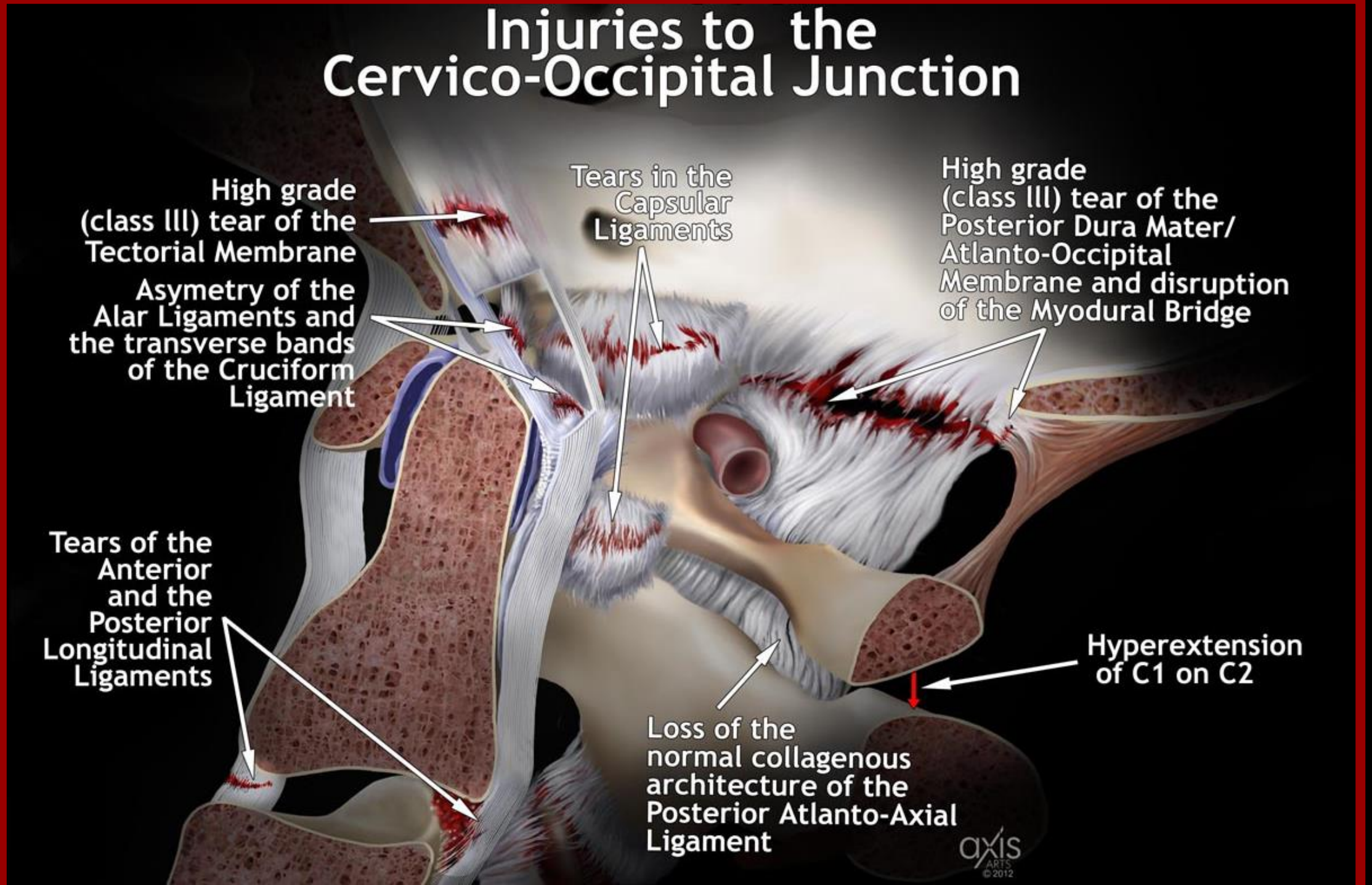
- Language – Capital T, second toe, fifth toe
- Practice

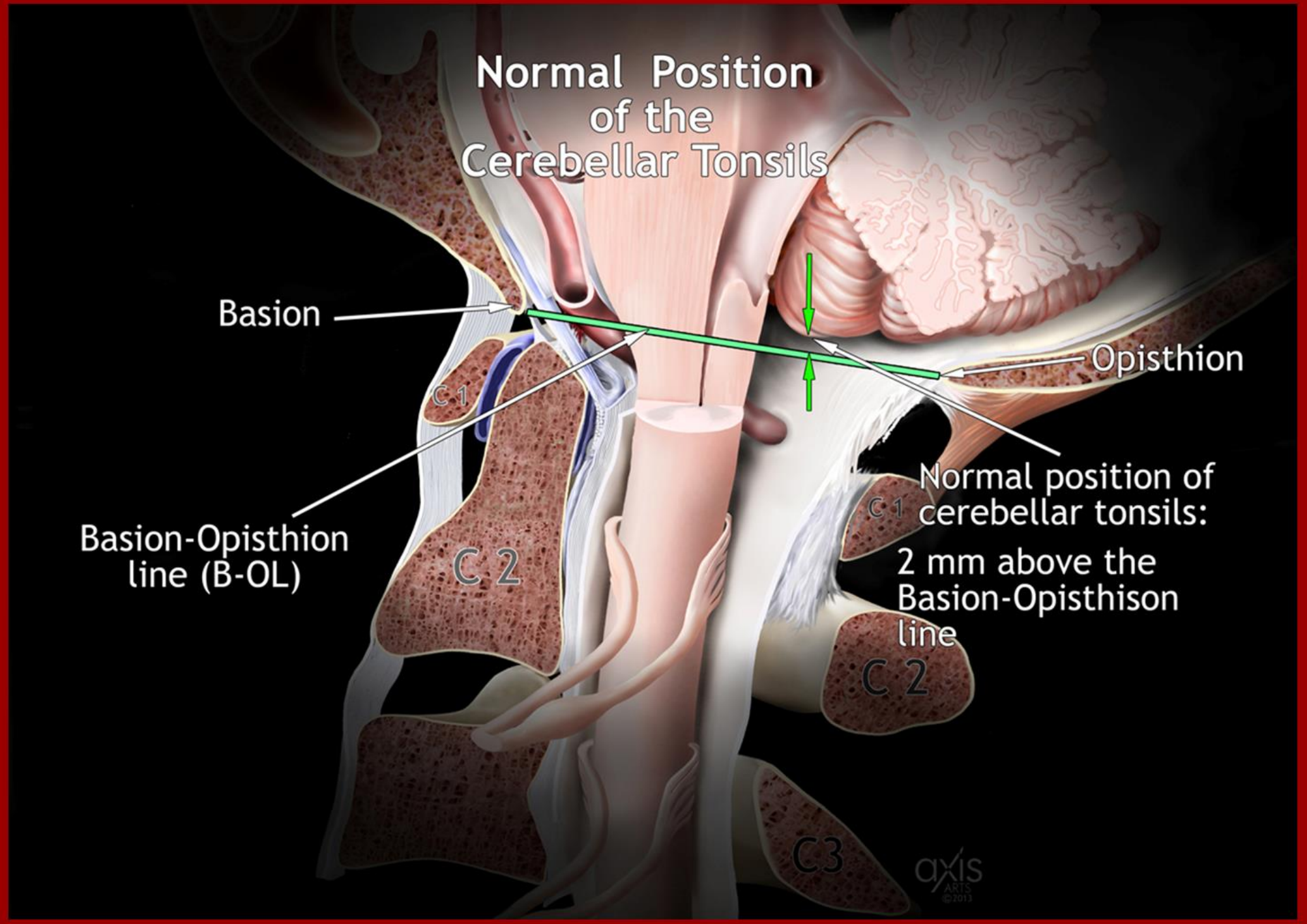

LIGAMENTS & MEMBRANES
of the
CRANIO-VERTEBRAL JUNCTION
Tectorial membrane
Cruciform ligament:
Superior band
Right transverse band
Cranial dura
Apical ligament
Right alar ligament
Anterior alantoaxial ligament
Posterior atlanto-occipital membrane
Myodural bridge
(from rectus capitis posterior minor muscle)
Posterior atlantoaxial ligament
Normal Anatomy


Normal Position
of the
Cerebellar Tonsils
Basion
Opisthion
C1
C2
Basion-Opisthion
line (B-OL)
Normal position of
cerebellar tonsils:
2 mm above the
Basion-Opisthison
line
C1
C2
C3
axis
ARTS
©2013


Grade III Trauma of the
Cranio-Vertebral Junction
Tear of the tectorial membrane
Tear of the cruciform ligament:
Superior band
Right transverse band
Cranial dura
Tear of the posterior atlanto-occipital membrane
Tear of the right alar ligament
Tear of the apical ligament
Tear of the myodural bridge
(from rectus capitis posterior minor muscle)
Tear of the posterior atlantoaxial ligament

