

Back To Chiropractic Continuing Education Seminars

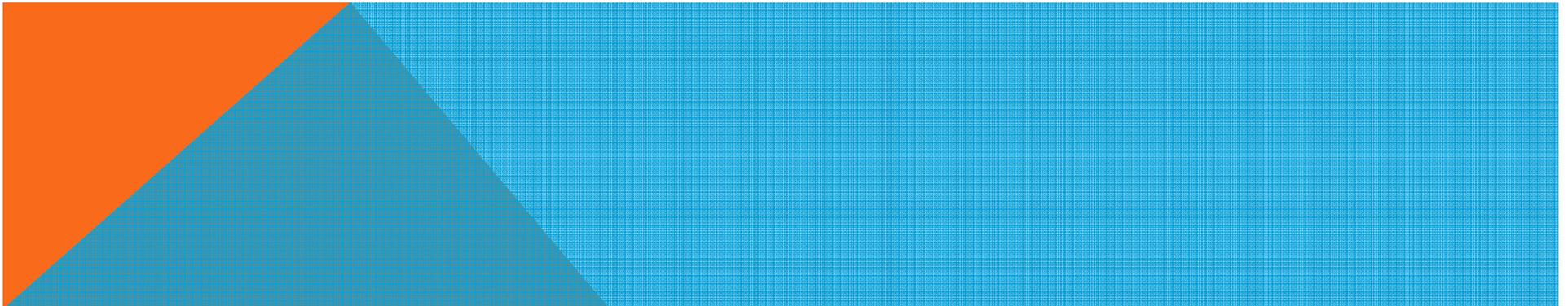
Arthritis ~ X-Ray ~ 6 Hours

Welcome:

This course is approved for 6 Hours of Arthritis ~ X-Ray for the Chiropractic Board of Examiners for the state of California and is also accepted in Colorado, Iowa, Michigan, Oregon and Washington.

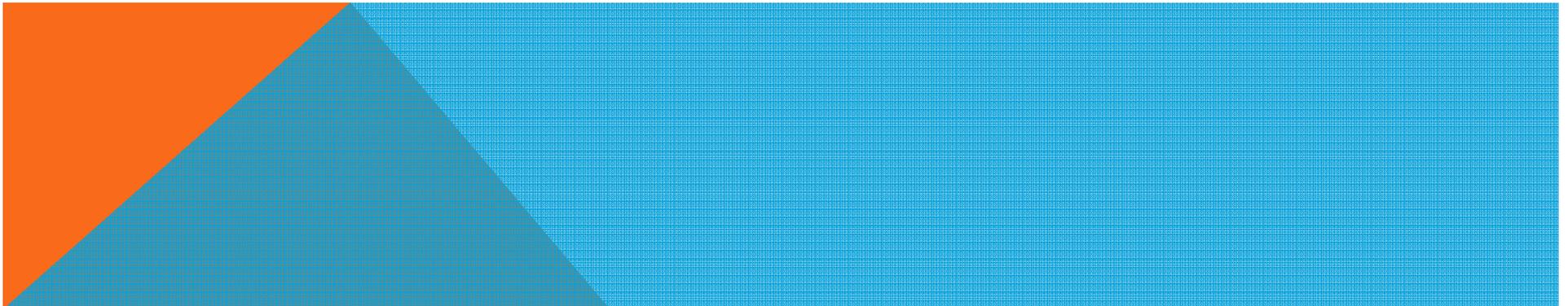
This course counts as 6 Hours towards your Radiography Supervisor and Operator Permit renewal. Course must be completed before your permit expires.

There is no time element to this course, take it at your leisure. If you read slow or fast or if you read it all at once or a little at a time it does not matter.



How it works:

- 1. Helpful Hint: Print exam only and read through notes on computer screen and answer as you read.**
- 2. Printing notes will use a ton of printer ink, so not advised.**
- 3. Read thru course materials.**
- 4. Take exam; e-mail letter answers in a NUMBERED vertical column to marcusstrutzdc@gmail.com.**
- 5. If you pass exam (70%), I will email you a certificate, within 24 hrs, if you do not pass, you must repeat the exam. If you do not pass the second time then you must retake and pay again.**
- 6. If you are taking the course for DC license renewal you must complete the course by the end of your birthday month for it to count towards renewing your license. I strongly advise to take it well before the end of your birthday month so you can send in your renewal form early.**
- 7. Upon passing, your Certificate will be e-mailed to you for your records.**
- 8. DO NOT send the state board this certificate.**
- 9. I will retain a record of all your CE courses. If you get audited and lost your records, I have a copy.**



The Board of Chiropractic Examiners requires that you complete all of your required CE hours BEFORE you submit your chiropractic license renewal form and fee.

NOTE: It is solely your responsibility to complete the course by then, no refunds will be given for lack of completion.

Enjoy,

Marcus Strutz DC

CE Provider

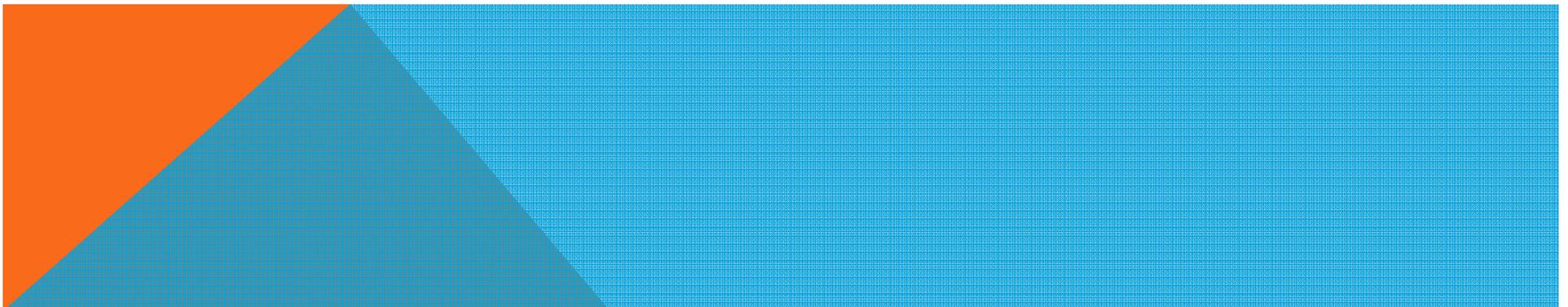
Back To Chiropractic CE Seminars

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Cartilage In Health and Disease (Degeneration)

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A night-time photograph of the Golden Gate Bridge in San Francisco, California. The bridge's towers and suspension cables are illuminated with warm orange lights, and the city lights of San Francisco are visible in the background. The water of the bay is dark, reflecting some of the bridge's lights.

Terminology

Degenerative Joint Disease

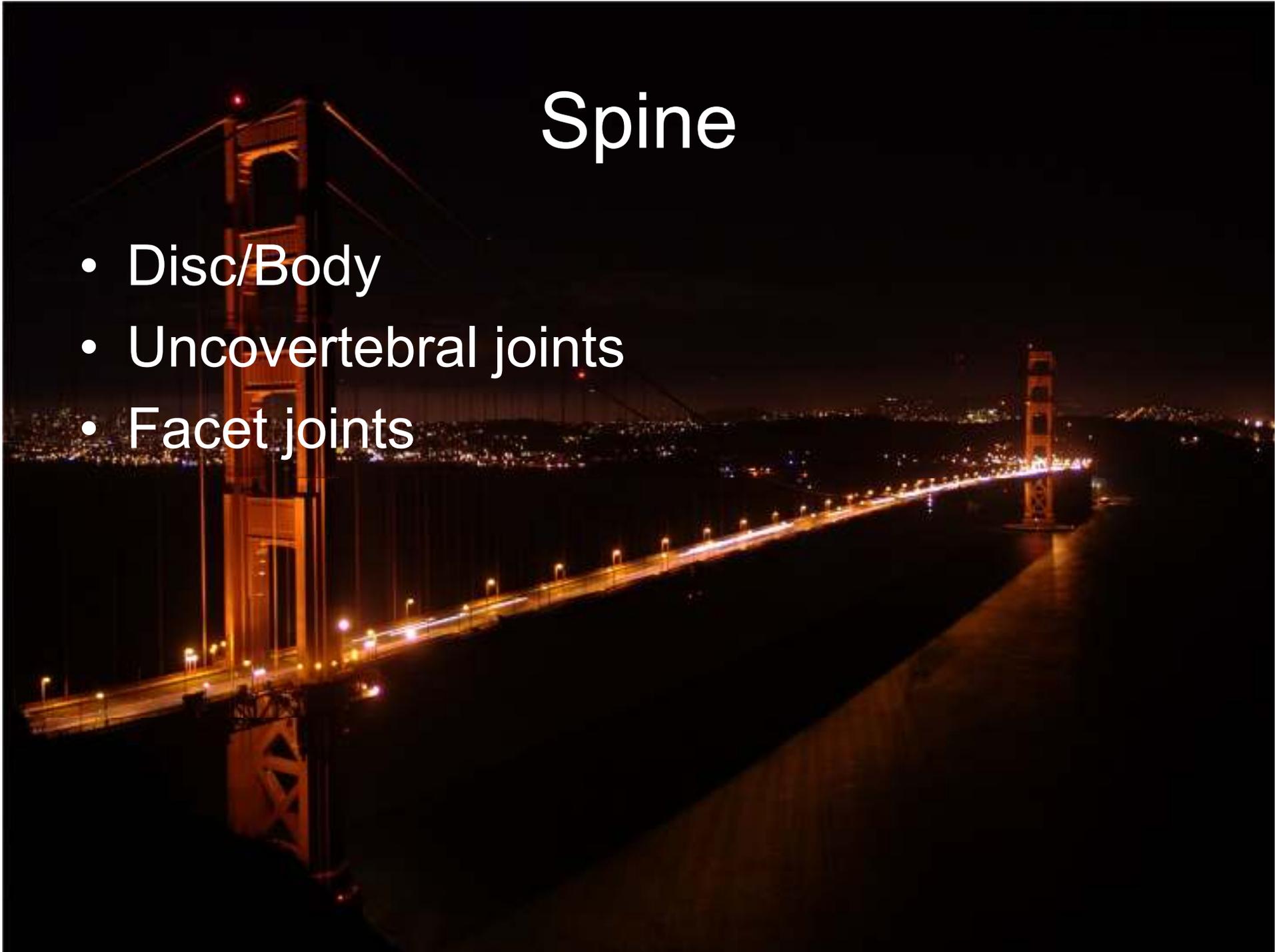
DJD

Osteoarthritis

OA

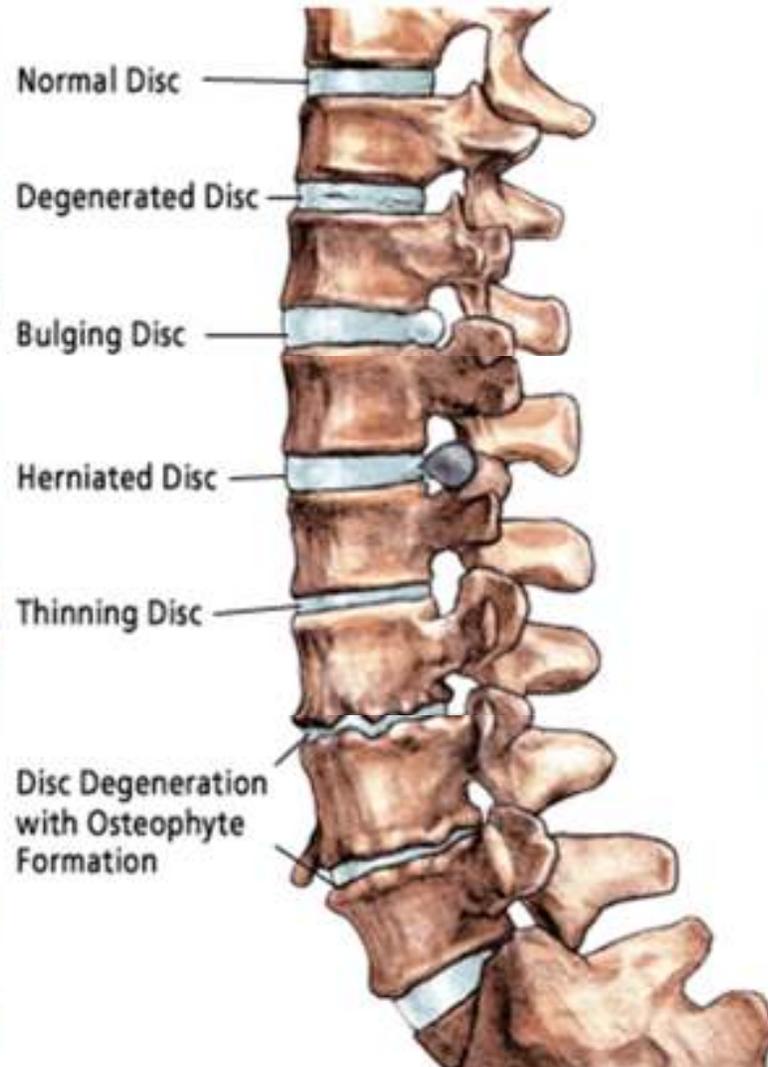
Spine

- Disc/Body
- Uncovertebral joints
- Facet joints

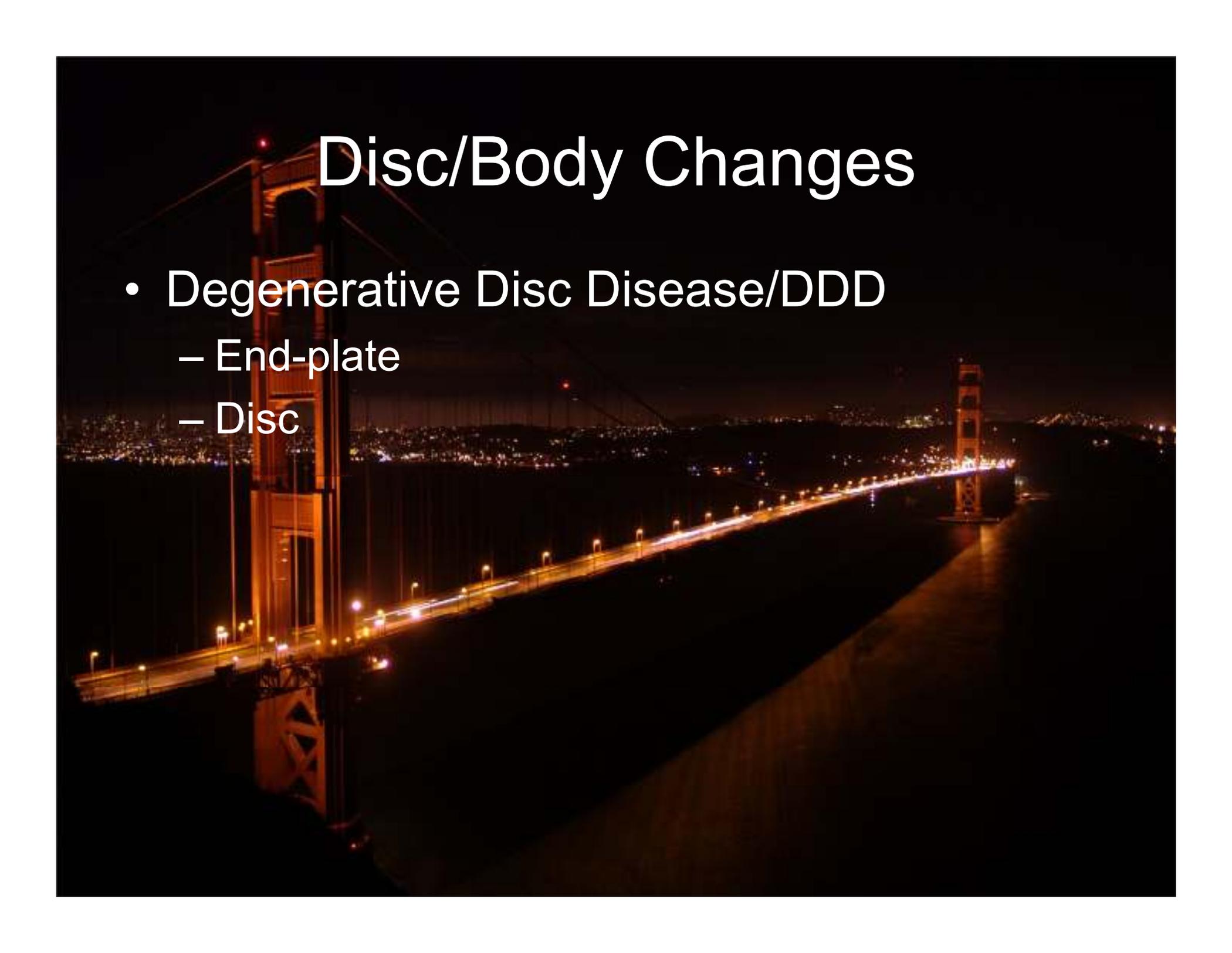


Spectrum of DDD

Examples of Disc Problems



Disc/Body Changes

A nighttime photograph of the Golden Gate Bridge in San Francisco. The bridge's towers and suspension cables are illuminated with warm orange lights. The city lights of San Francisco are visible in the background, and the water of the bay is dark. The text 'Disc/Body Changes' is overlaid in white at the top, and a bulleted list is on the left side.

- Degenerative Disc Disease/DDD
 - End-plate
 - Disc

End-plate Changes



- Spondylosis
 - Osteophytes/spondylophytes
 - Traction spur: early change
 - Claw osteophyte: late change

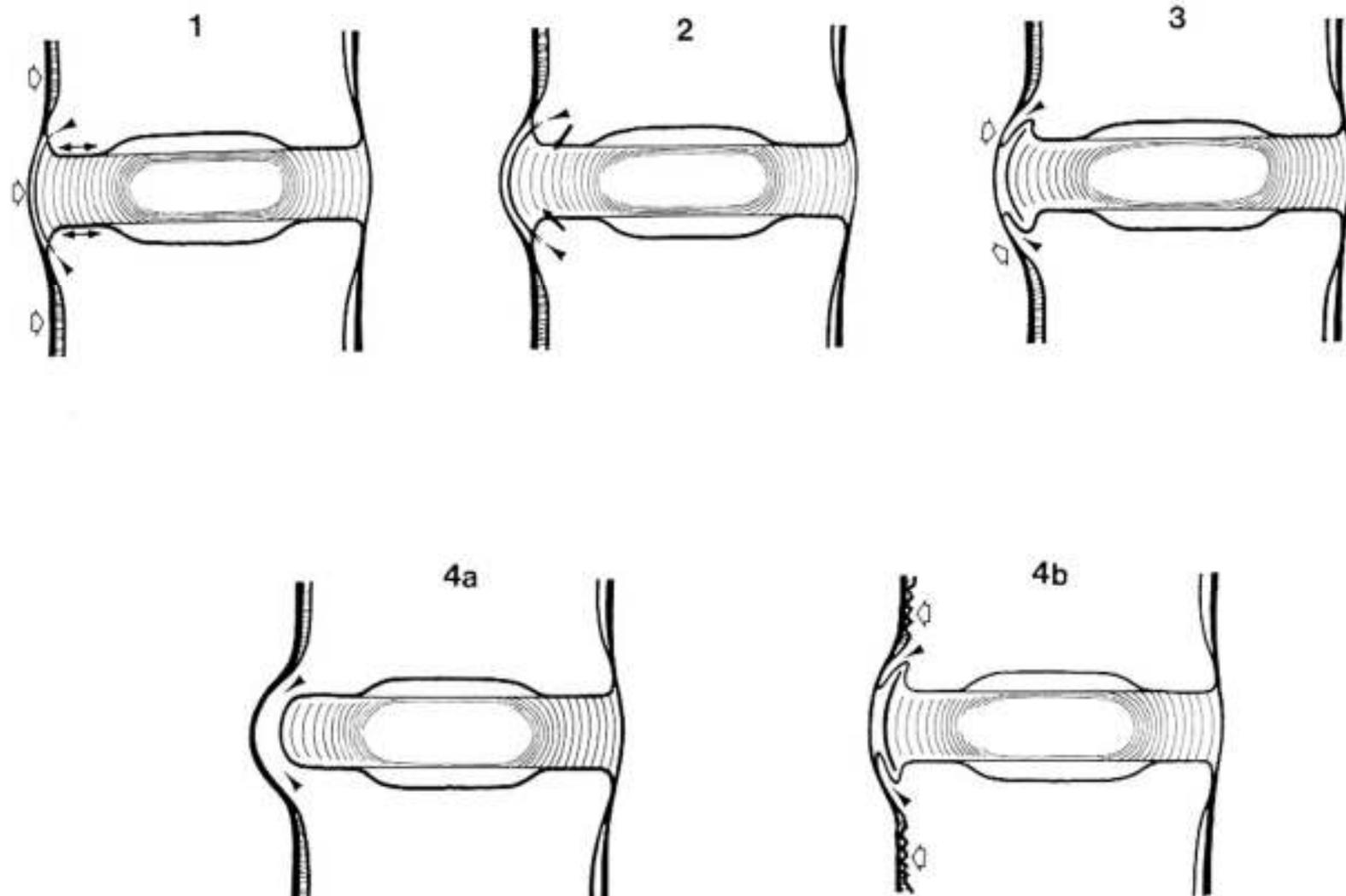


Figure 44-12. Spondylosis deformans: Modified concept of its pathogenesis. Progressive stages of spondylosis deformans. The normal situation is depicted in 1. The annulus fibrosus is attached to the vertebral rim by calcified cartilage (double-ended arrows) and to the anterior vertebral surface by Sharpey's fibers (arrowheads). The anterior longitudinal ligament (open arrows) is connected to the anterior vertebral surface. In 2, breakdown in the sites of attachment of annulus fibrosus to vertebral rim is evident (arrows), although Sharpey's fibers (arrowheads) are intact. Mild anterior discal displacement is seen. With progression of disease, as shown in 3, osteophytes (arrowheads) develop at the site of attachment of Sharpey's fibers to the anterior vertebral surface. The anterior longitudinal ligament (open arrows) is stretched by the displaced intervertebral disc. With still further progression, as in 4a, an osteophyte that bridges the intervertebral disc is seen (arrowheads). Alternatively, as in 4b, continued traction on the anterior longitudinal ligament may lead to proliferative enthesopathy, with the production of new bone (open arrows) at its site of attachment to the anterior vertebral surface, combined with more typical osteophytes (arrowheads).

(3, From Resnick D: Radiology 156:3, 1985.)

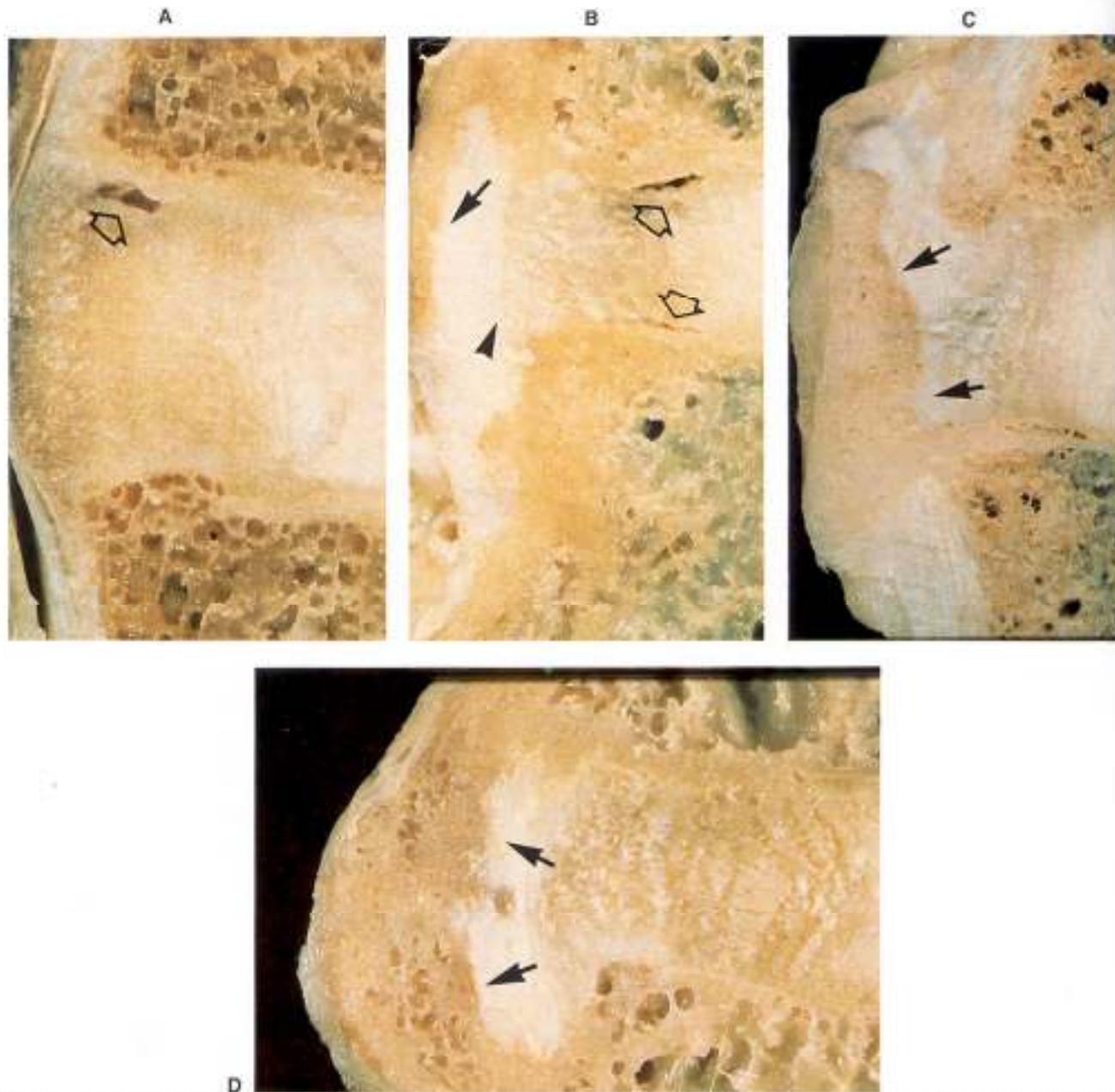


Figure 44-13. Spondylosis deformans: Pathologic abnormalities. Four different sagittal sections of the discovertebral junction illustrate the sequential pathologic steps in spondylosis deformans. Initially **(A)**, a defect is observed at the sites of attachment of outer fibers of the annulus fibrosus to the vertebral rim (open arrow). At a later stage **(B)**, larger defects are evident (open arrows), and displacement of discal material can be identified (arrowhead). Traction on Sharpey's fibers will lead to osteophyte formation (arrow). With further progression **(C, D)**, these osteophytes (arrows) may bridge the intervertebral disc space.