Injuries to the Cervico-Occipital Junction




Normal Position
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C2
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line (B-OL)
Normal position of
cerebellar tonsils:
2 mm above the
Basion-Opisthison
line
C1
C2
C3
axis
ARTS
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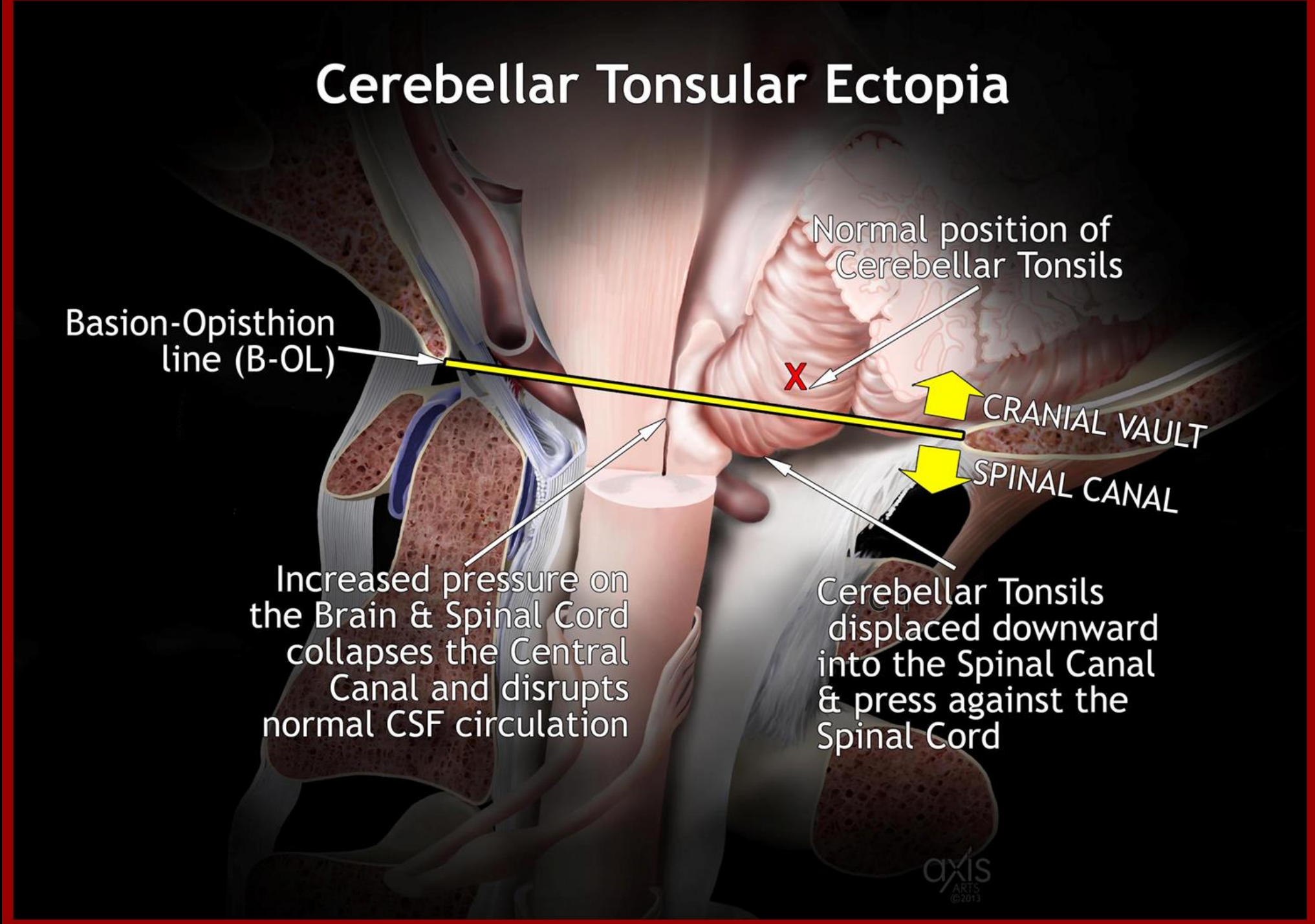
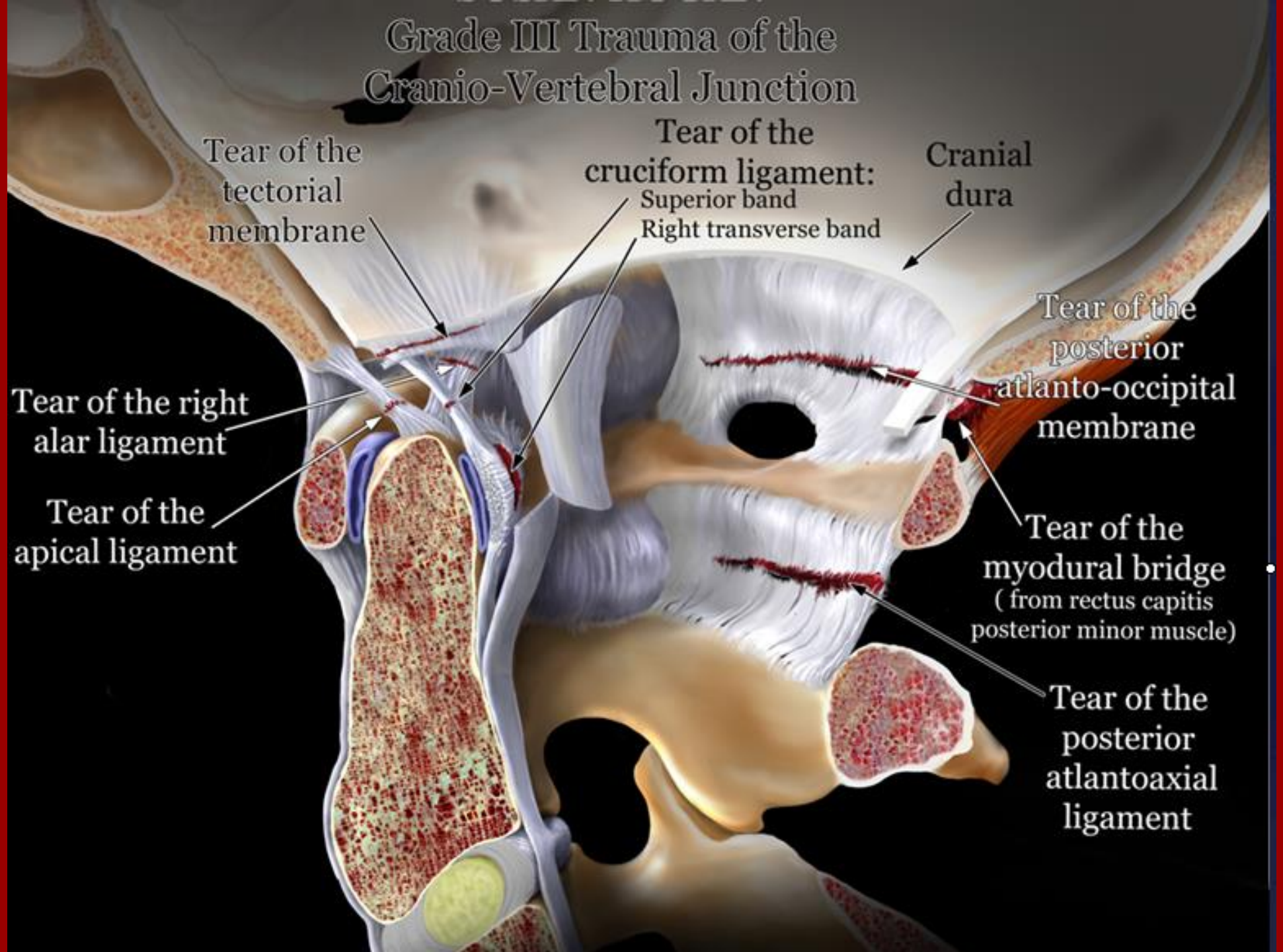
Cerebellar Tonsular Ectopia

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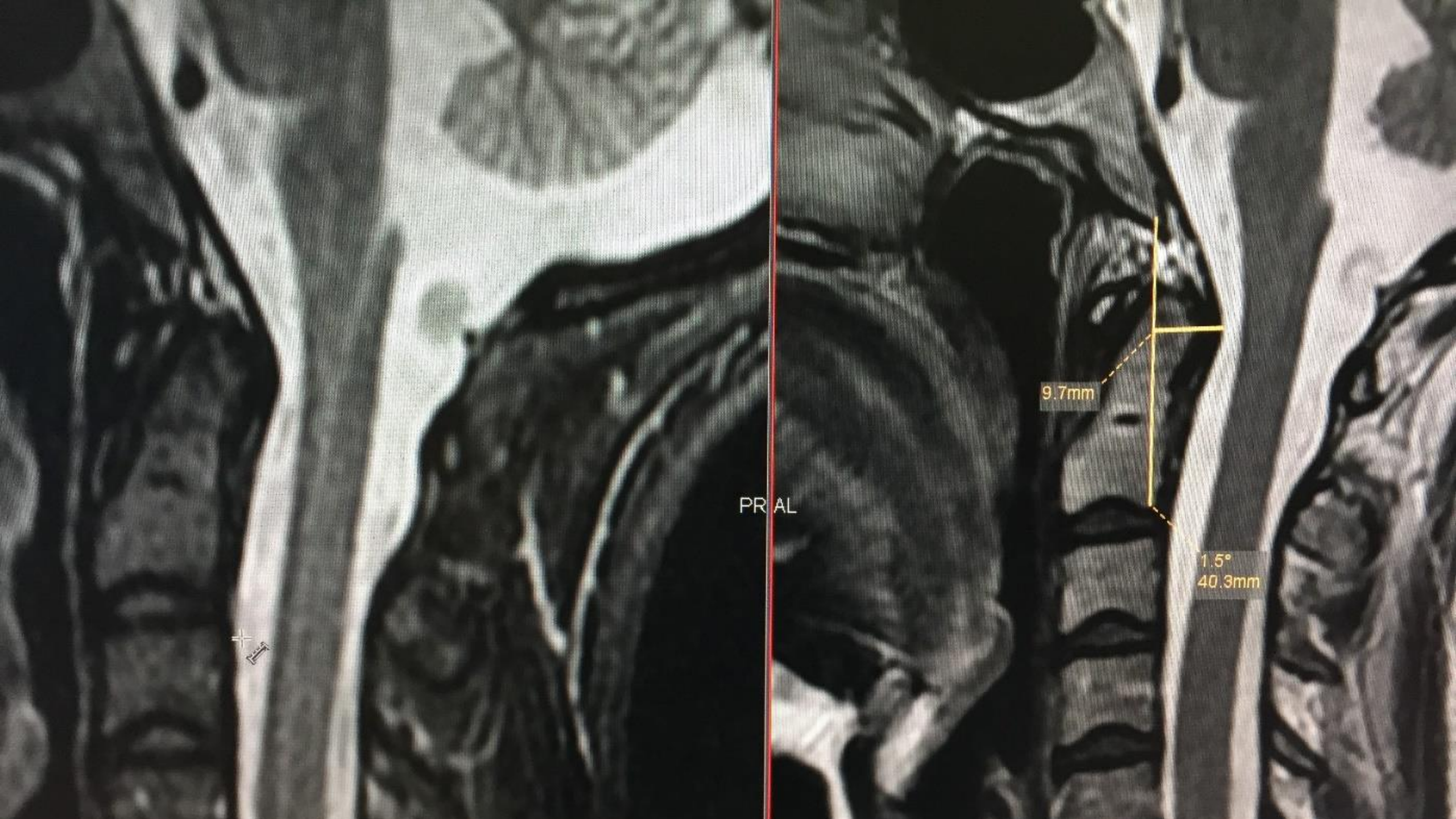

9.7mm
1.5°
40.3mm

Dural Venous Sinus Review

Confluence of Sinus'
(located at Internal
Occipital Protuberance)

Created by:

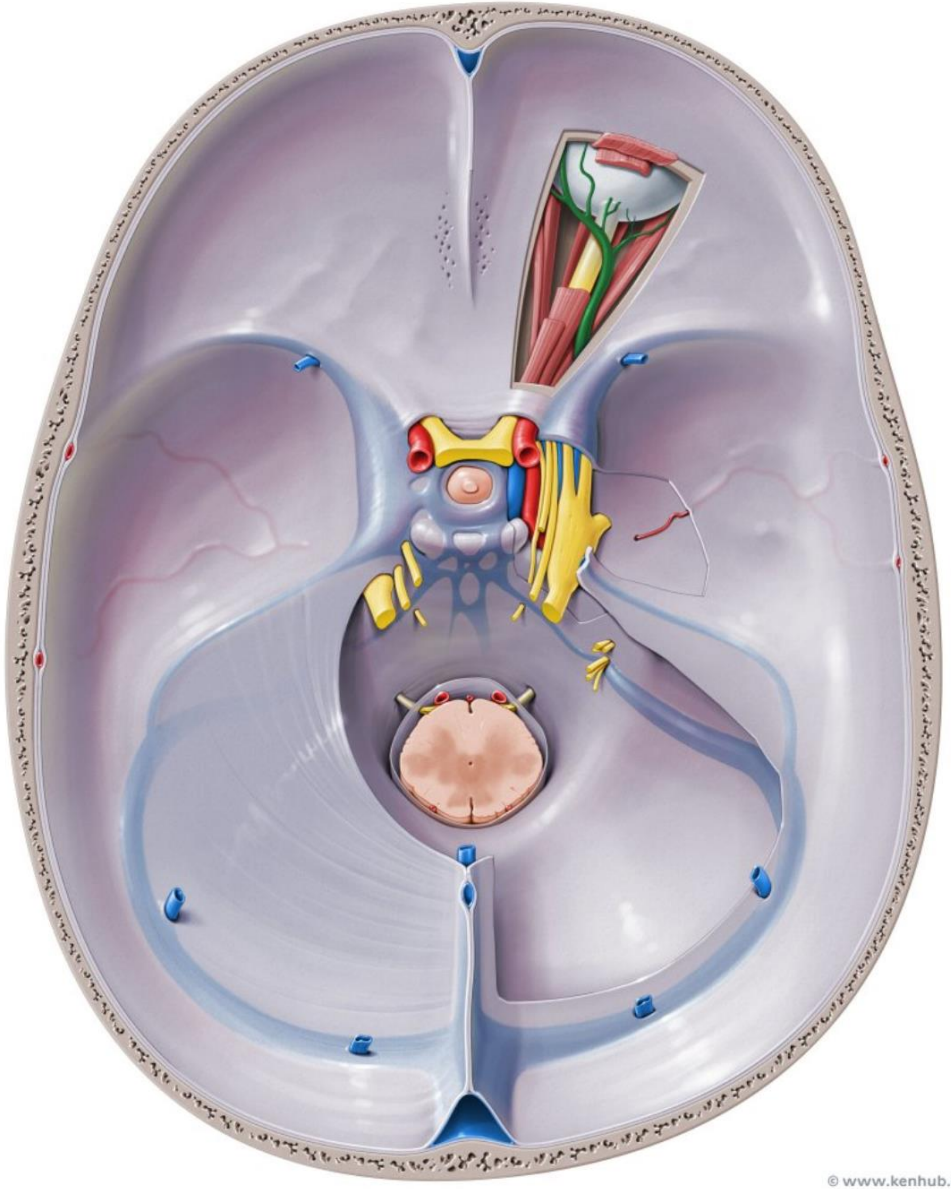
1. Superior
2. Transverse
3. Straight
4. Occipital

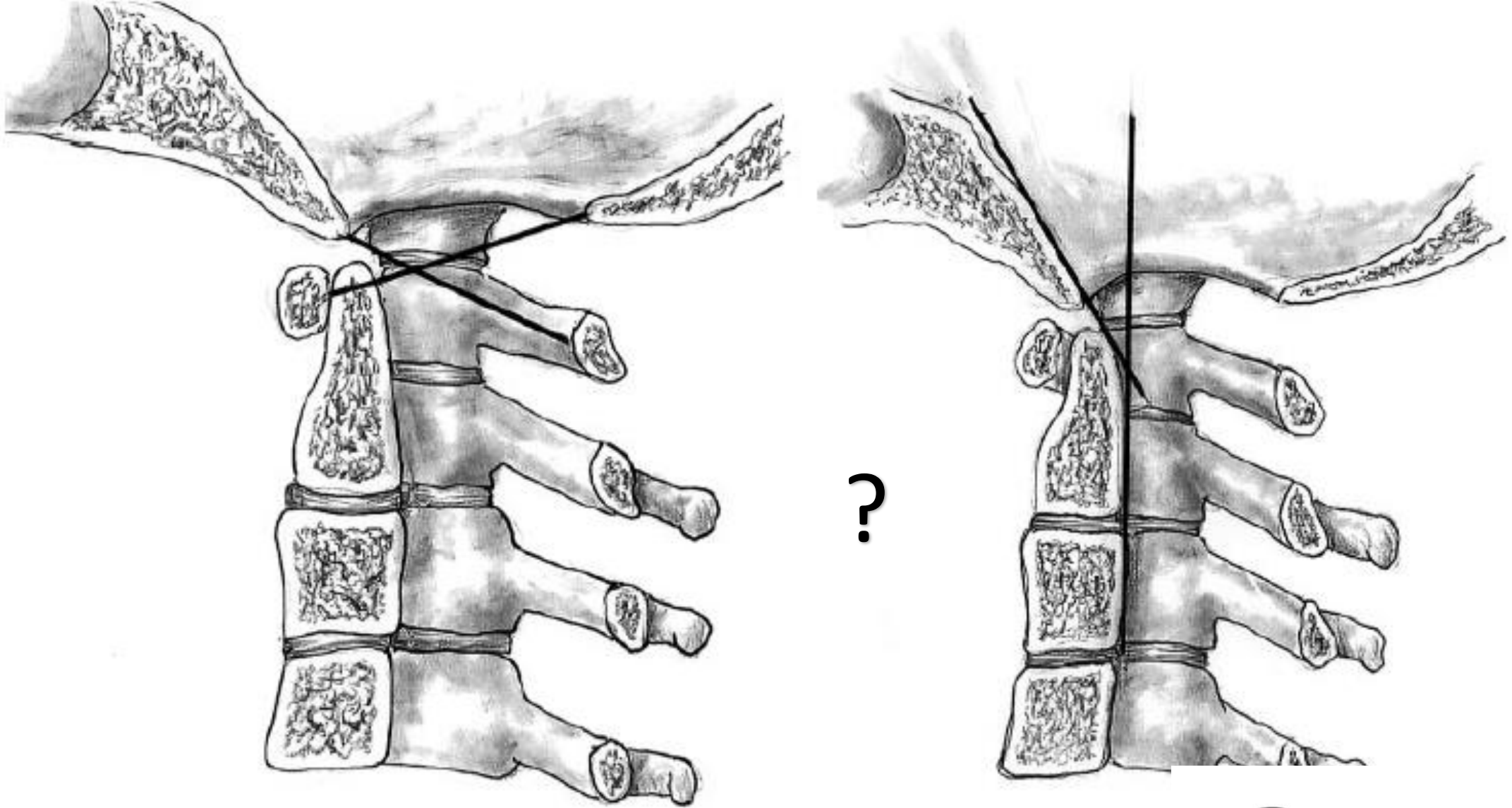
6 paired

1. Sigmoid
2. Transverse
3. Superior Petrosal
4. Inferior Petrosal
5. Cavernous
6. Sphenoparietal

4 unpaired

1. Superior
2. Inferior
3. Straight
4. Occipital





Lustrin ES, etal. Pediatric Cervical Spine: Normal Anatomy, Variants, and Trauma. *Radiographics.* 2003; 23 (3): 539-60.