Disc Changes



- Intervertebral osteochondrosis
 - Loss of disc height
 - Vacuum phenomenon
 - Disc calcification
 - Posterior spur/osteocartilagenous ridge

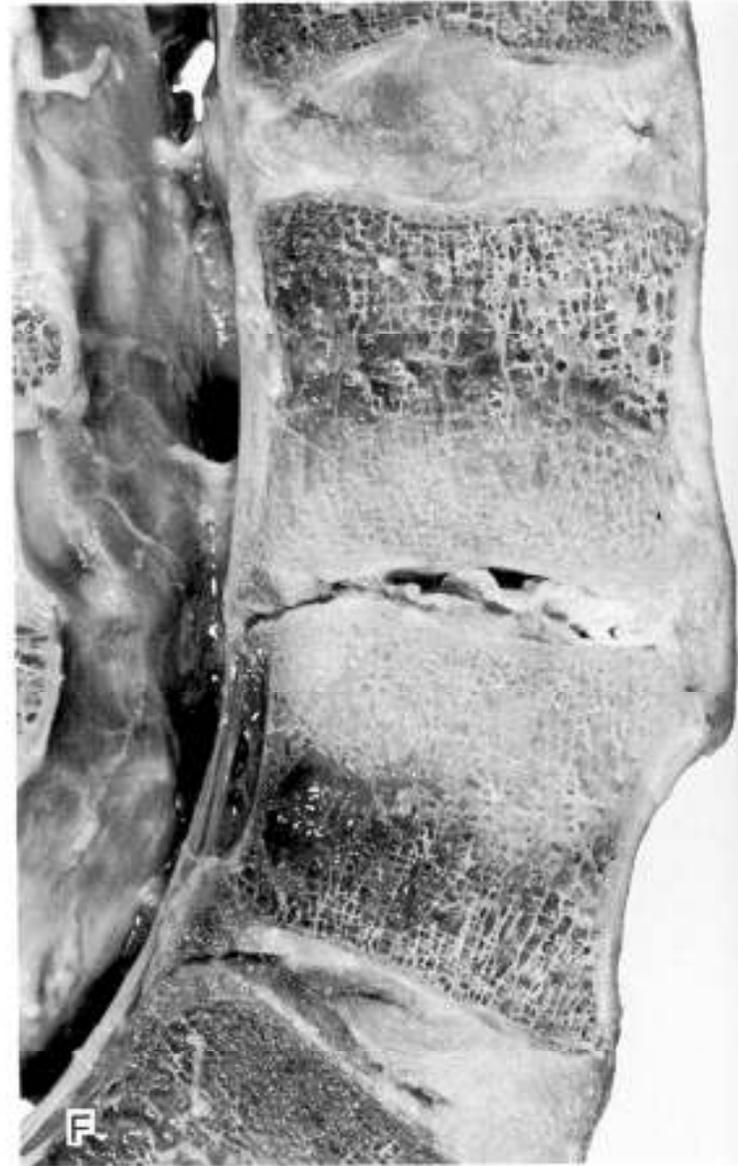
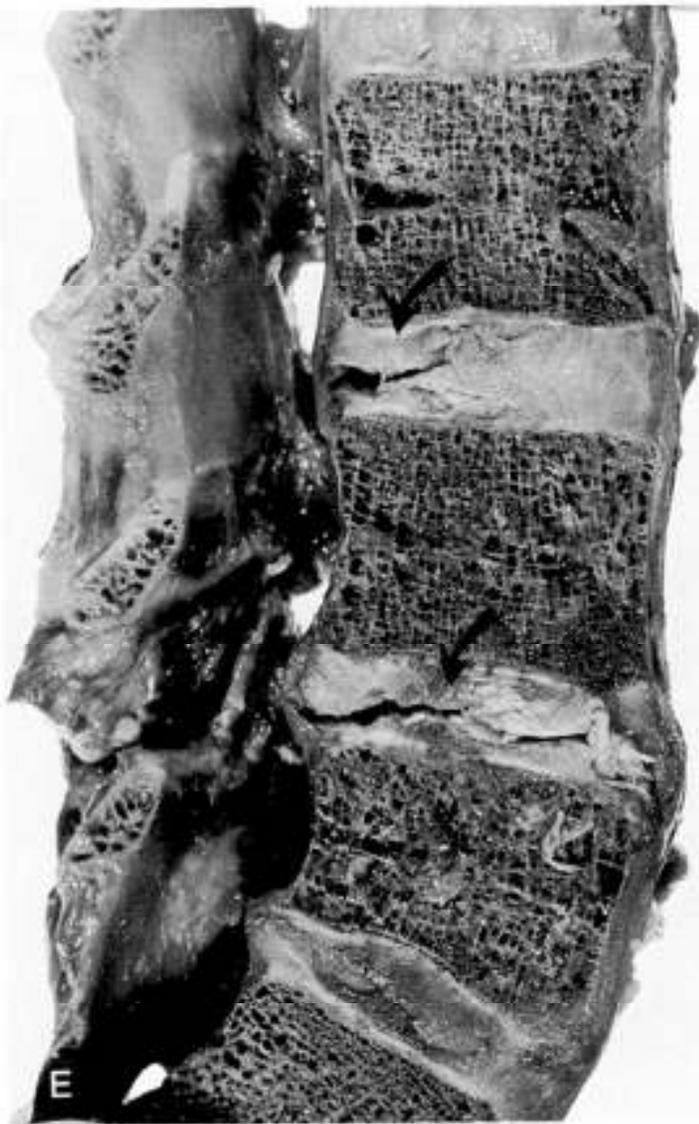


Fig. 4-11 (Continued). (E) Macroscopic sagittal section of the lumbar spine. The upper arrow points to a disc showing early internal disruption; the lower arrow points to a disc characterized by severe internal disruption. (F) Macroscopic sagittal section of the lumbar spine. The central disc demonstrates marked resorption; the disc itself is a narrow slit; vertebral body bone on either side is sclerotic. (Fig. F from Kirkaldy-Willis WH, Wedge JH, Yong-Hing K, Reilly J: Pathology and pathogenesis of lumbar spondylosis and stenosis. Spine 3:323, 1978.)

Vacuum Phenomenon on CT

- A sign of an actively degenerating disc that is often pain producing
- Represents nitrogen gas that is released as lipids break down in the disc



Disc Calcification (Annulus)

- Can be in annular fibers (eventually get incorporated into an osteophyte) or in the nucleus pulposus (rare)



Disc Calcification (Nucleus)



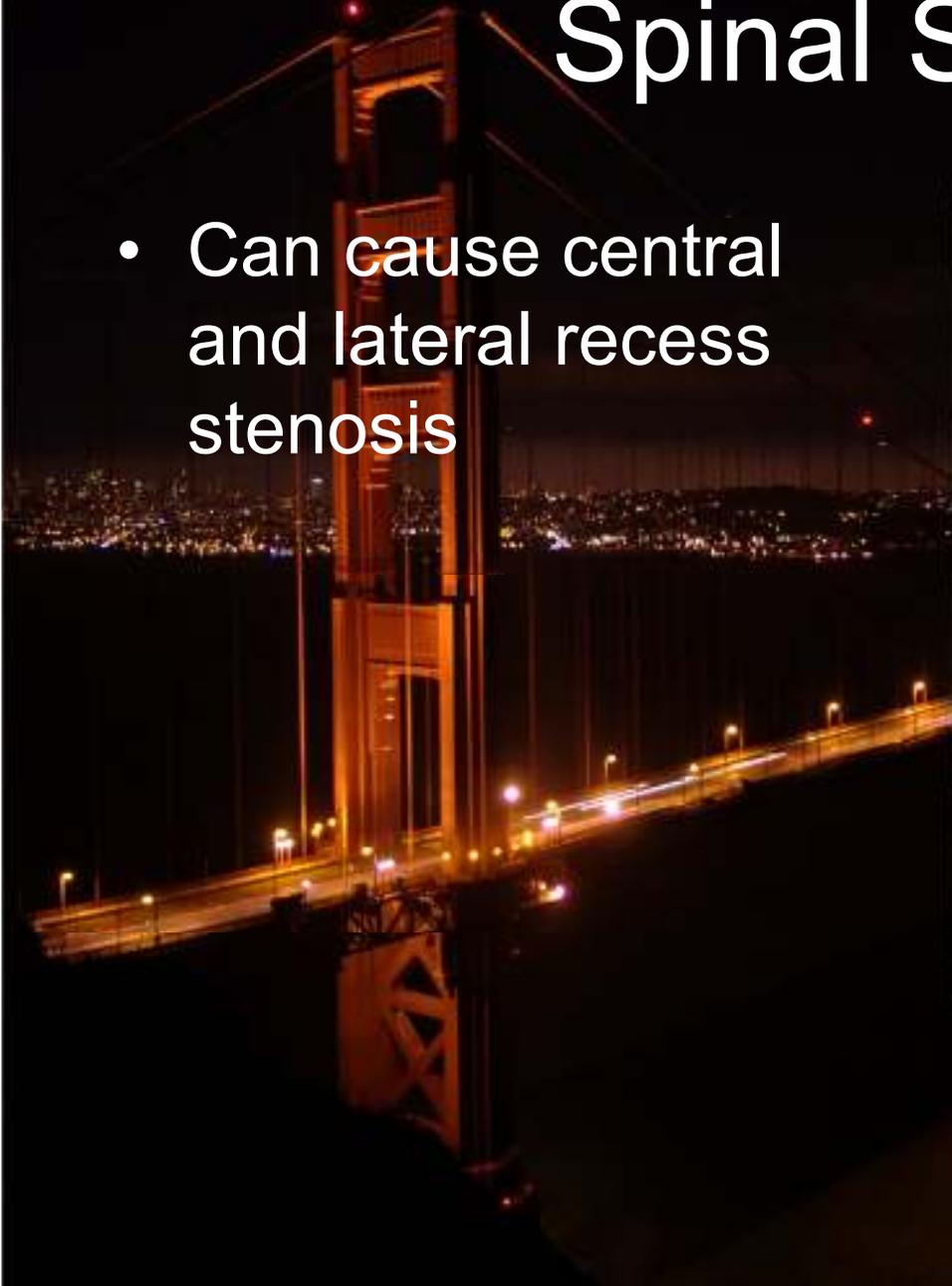
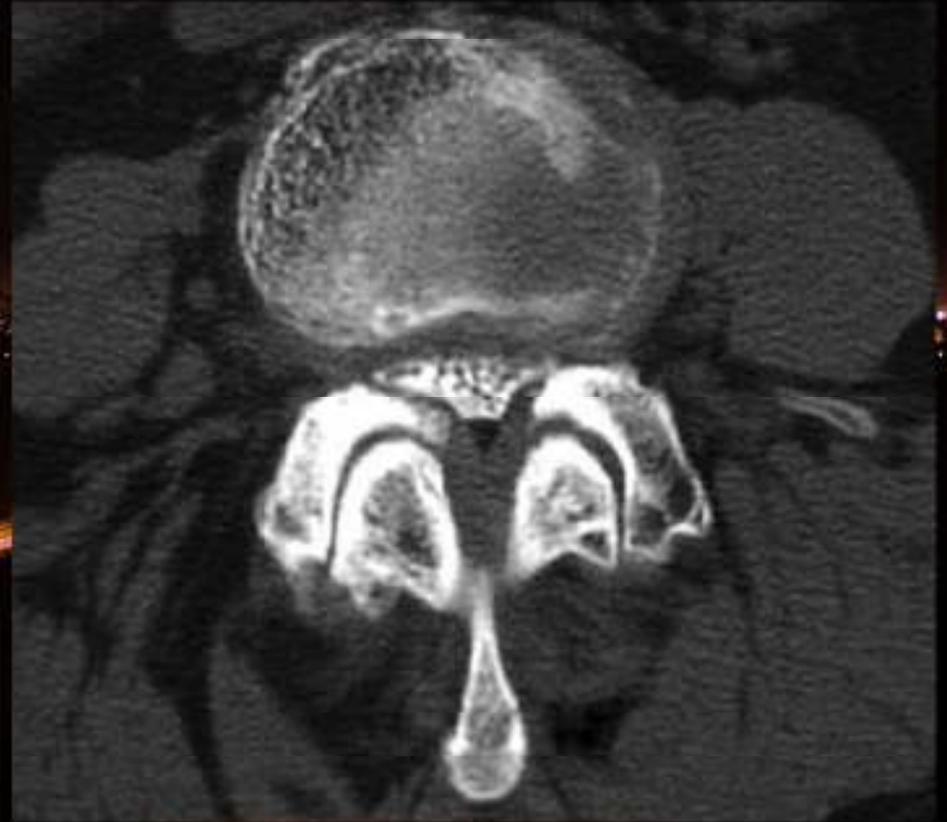
Complications

- Degenerative spondylolisthesis
- Degenerative retrolisthesis
- Spinal stenosis



Spinal Stenosis

- Can cause central and lateral recess stenosis



Retrolisthesis

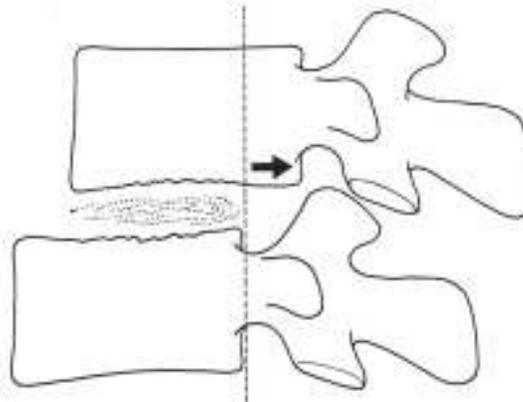
- Can cause stenosis
- Can result in degeneration or can be caused by degeneration

Figure 44-39. Spondylolisthesis without spondylolysis: Retrolisthesis.

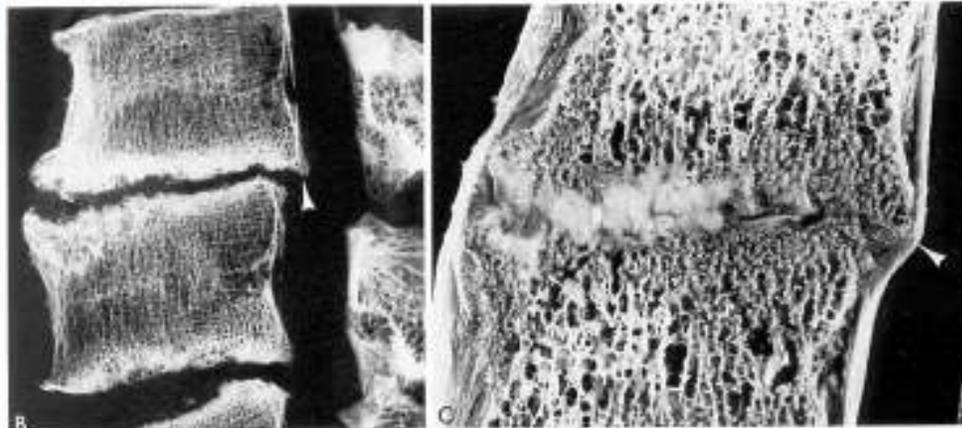
A As the intervertebral disc space narrows due to intervertebral (osteo)chondrosis, telescoping of the apophyseal joints allows backward displacement of the upper lumbar vertebra on the lower one.

B, C Retrolisthesis of L2 in relationship to L3 (arrowsheads) is related to severe intervertebral (osteo)chondrosis in the intervening intervertebral disc.

(B, From Resnick D: Radiology 156:3, 1984.)



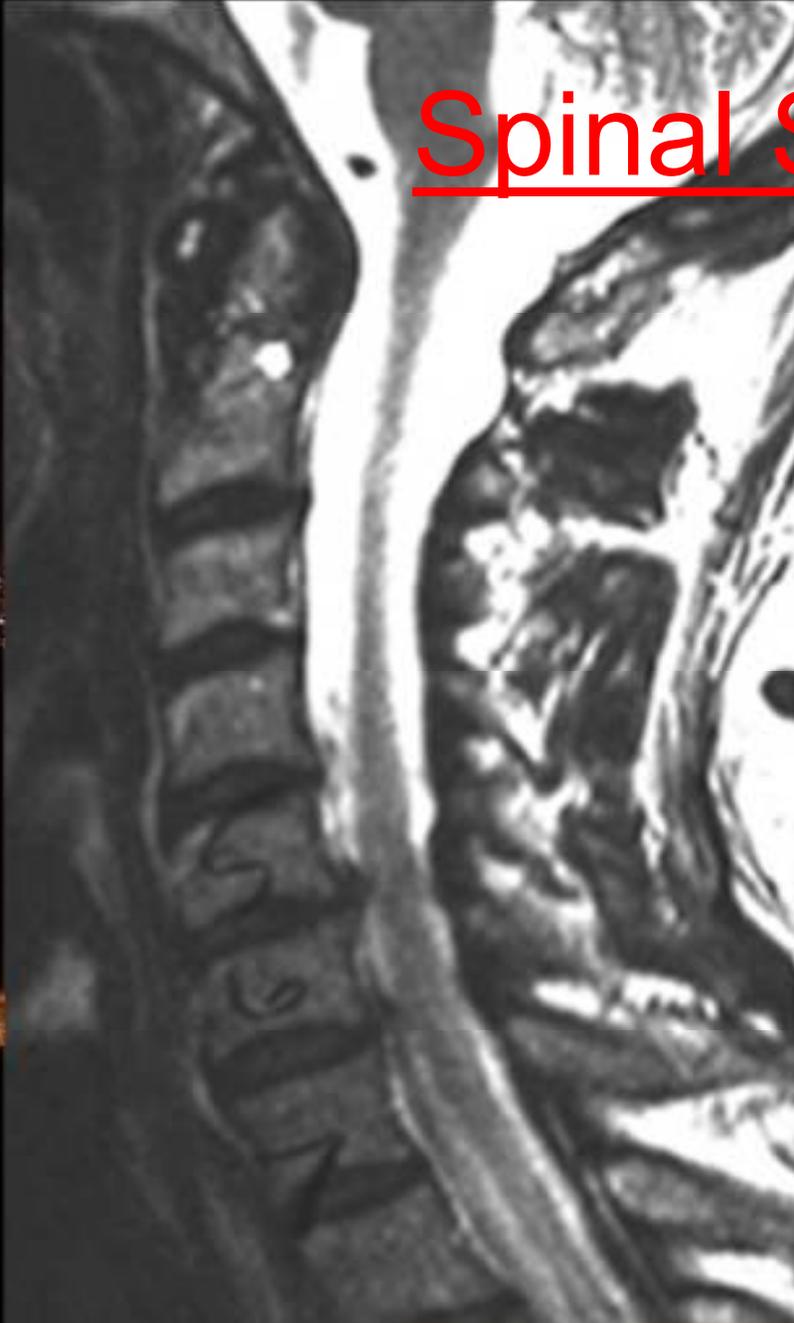
A



B

C

Spinal Stenosis



DJD Facts

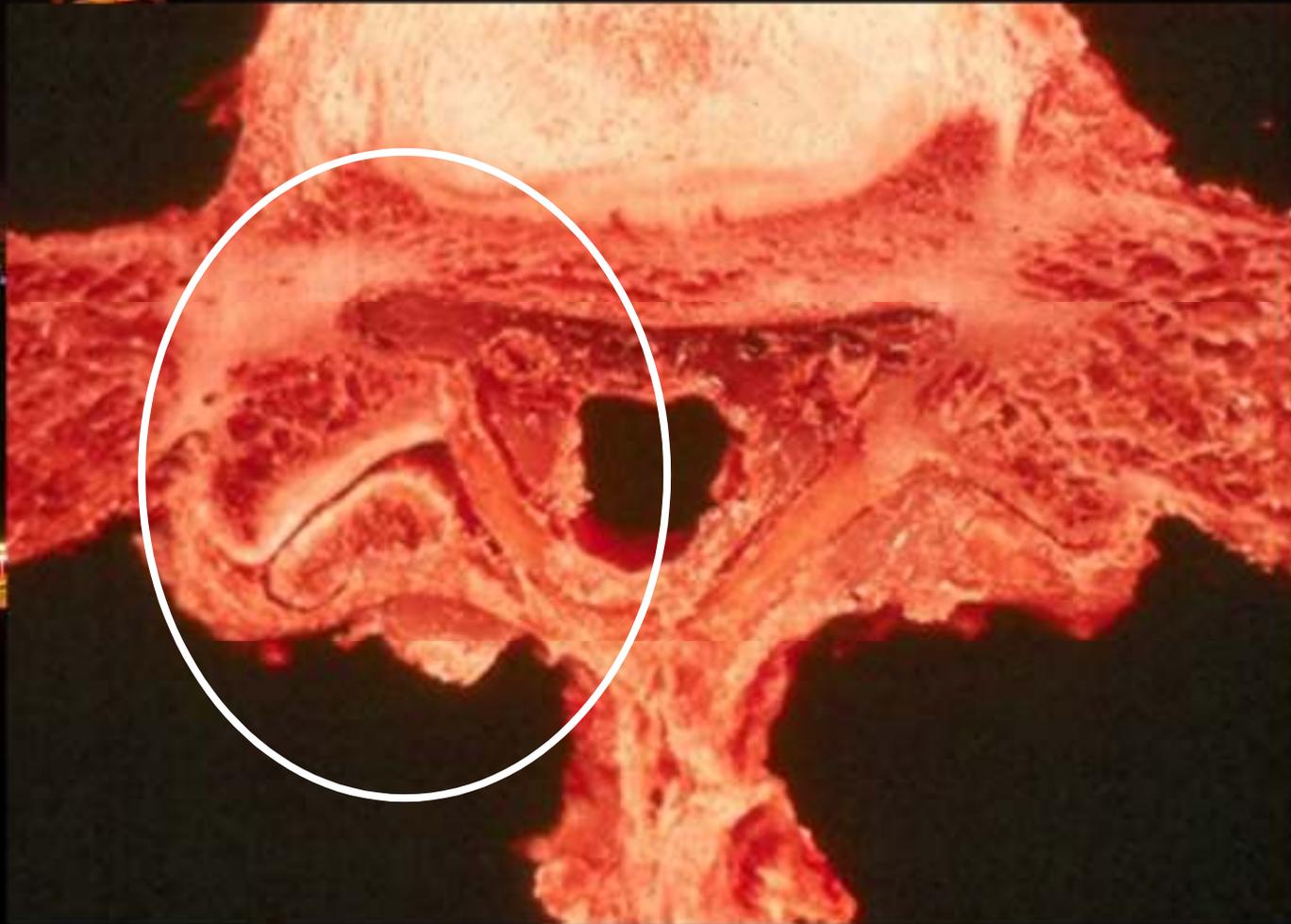
- Scientific studies suggest that spondylosis deformans is the consequence of normal aging, whereas intervertebral osteochondrosis (AKA deteriorated disc), results from a clearly pathologic process with (or without) symptoms.
 - J Bone Jnt Surg 1962; 44: 243-68
 - Acta Ortop Scan 1985; 56: 496-99
 - Cin Orthop RI Res 1987; 224: 97-104
 - Spine 2004; 4(6suppl): 167s-72s

Uncinates and facets

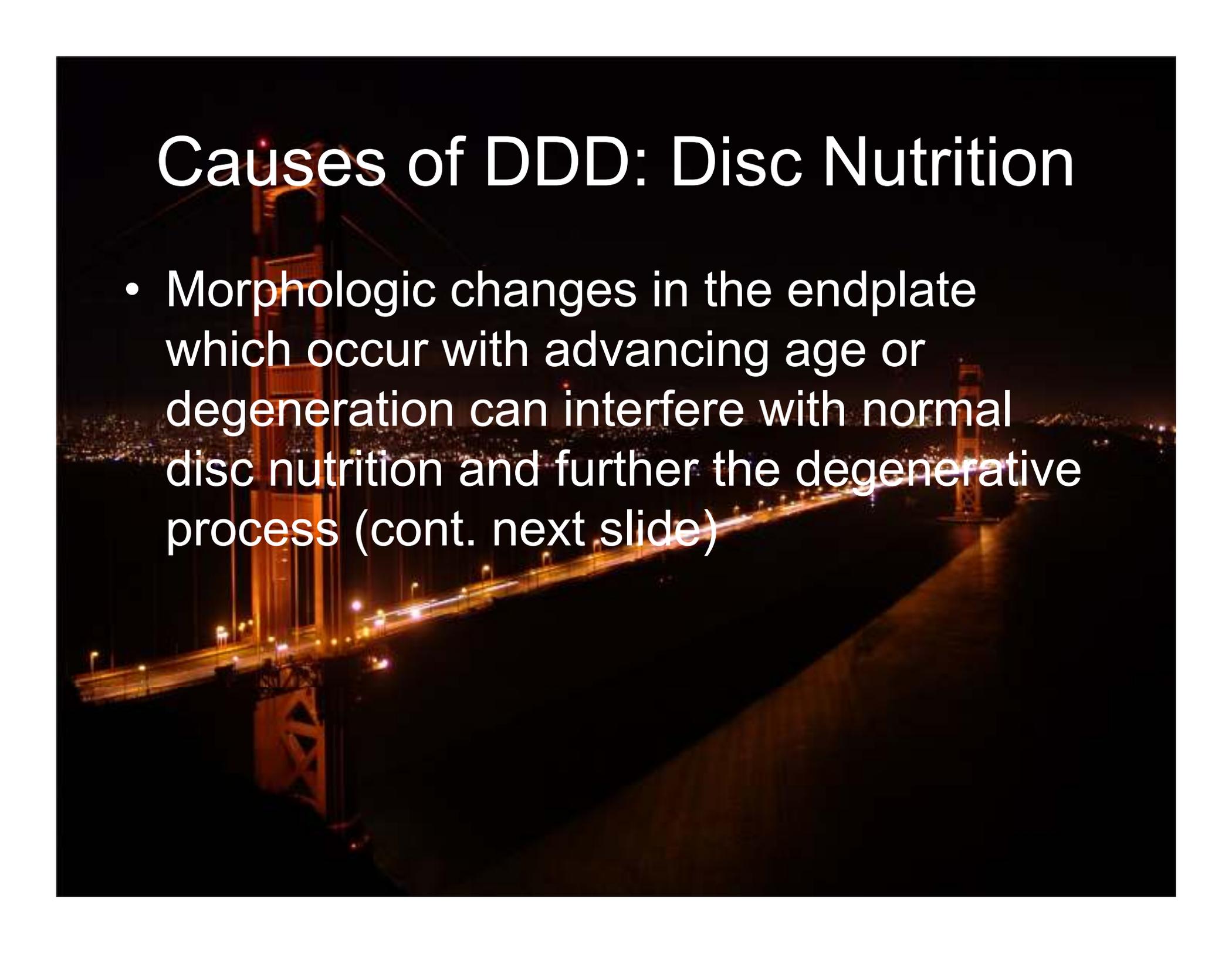
- Osteoarthritis or arthrosis



Facet OA Causing Lateral Recess Stenosis and Nerve Compression



Causes of DDD: Disc Nutrition



- Morphologic changes in the endplate which occur with advancing age or degeneration can interfere with normal disc nutrition and further the degenerative process (cont. next slide)