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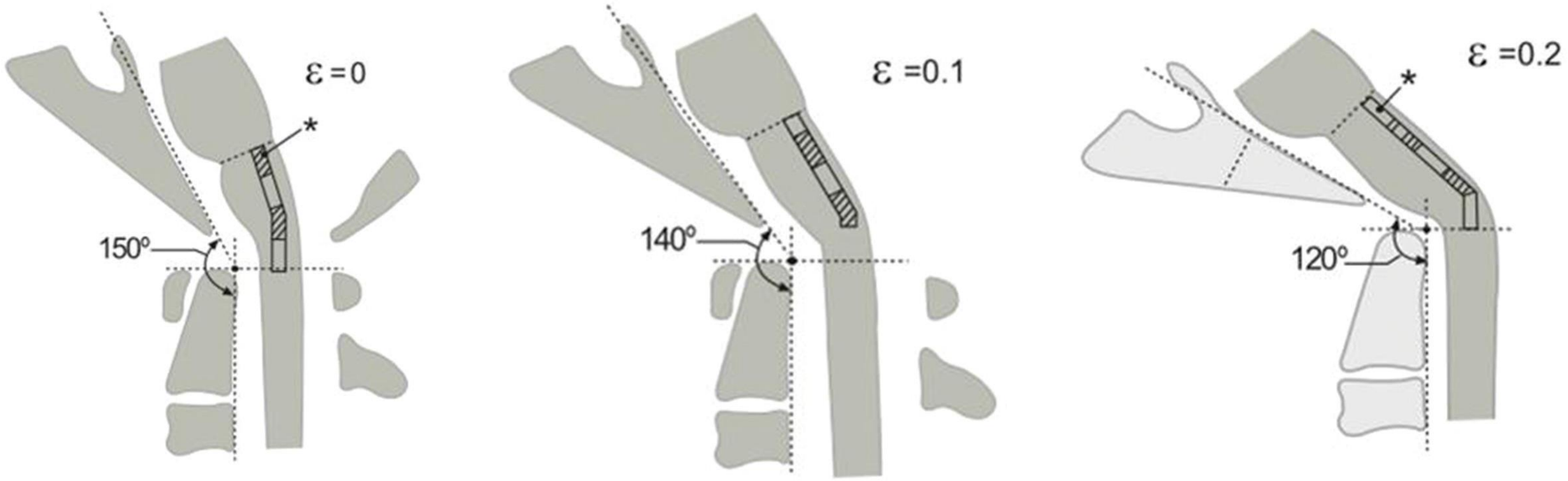
Normal craniocervical junction in flexion. The neuraxis stretches by approximately **10%** of its total length with flexion of the craniocervical junction



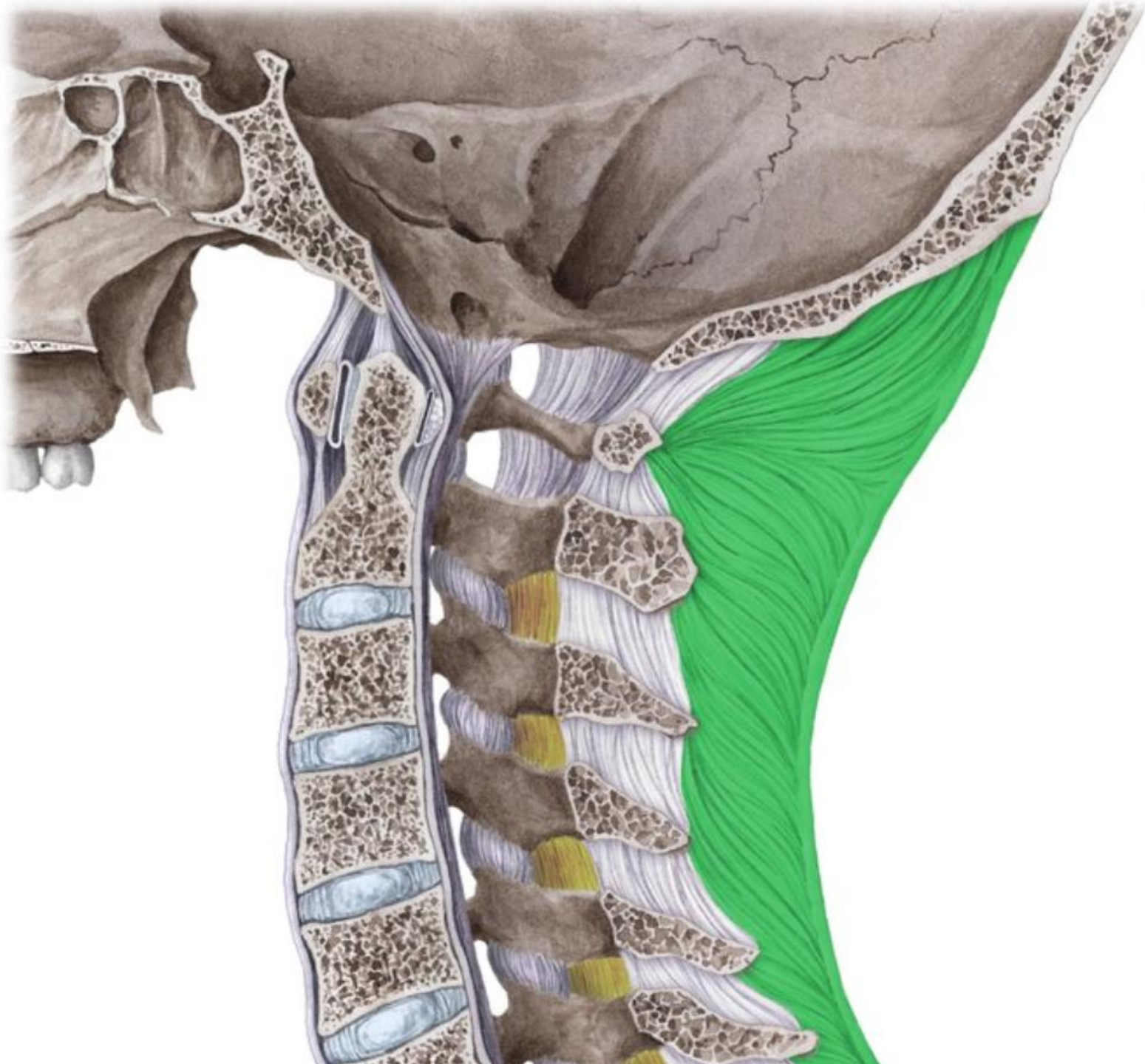
Bhusri N, Lim DC. Correlation of clivoaxial angle to skeletal malocclusions: A pre-screening for future risk of neurodegenerative disorders. *APOS Trends in Orthodontics.* 2016;6(5):246-250

CXA

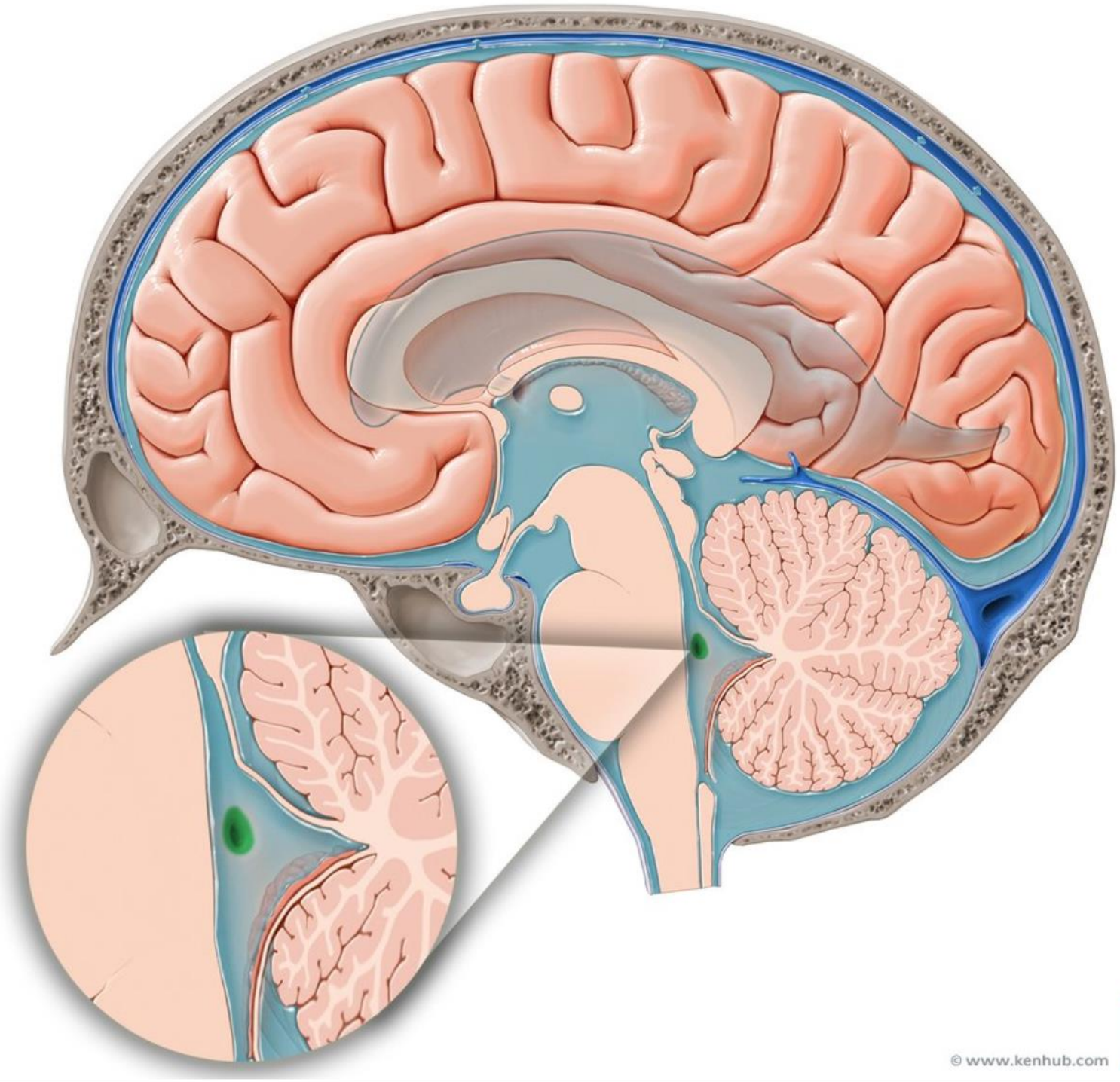
A clivo-axial angle of less than 130° was associated with delay or failure to recover after foramen magnum decompression.