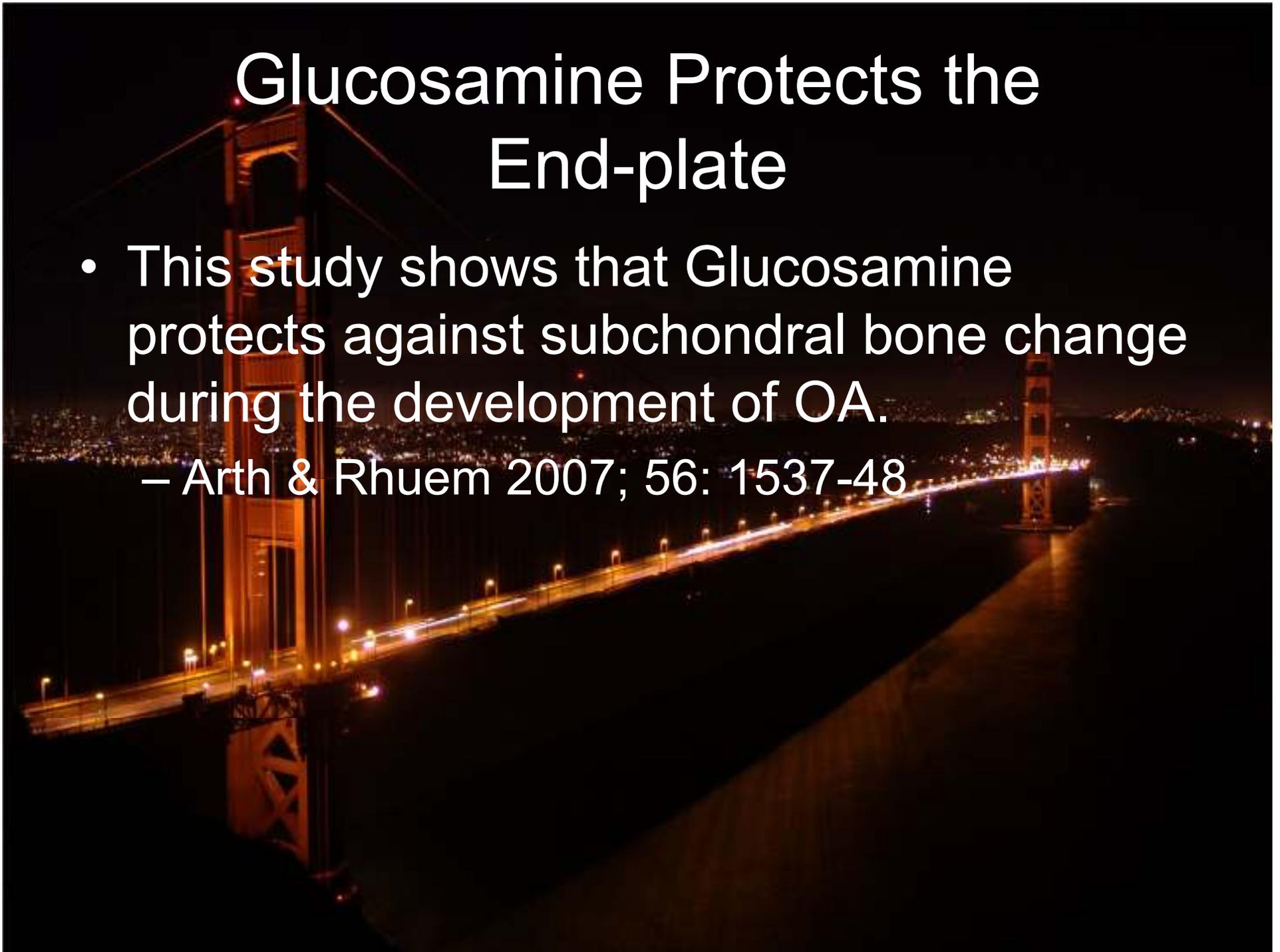
Causes of DDD: Disc Nutrition

- These changes then alter the integrity of the proteoglycans and water concentration, reducing the number of viable cells with subsequent alteration in the movement of solutes into and out of the disc.

– Pain 2004; 112: 225-8

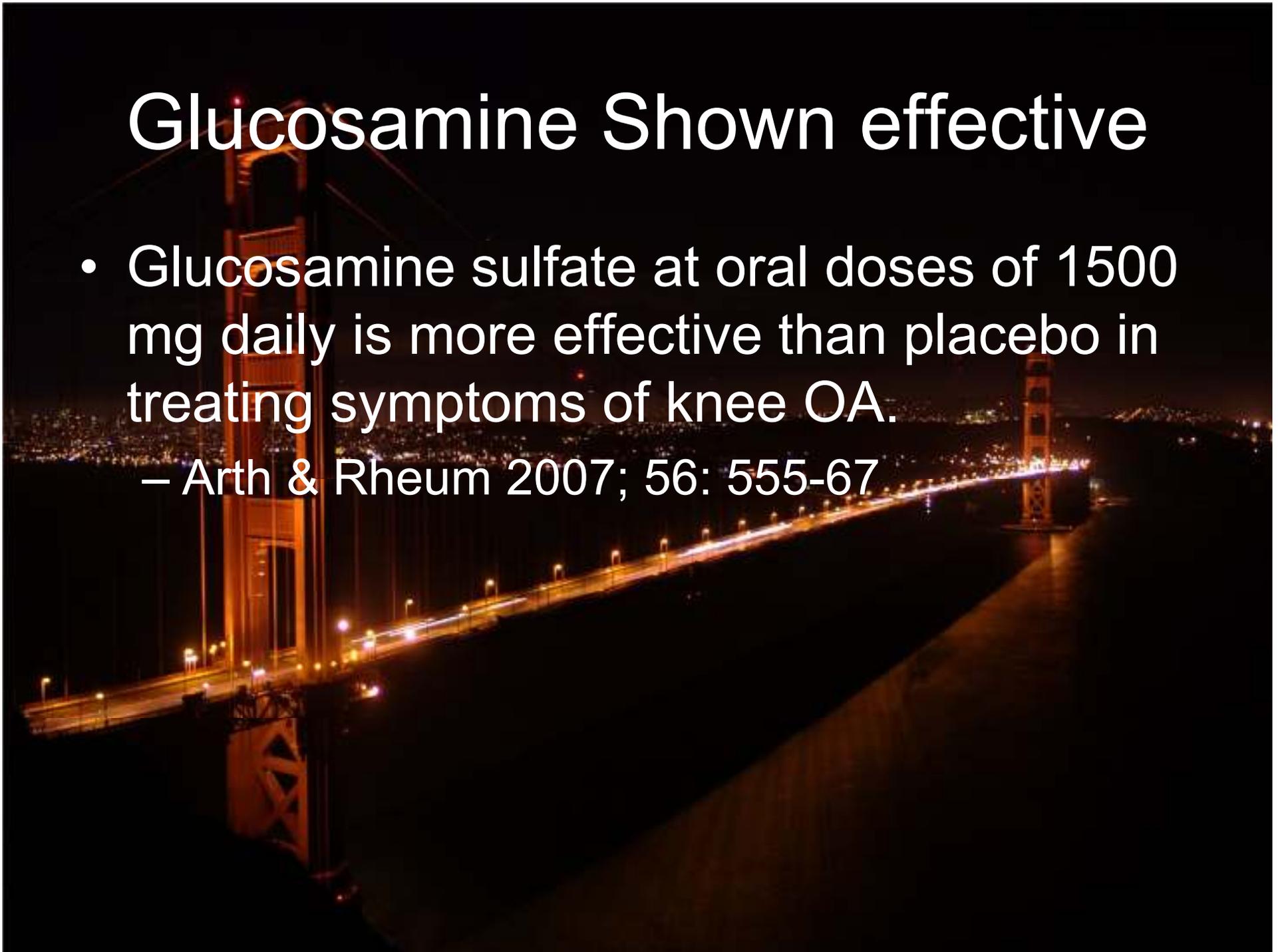
Glucosamine Protects the End-plate

- This study shows that Glucosamine protects against subchondral bone change during the development of OA.
 - Arth & Rhuem 2007; 56: 1537-48



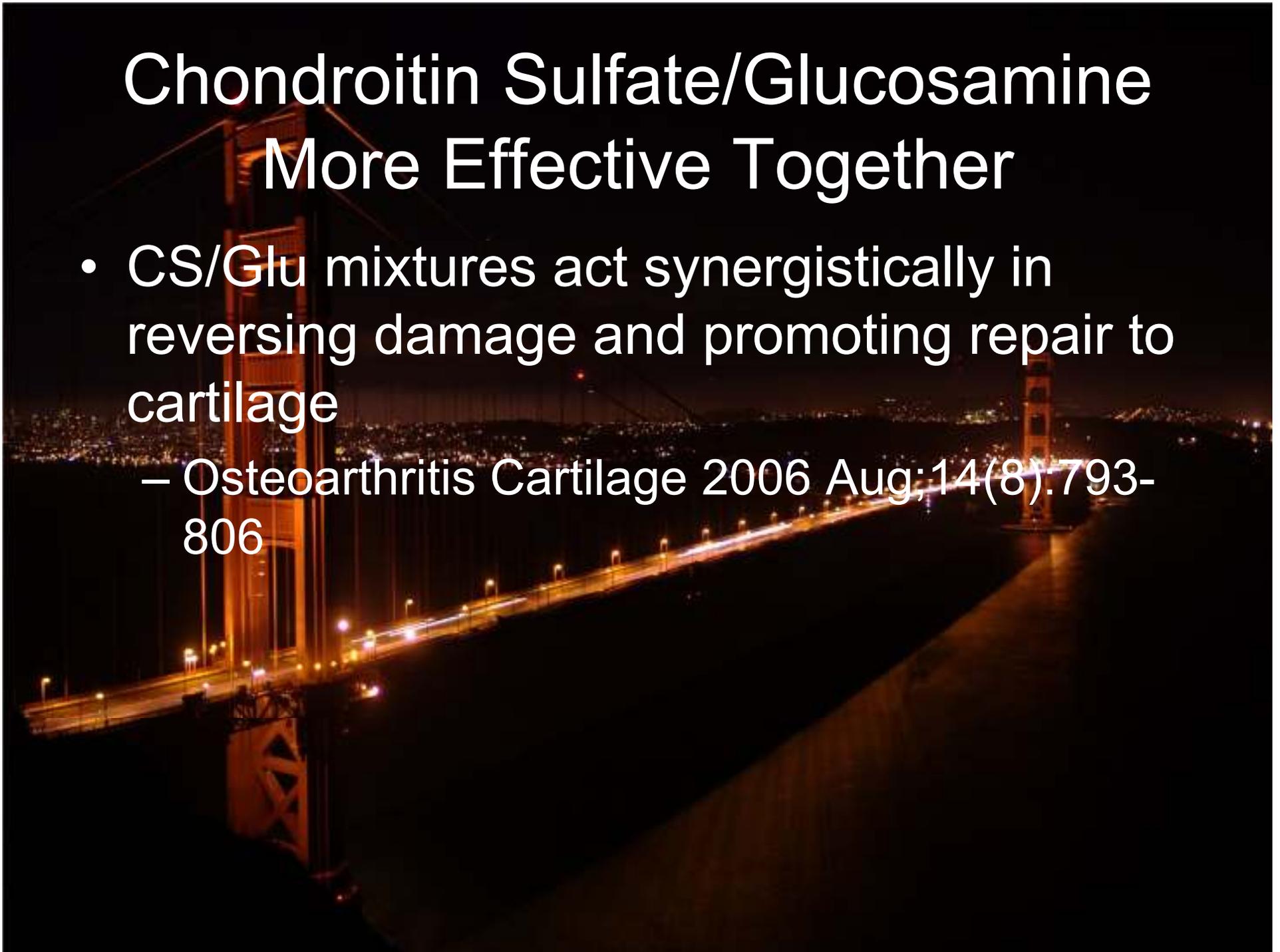
Glucosamine Shown effective

- Glucosamine sulfate at oral doses of 1500 mg daily is more effective than placebo in treating symptoms of knee OA.
 - Arth & Rheum 2007; 56: 555-67



Chondroitin Sulfate/Glucosamine More Effective Together

- CS/Glu mixtures act synergistically in reversing damage and promoting repair to cartilage
 - Osteoarthritis Cartilage 2006 Aug;14(8):793-806



Methylsulfonylmethane (MSM)

- MSM improved symptoms of pain and physical function in OA without major adverse affects
 - Osteoarthritis Cartilage 2006 Mar;14(3):286-94
 - Osteoarthritis Cartilage 2008 Nov;16(11):1277-88

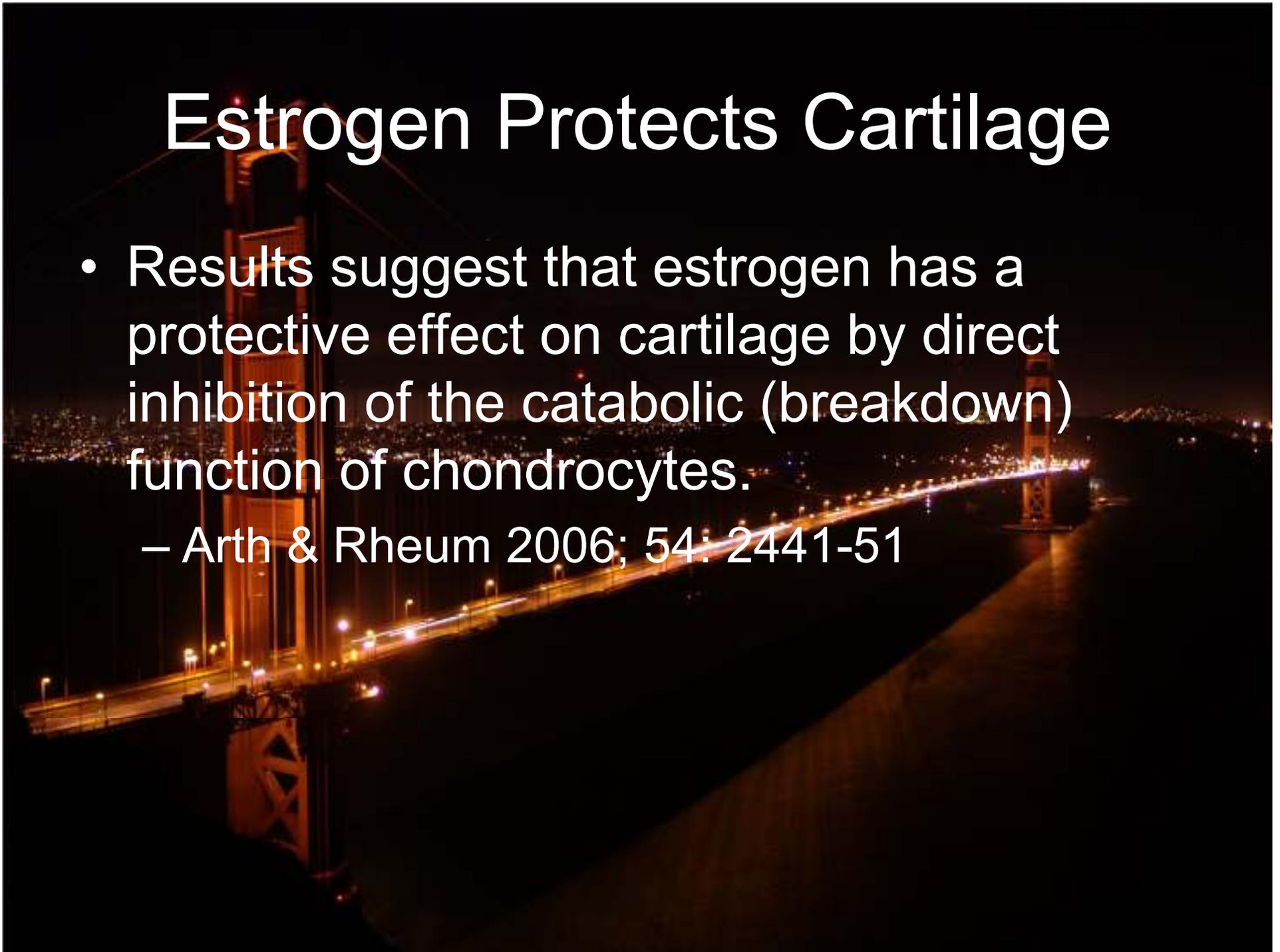
Glucosamine/MSM Together

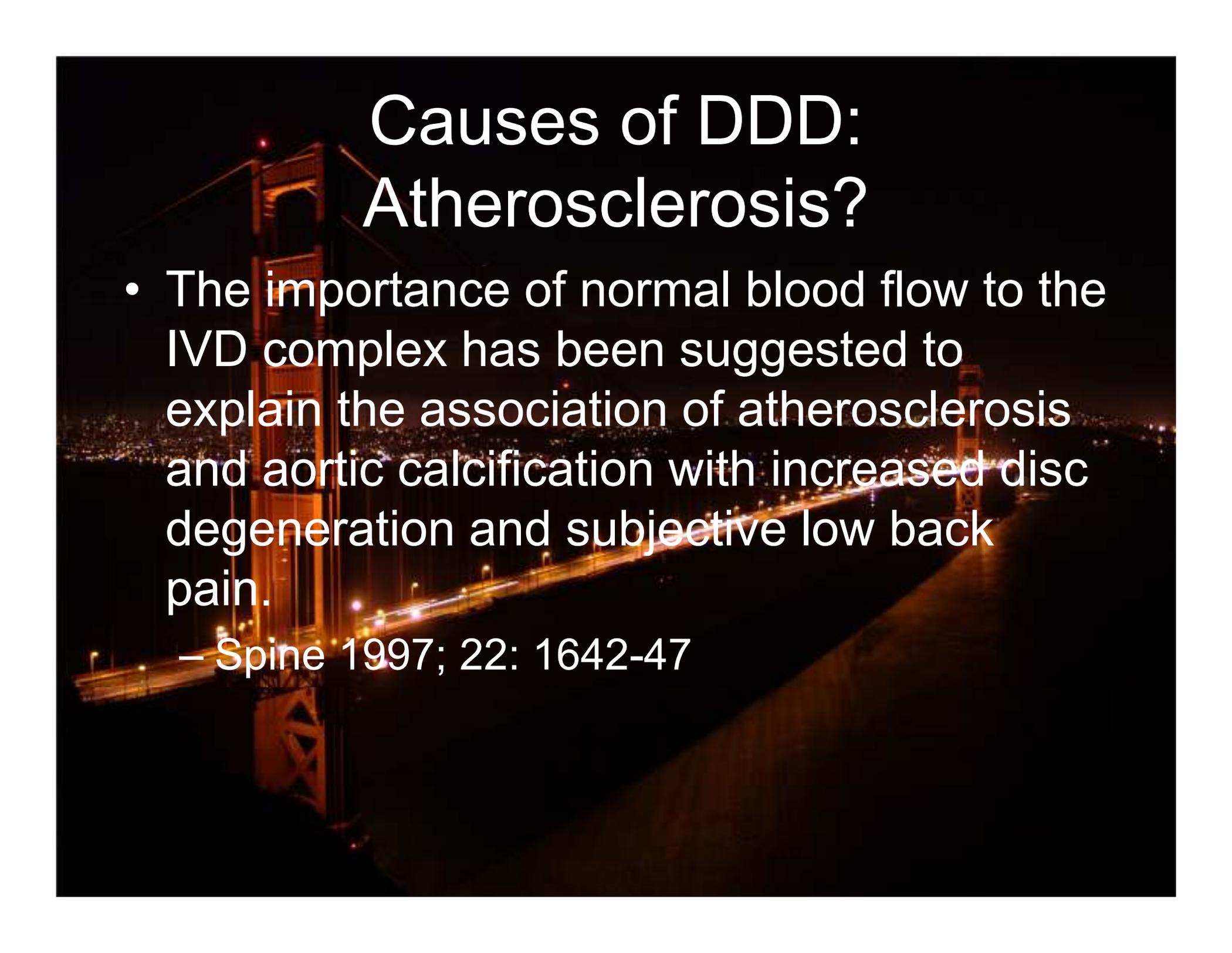
- Glu/MSM and their combination produced an analgesics and anti-inflammatory effect in OA.
 - Clin Drug Invets 2004;24(6):353-63



Estrogen Protects Cartilage

- Results suggest that estrogen has a protective effect on cartilage by direct inhibition of the catabolic (breakdown) function of chondrocytes.
 - Arth & Rheum 2006; 54: 2441-51





Causes of DDD: Atherosclerosis?

- The importance of normal blood flow to the IVD complex has been suggested to explain the association of atherosclerosis and aortic calcification with increased disc degeneration and subjective low back pain.

– Spine 1997; 22: 1642-47

Causes of DDD: Genetic Predisposition?

- In addition to mechanical and nutritional causes, a genetic predisposition has been suggested by animal models that consistently develop DDD at an early age, as well as by reports of familial OA and lumbar canal stenosis in humans.

– Arth Rheum 1986; 29: 863-71

Causes of DDD: Genetic Predisposition?

- A study of 115 male identical twins suggested that the development of DDD was strongly influenced by genetics. The authors concluded that DDD may be explained primarily by genetic influences and by unidentified factors.

– Spine 1995; 20: 26001-12

Causes of DDD: Genetic Predisposition?

- A Danish twin study showed that as the twins grew older the effect of a NON-SHARED environment increased and non-additive genetic effects became more evident suggesting the substantial genetic influence on the susceptibility to DDD.

– Twin Res 2004; 7: 16-26

Causes of DDD: Genetic Predisposition?

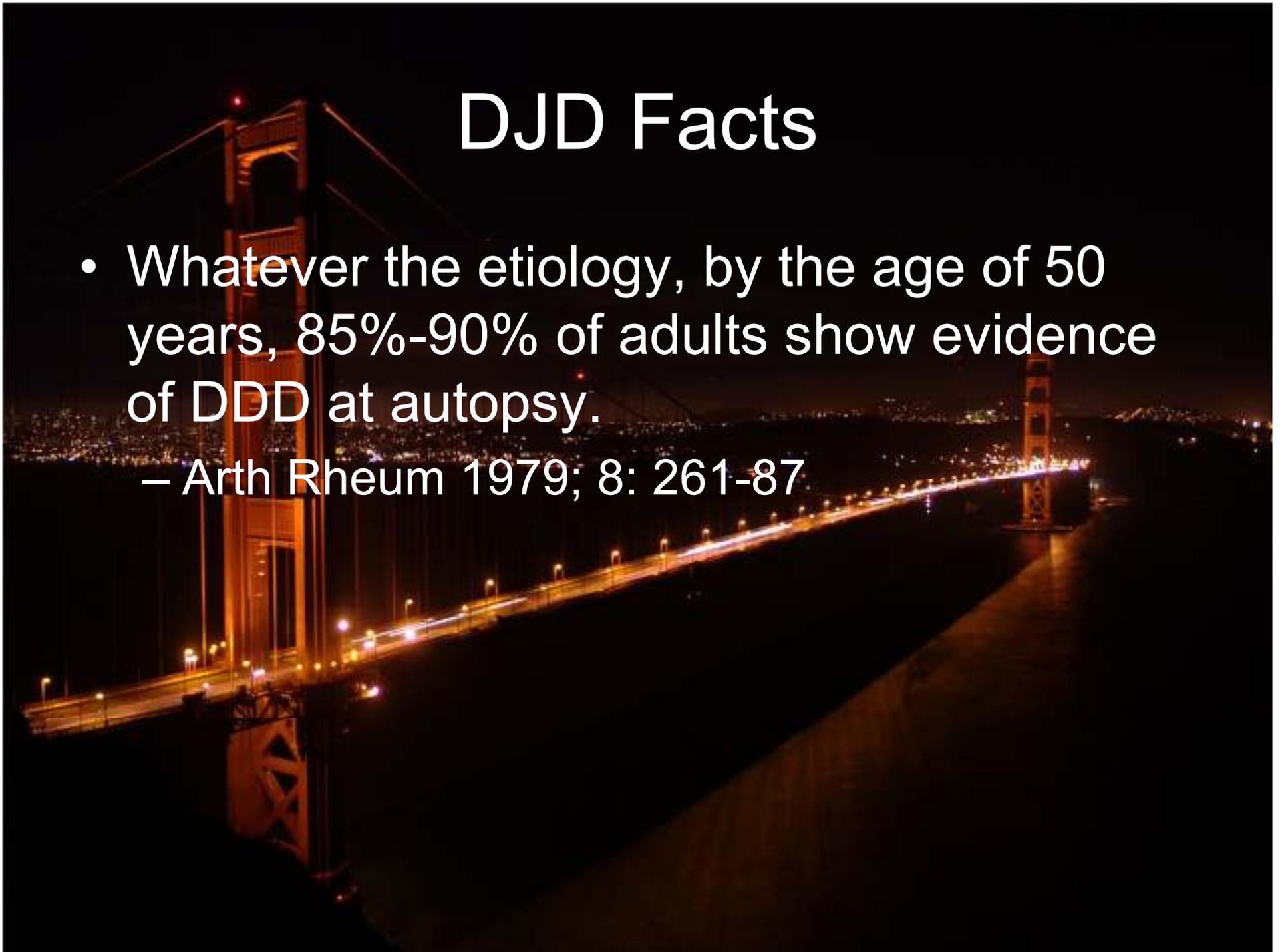
- Type II collagen is the most abundant in cartilage. Two genetic allele substitutions have been associated with DDD. In the case of the Trp3 allele, it is a genetic factor associated with a **THREEFOLD INCREASE IN THE RISK OF SYMPTOMATIC DDD.**
 - Science 1999; 285: 409-12
 - JAMA 2001; 285: 1886-8
 - JAMA 2001; 285: 1843-9

Patients' Belief of Cause of DJD

- (May have chosen from more than 1 category)
 - Hereditary 38%
 - Wear/Tear 31%
 - Occupation 27%
 - Sport 27%
 - Weather/Environment 24%
 - Age 17%
 - Falls 14%
 - Excess weight 7%
 - Previous accidents 7%
- Arth Care & Rsrch 2007; 57: 267-71

DJD Facts

- Whatever the etiology, by the age of 50 years, 85%-90% of adults show evidence of DDD at autopsy.
 - Arth Rheum 1979; 8: 261-87

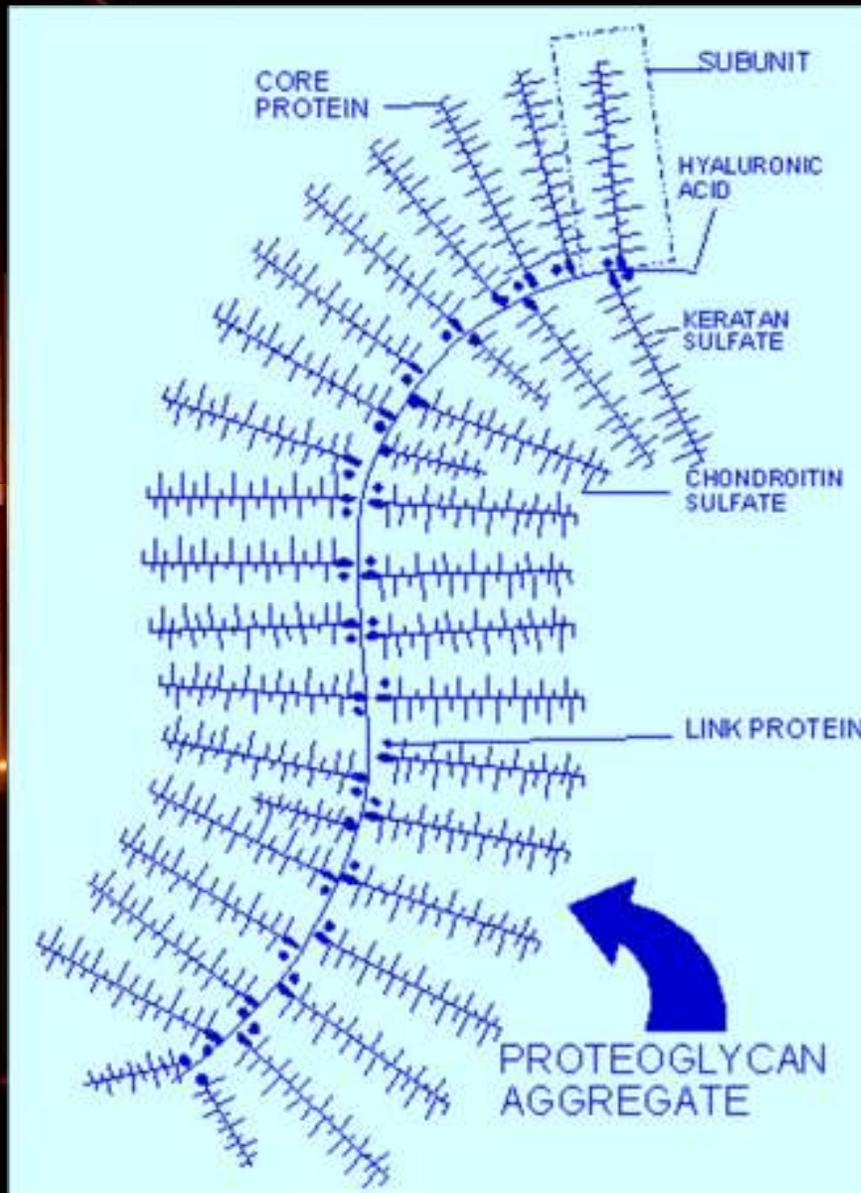


A night-time photograph of the Golden Gate Bridge in San Francisco, California. The bridge's towers and suspension cables are illuminated with warm orange lights, and the city lights in the background create a bokeh effect. The sky is dark, and the water of the bay is visible in the foreground.