Kubota M, Yamauchi T, Saeki N, Surgical Results of Foramen Magnum Decompression for Chiari Type 1 Malformation associated with Syringomyelia: A Retrospective Study on Neuroradiological Characters influencing Shrinkage of Syringes. Spinal Surg 2004;18:81-6.

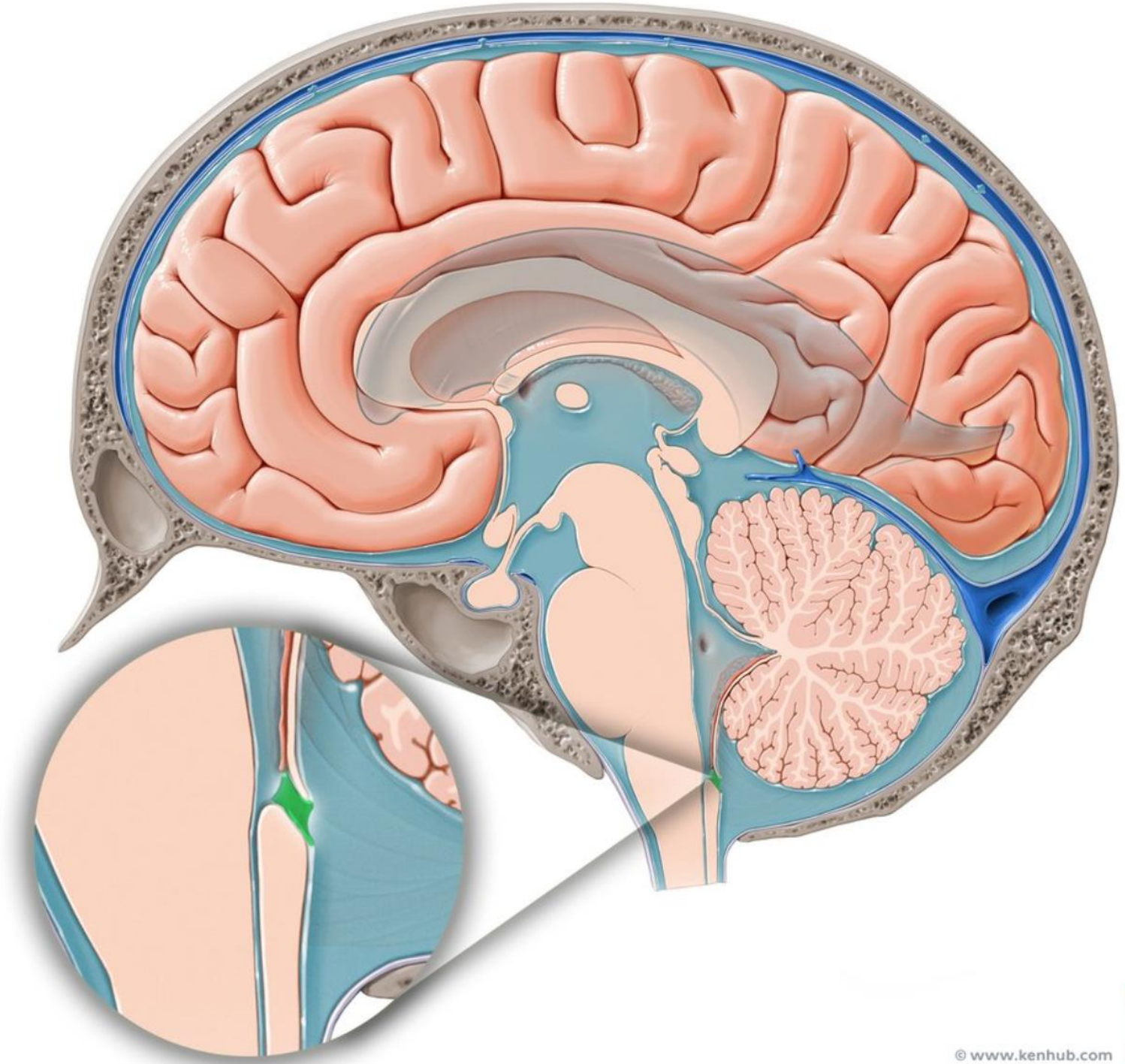
Ligamentum Nuchae

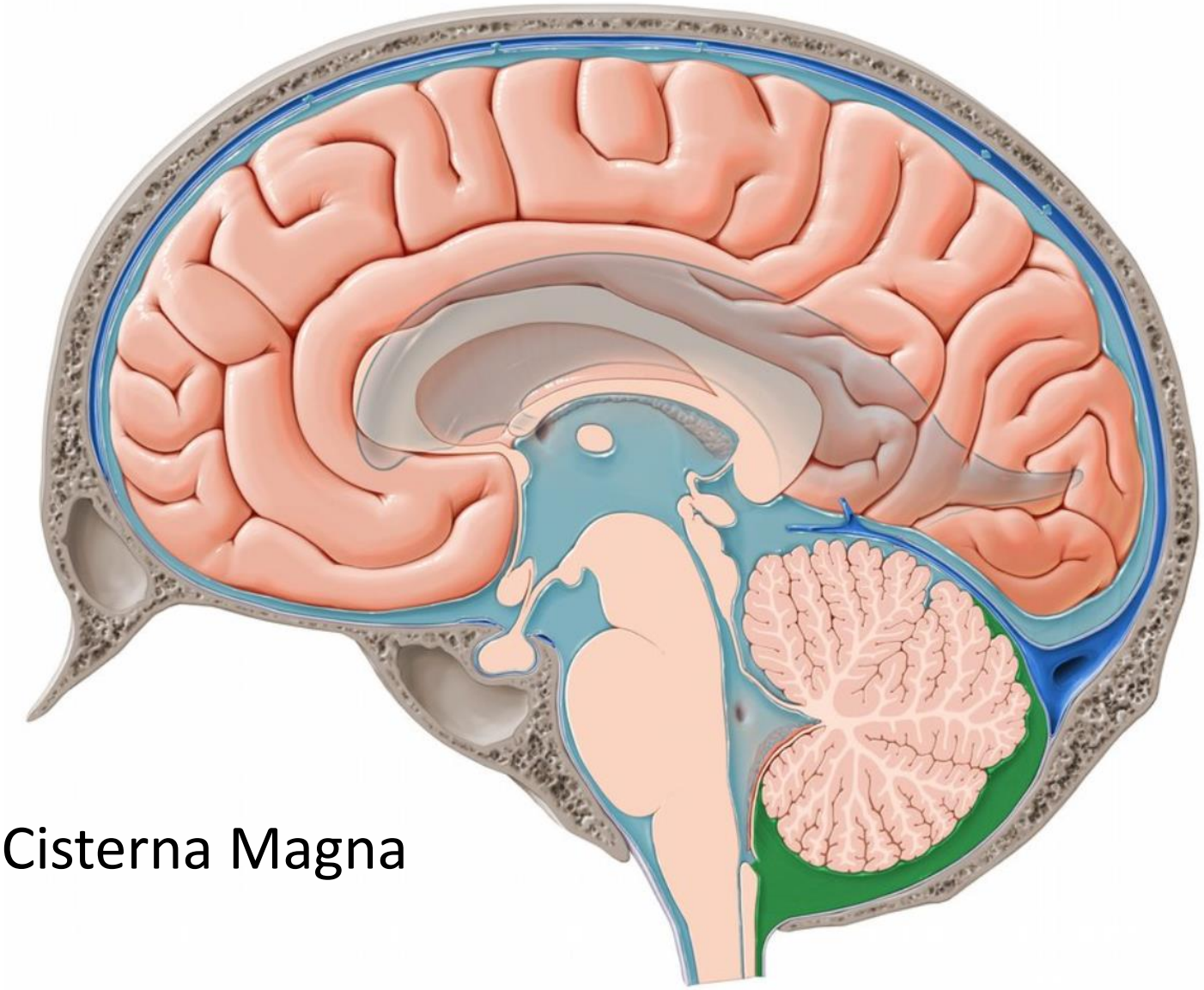


Lateral Aperature



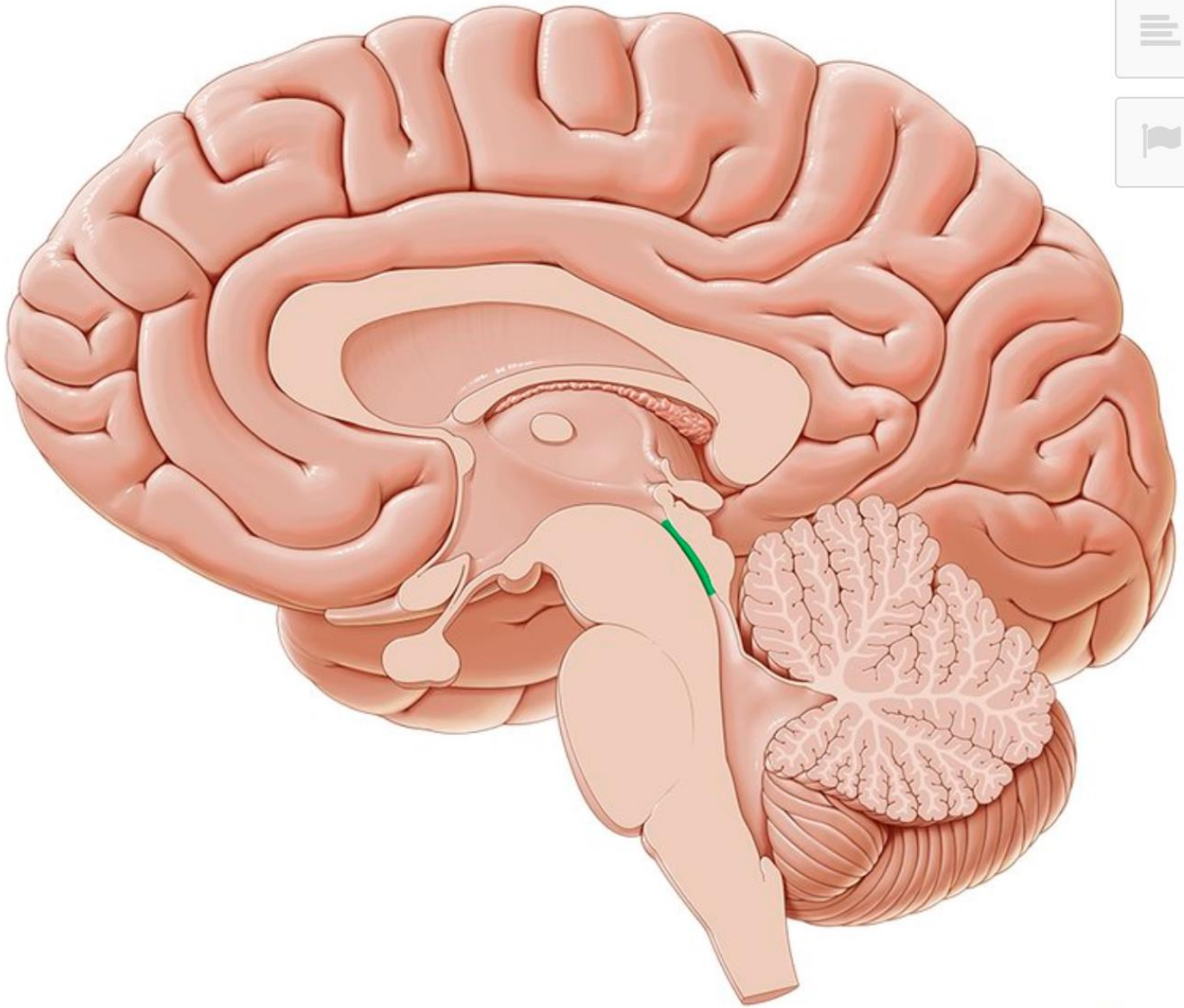
Median Aperature