PGs and DDD

- Disc degeneration →
- Decrease in Type II collagen →
- Change in PG composition →
- Decreased water in disc →
- Results in ***ABNORMAL*** disc nutrition

PG/GAG: The Water Binders



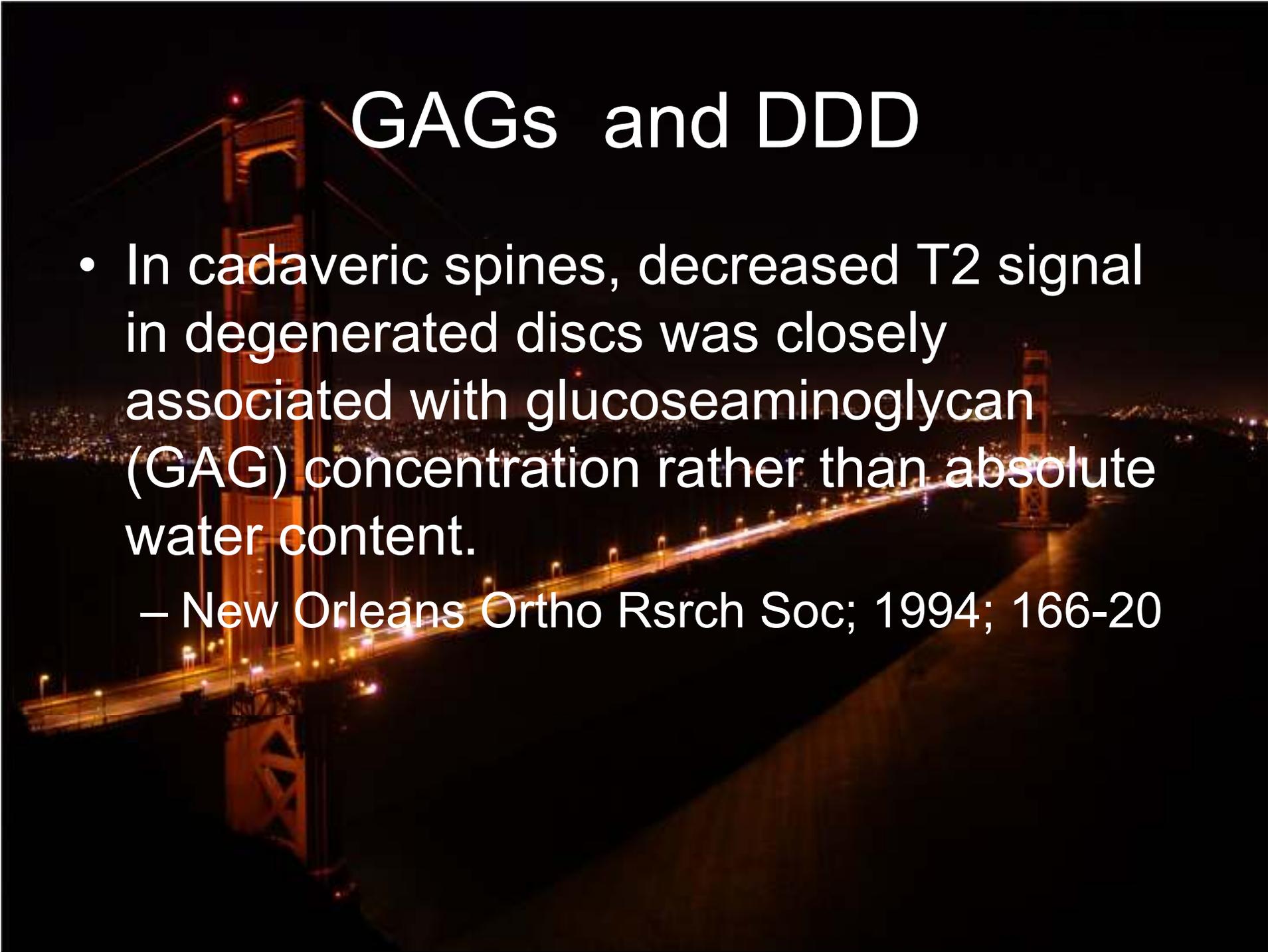
Importance of Water in Cartilage

- Although the tensile strength of the collagen is that of steel wire, it cannot support compressive load since it would fold or crumble. It is the hydrostatic pressure of water bound to proteoglycans, retained and retrained by the collagen meshwork, that gives cartilage its resilience and load bearing properties.
 - Sem In Arth & Rheum 1984; 14(2): 110

PGs and DDD

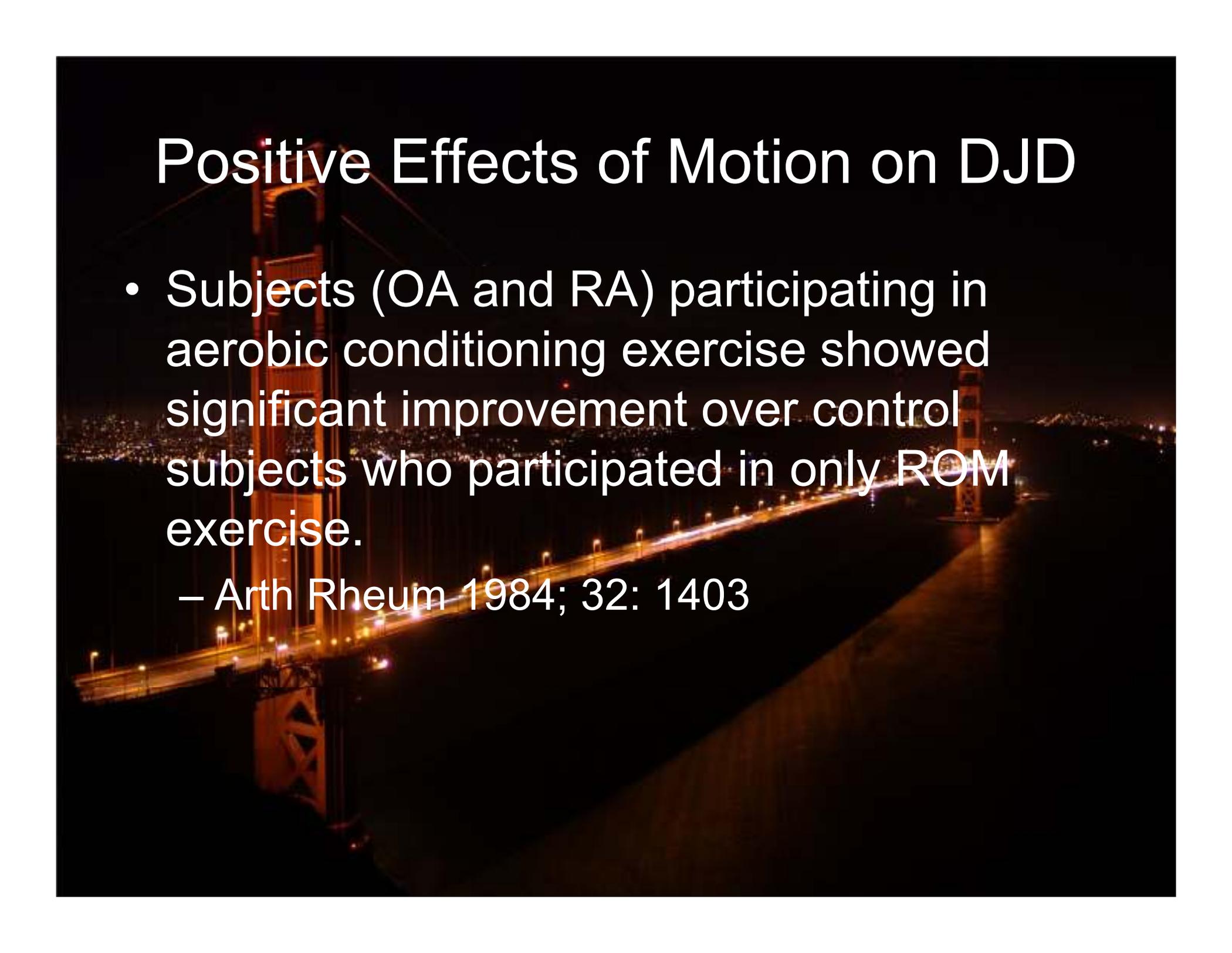
- The degenerated PG has a higher keratin sulfate to chondroitin sulfate ratio reducing the tensile strength and the disc becomes progressively more fibrous and disorganized.
 - Rehabil 1977; 16: 22-9
 - Orthop Clin N Am 1971; 2: 59-70
 - Arth Rheum 1981; 24: 12-21

GAGs and DDD



- In cadaveric spines, decreased T2 signal in degenerated discs was closely associated with glucoseaminoglycan (GAG) concentration rather than absolute water content.
 - New Orleans Ortho Rsrch Soc; 1994; 166-20

Positive Effects of Motion on DJD

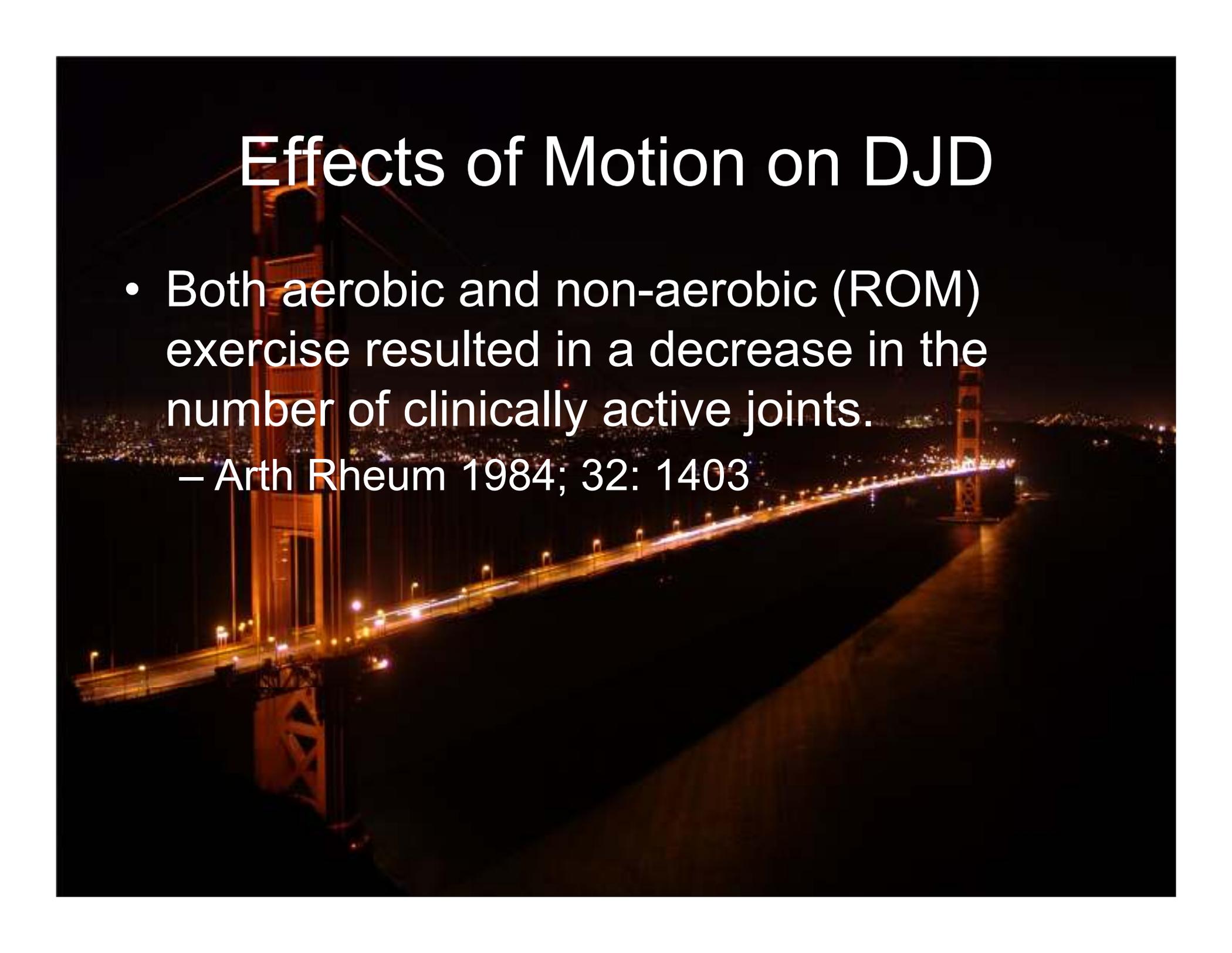


- Subjects (OA and RA) participating in aerobic conditioning exercise showed significant improvement over control subjects who participated in only ROM exercise.
 - Arth Rheum 1984; 32: 1403

Effects of Motion on DJD

- Subjects (OA and RA) participating in conditioning exercise showed significant improvement in exercise endurance, grip strength, flexibility, and number of clinically active joints.
 - Arth Rheum 1984; 32: 1403

Effects of Motion on DJD



- Both aerobic and non-aerobic (ROM) exercise resulted in a decrease in the number of clinically active joints.
 - Arth Rheum 1984; 32: 1403

Vibration and Cartilage



- Vibration allows the HA to be directed evenly among chondrocytes and the extracellular matrix thus improving delivery of nutrients to chondrocytes in deeper layers and improving transportation of waste products.