Cerebellomedullary Cistern Cisterna Magna

Cerebral Aquaduct



Neurological Involvement

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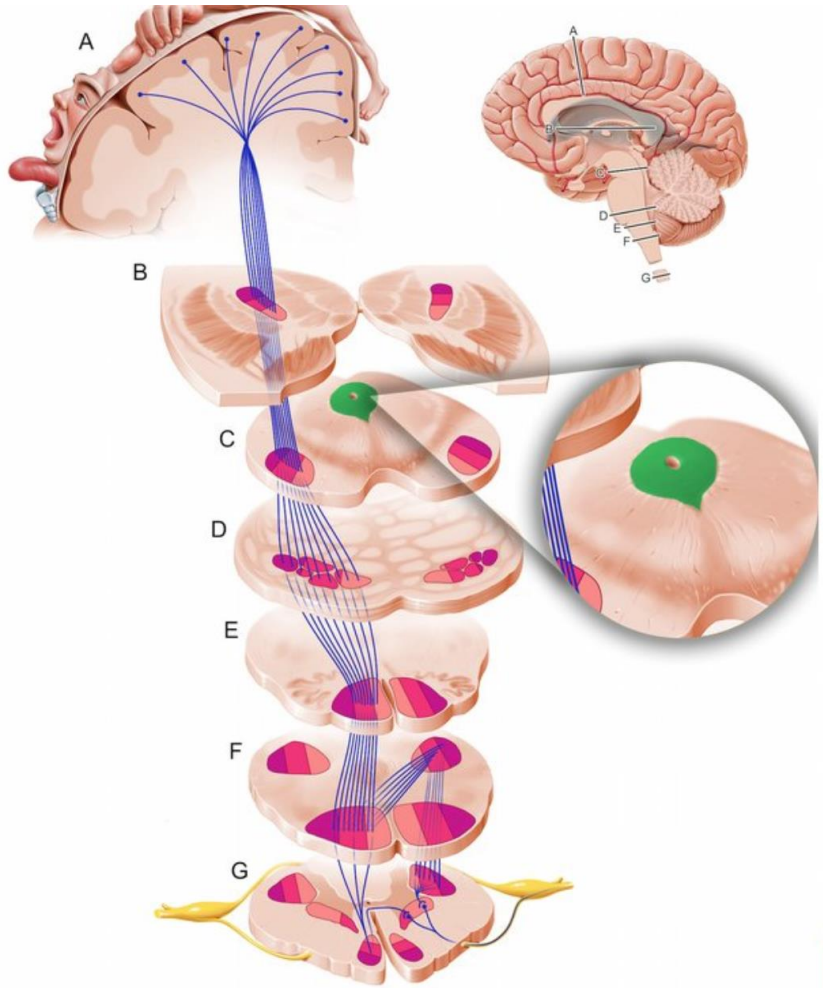
Express your potential

Midbrain

Periaquaductal Gray

Pain signal transmission to the cortex

Crucial in descending pain modulation



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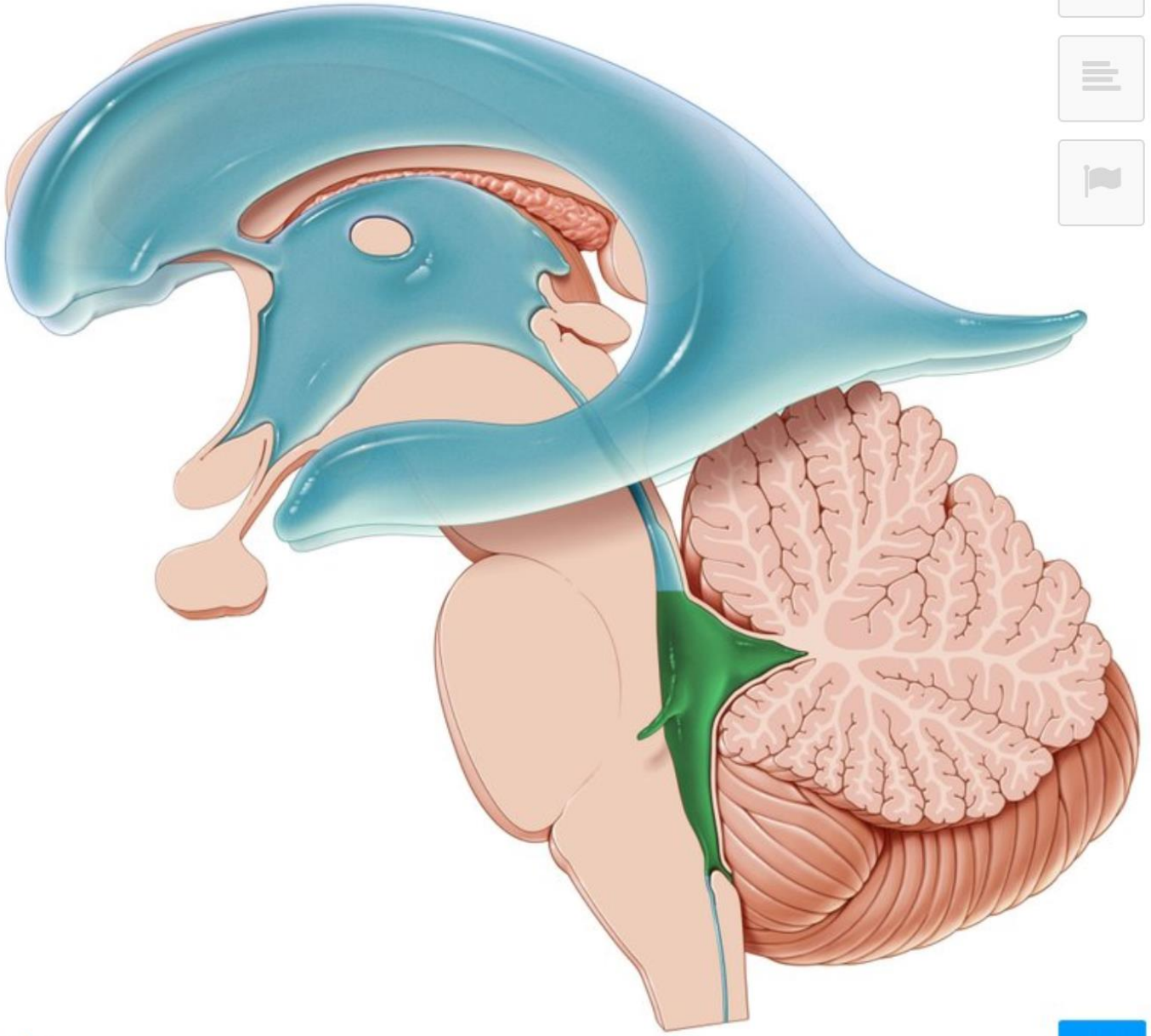
Fourth Ventricle



Neurological Involvement

LIFE CHIROPRACTIC COLLEGE WEST

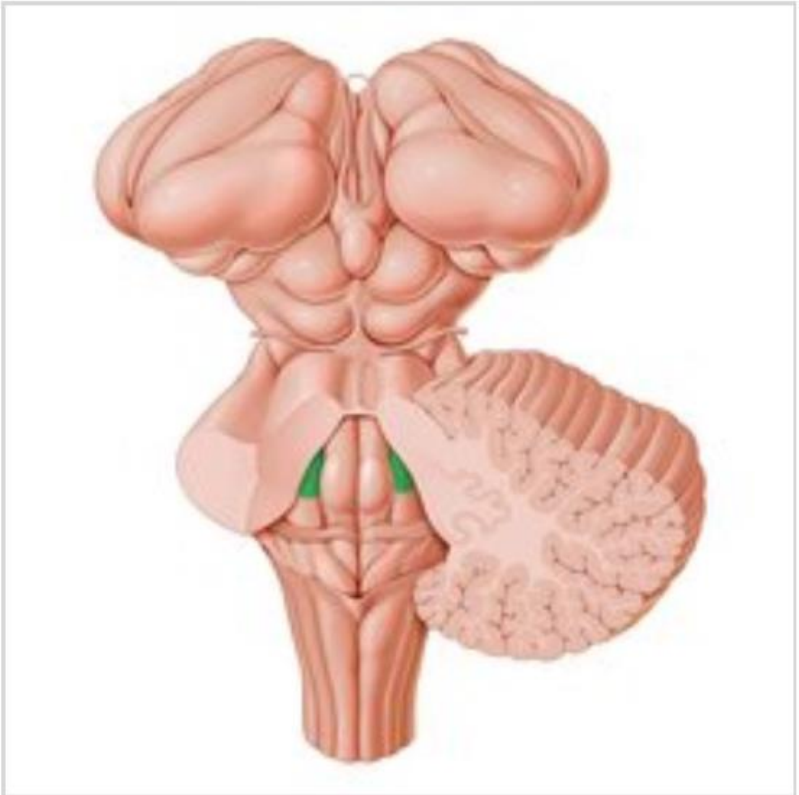
Express your potential

Locus Coeruleus – stress, panic, pain

(rhomboid fossa, reticular activating system)

Located in the **Pons**

Major relay center for pain



Locus coeruleus

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Neurological Involvement

LIFE CHIROPRACTIC COLLEGE WEST
Express your potential

Spinal Cord – relay centers from DRG – **Spinothalamic tract**

The brain sites known to be part of the pain transmission system in the thalamus and cortex were fully activated only when both stimulus intensity and high pain cues were given together

what happens and what we expect

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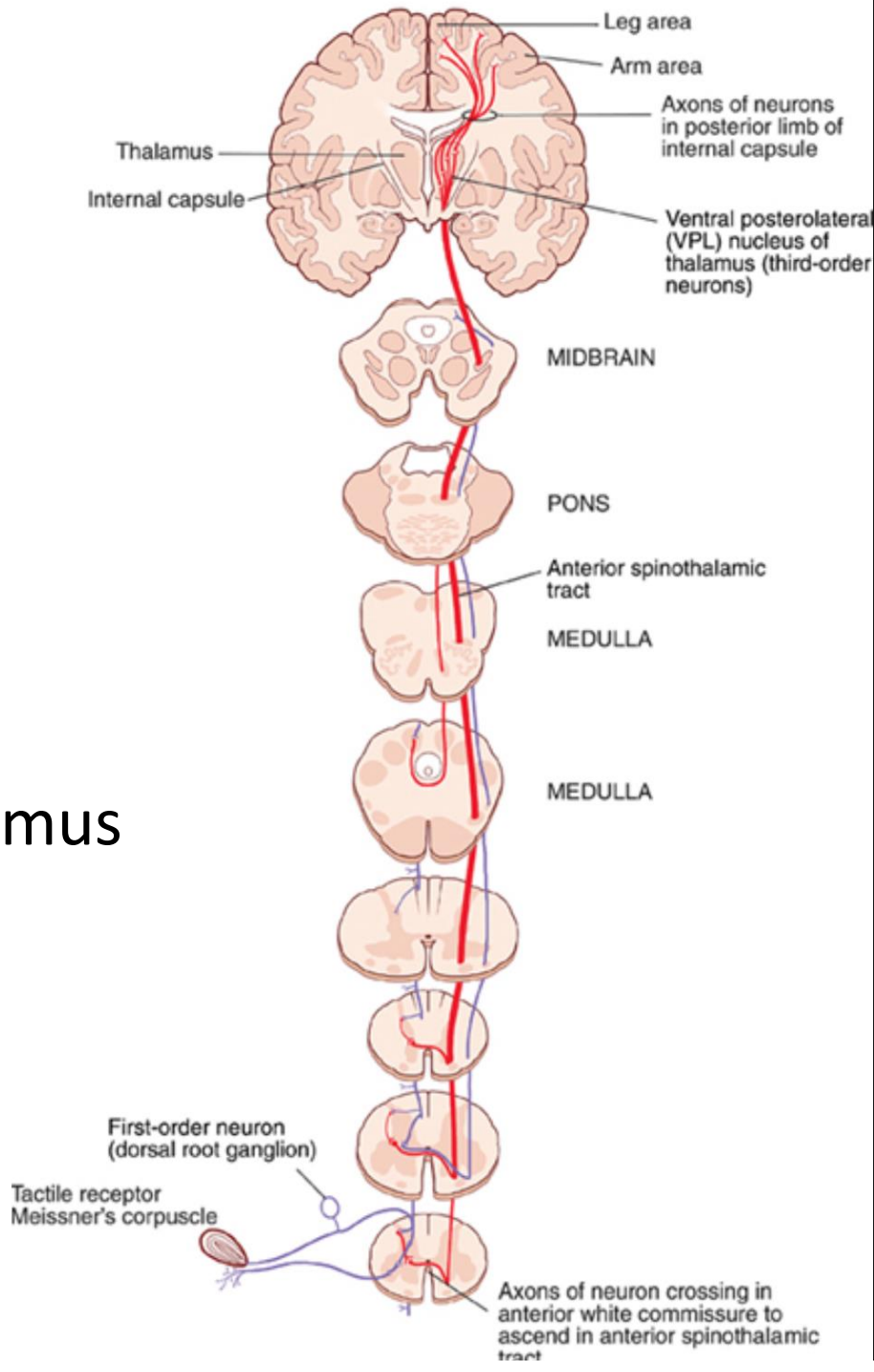
Spinothalamic

i. Pain Temperature
ii. Light touch

Enters cord – synapses

Crosses at or close to cord level where it enters

Travels through cord and brainstem to the Thalamus



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Express your potential

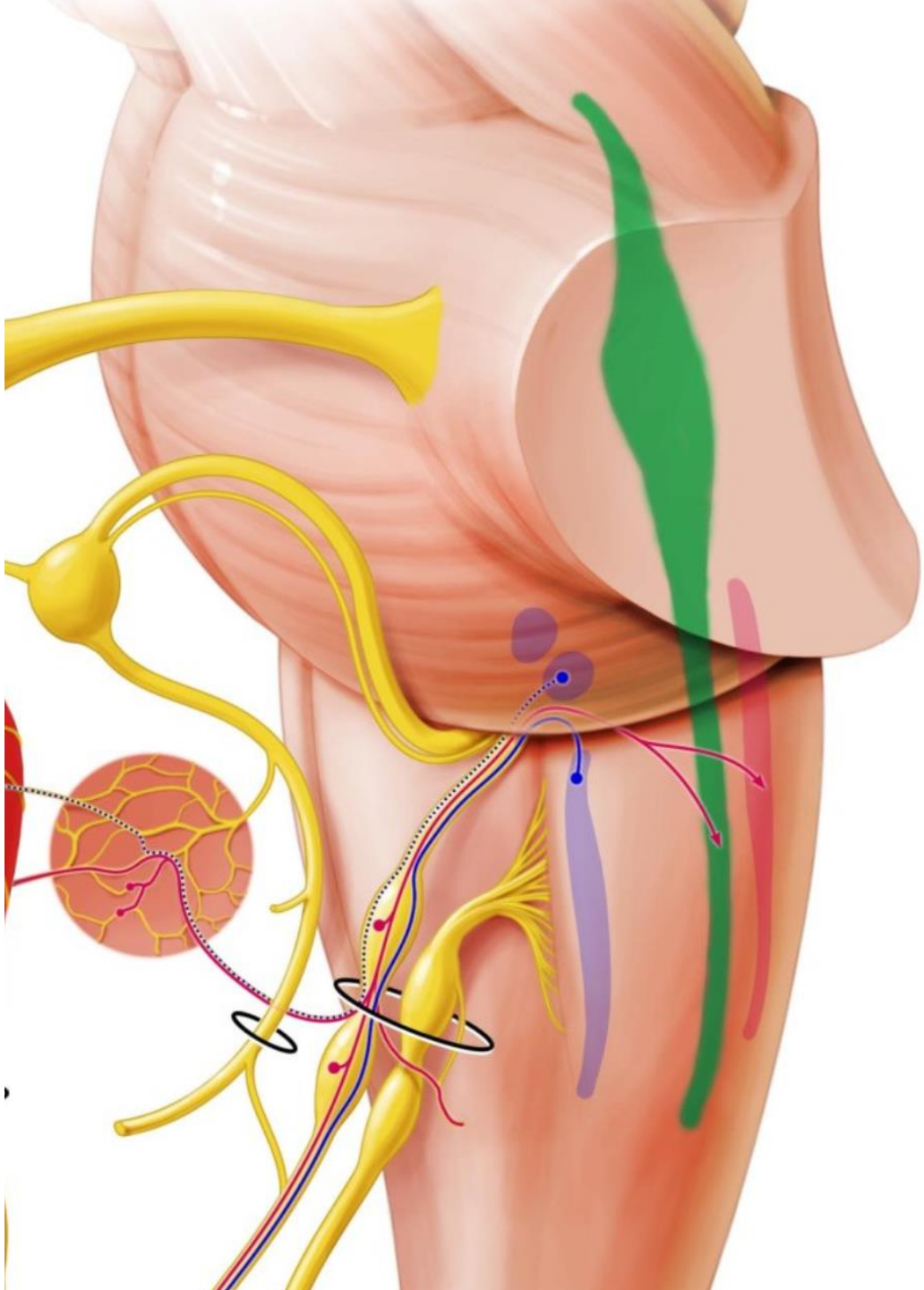
https://www.physio-pedia.com/images/6/66/Spinothalmaic_tract.jpg

Spinal Trigeminal Tract

Mesencephalic – proprioception

Pons/Medulla – Light Touch

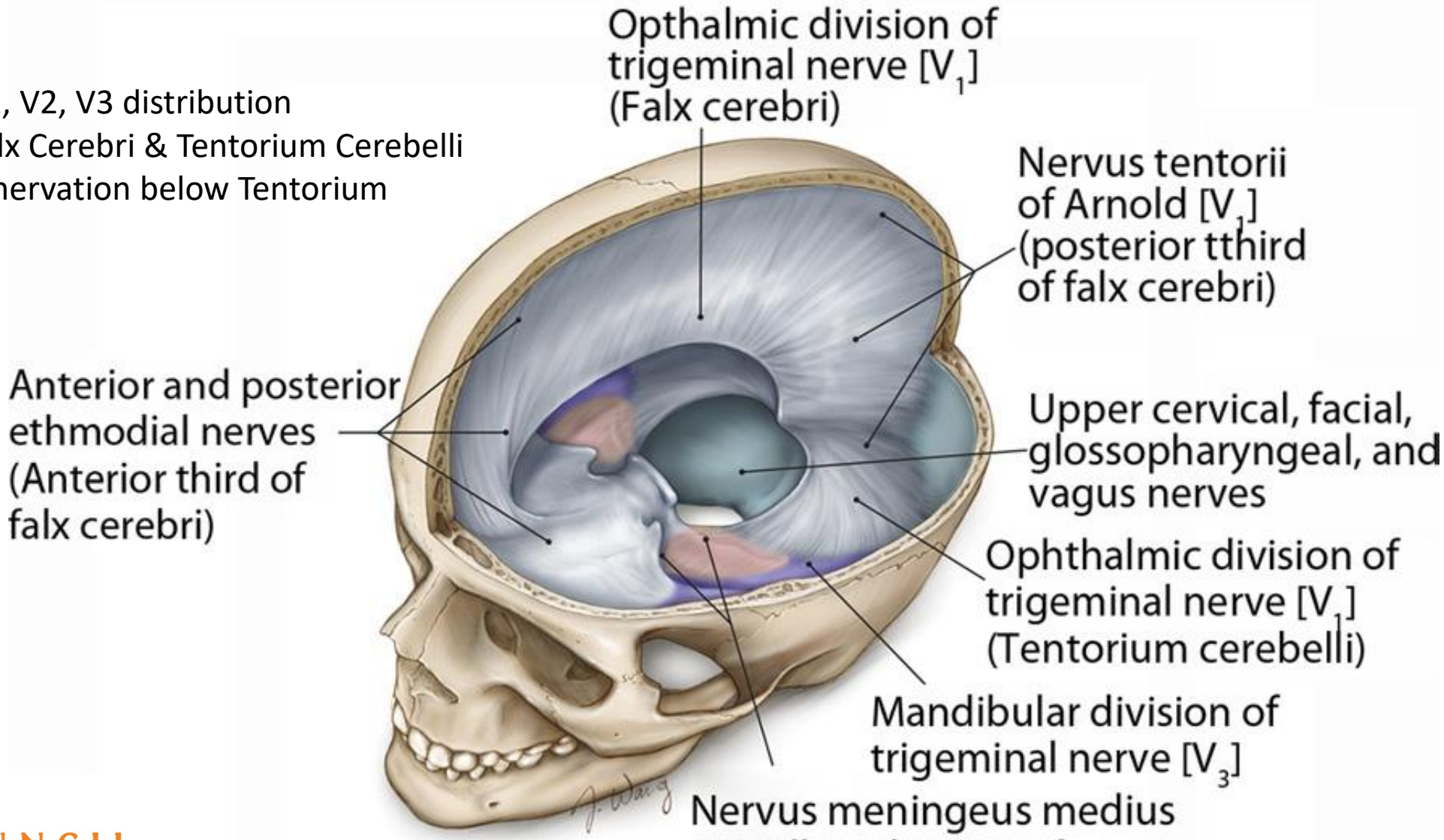
Cervical – Pain/Temperature



LIFE CHIROPRACTIC
COLLEGE WEST
Express your potential

William J. Kemp, III, R. Shane Tubbs, Aaron A. Cohen-Gadol. The Innervation of the Cranial Dura Mater: Neurosurgical Case Correlates and a Review of the Literature *World Neurosurg. (2012) 78, 5:505-510.*

Note: V1, V2, V3 distribution
Note: Falx Cerebri & Tentorium Cerebelli
Note: innervation below Tentorium



ICA COUNCIL ON UPPER CERVICAL CARE

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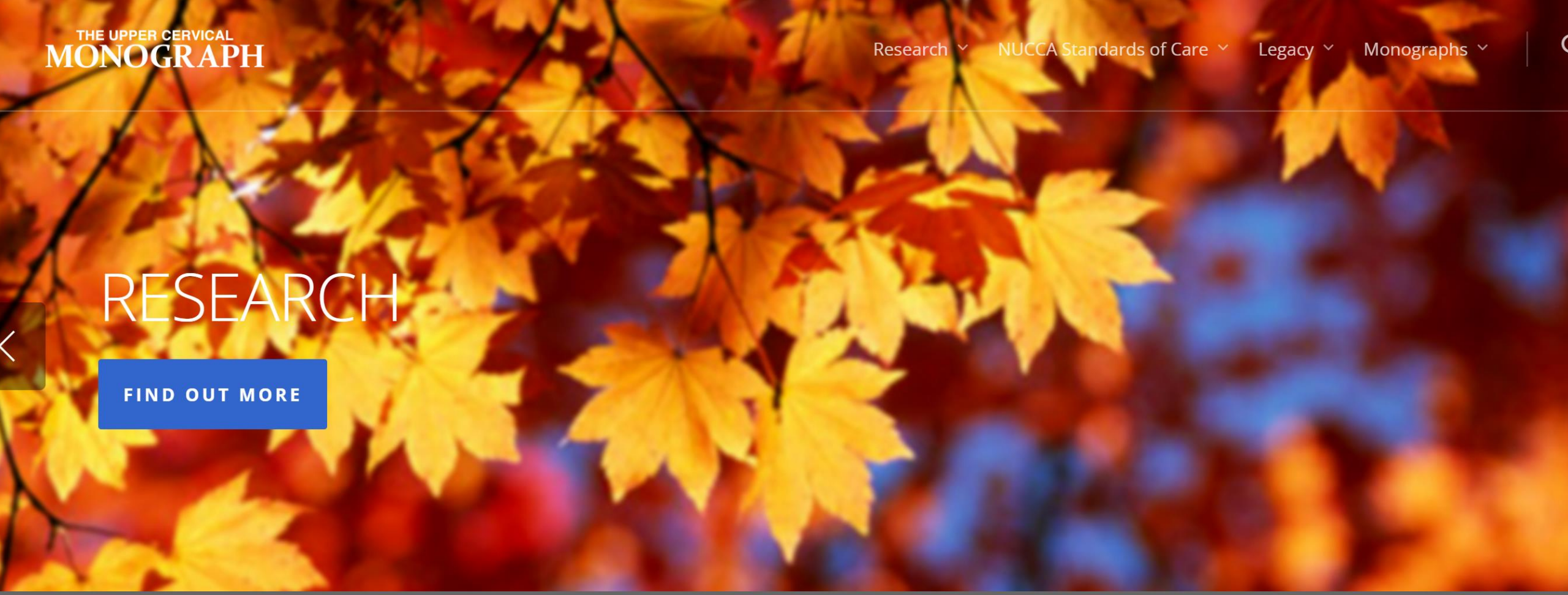
Classification/Diagnosis

Ascending/Descending

Ocular, Occlusal, Pedorthic



Welcome to the Upper Cervical Monograph

The National Upper Cervical Chiropractic Association (NUCCA) and the Upper Cervical Research Foundation (UCRF) are dedicated to the research, education and sustainability of a unique and profoundly influential form of healthcare.

This website is dedicated to bridging the understanding of research and clinical practice to offer best of outcome measures, the safest interventions and the greatest enhancement in quality-of-life.

Please explore the information here and look for updates as we continue to discover new possibilities for a healthier future.

SMALL STEPS TO SUCCESS
Flexible Giving Program

2019 NUCCA Fundraising Campaign

Donate

November 1st through November 30, 2019

Welcome to the 11th annual UCRF Small Steps to Success Campaign.

NUCCA® National Upper Cervical Chiropractic Association

UPPER CERVICAL RESEARCH FOUNDATION

Thank you

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DC, DCCJP, FCCJP, BSc(kin), PgCPain