– Arth & Rheum 2006; 54: 1897-1905

Adverse Affects of Friction

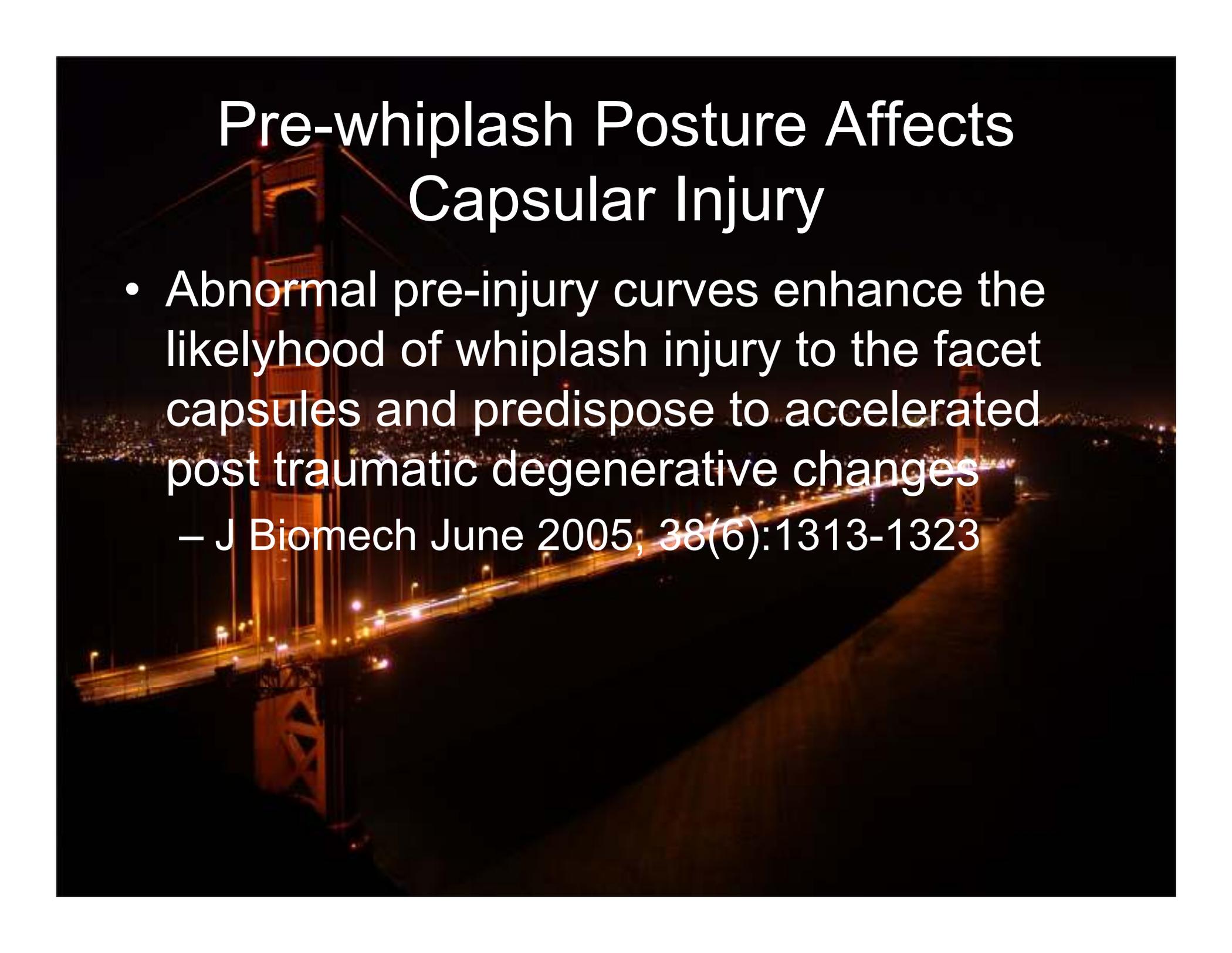
- Lubrican is a glycoprotein secreted by surface cartilage cells and reduces friction. This study showed that small increases in friction caused decreased lubrican and concludes that minor trauma predisposes to early cartilage degeneration.

– Arth & Rheum 2007; 57: 3662-9

Chondroitin Sulfate and Friction

- Chondroitin sulfate significantly reduces the friction coefficient of articular cartilage
 - J Biomech 2007;40(8):1847-54



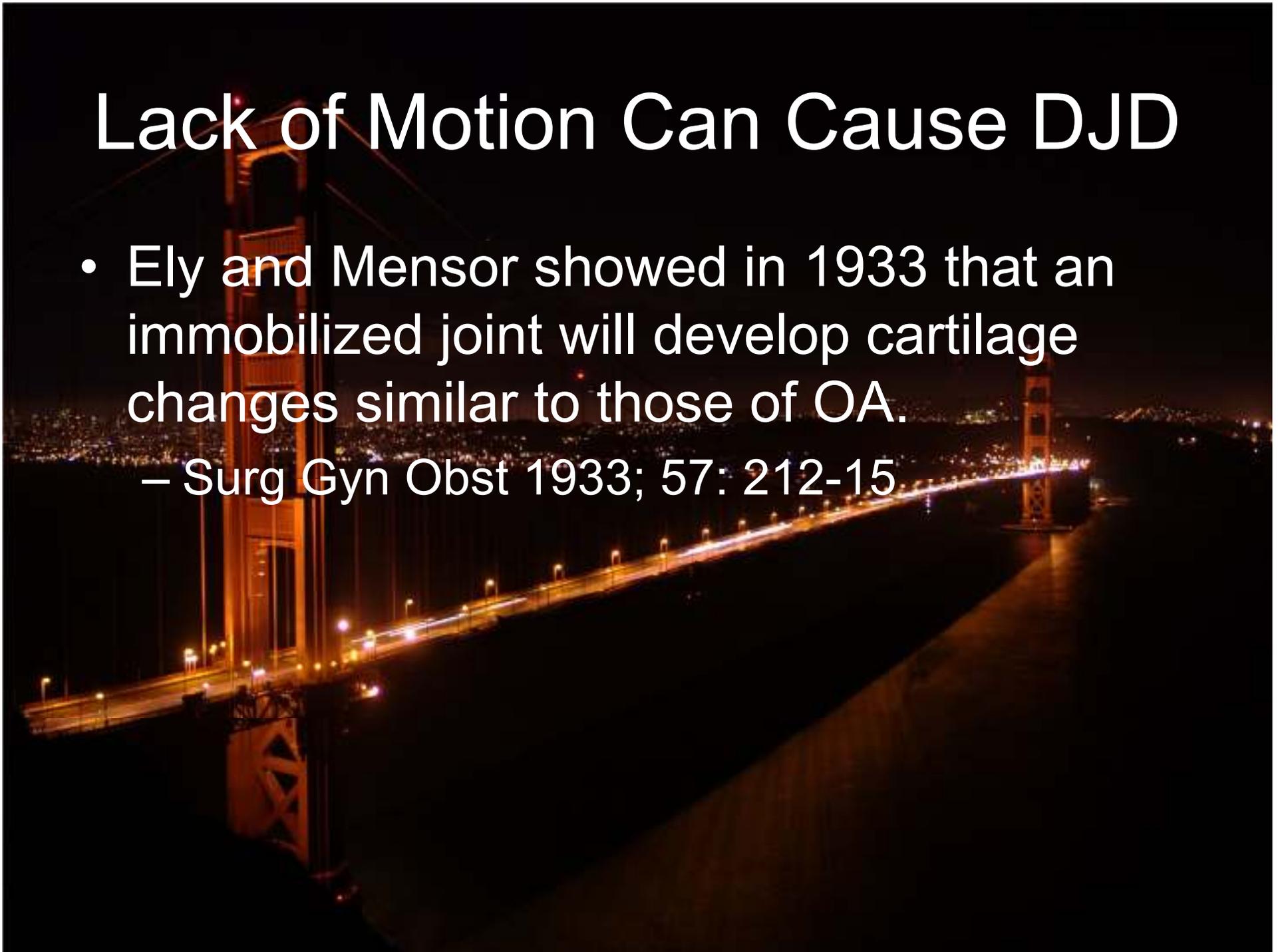


Pre-whiplash Posture Affects Capsular Injury

- Abnormal pre-injury curves enhance the likelihood of whiplash injury to the facet capsules and predispose to accelerated post traumatic degenerative changes
 - J Biomech June 2005, 38(6):1313-1323

Lack of Motion Can Cause DJD

- Ely and Mensor showed in 1933 that an immobilized joint will develop cartilage changes similar to those of OA.
 - Surg Gyn Obst 1933; 57: 212-15

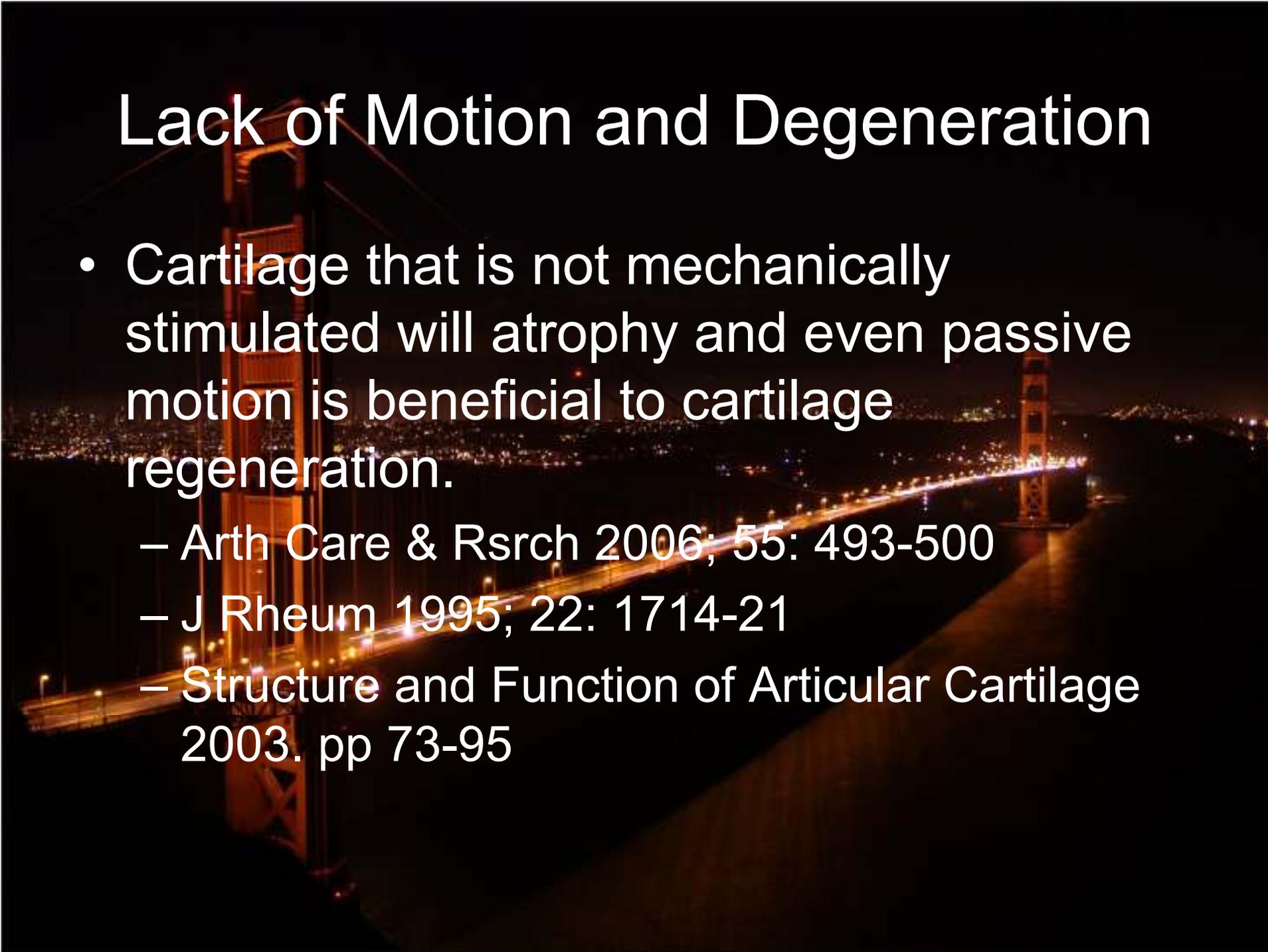


Lack of Motion Can Cause DJD

- Immobilization arthropathies are most probably a consequence of nutritional failure. Avascular cartilage, behaving like a water filled sponge, gives off fluid on compression and takes it up on release of pressure. Alternate compression and re-expansion allows supply of nutrients and removal of metabolic waste.

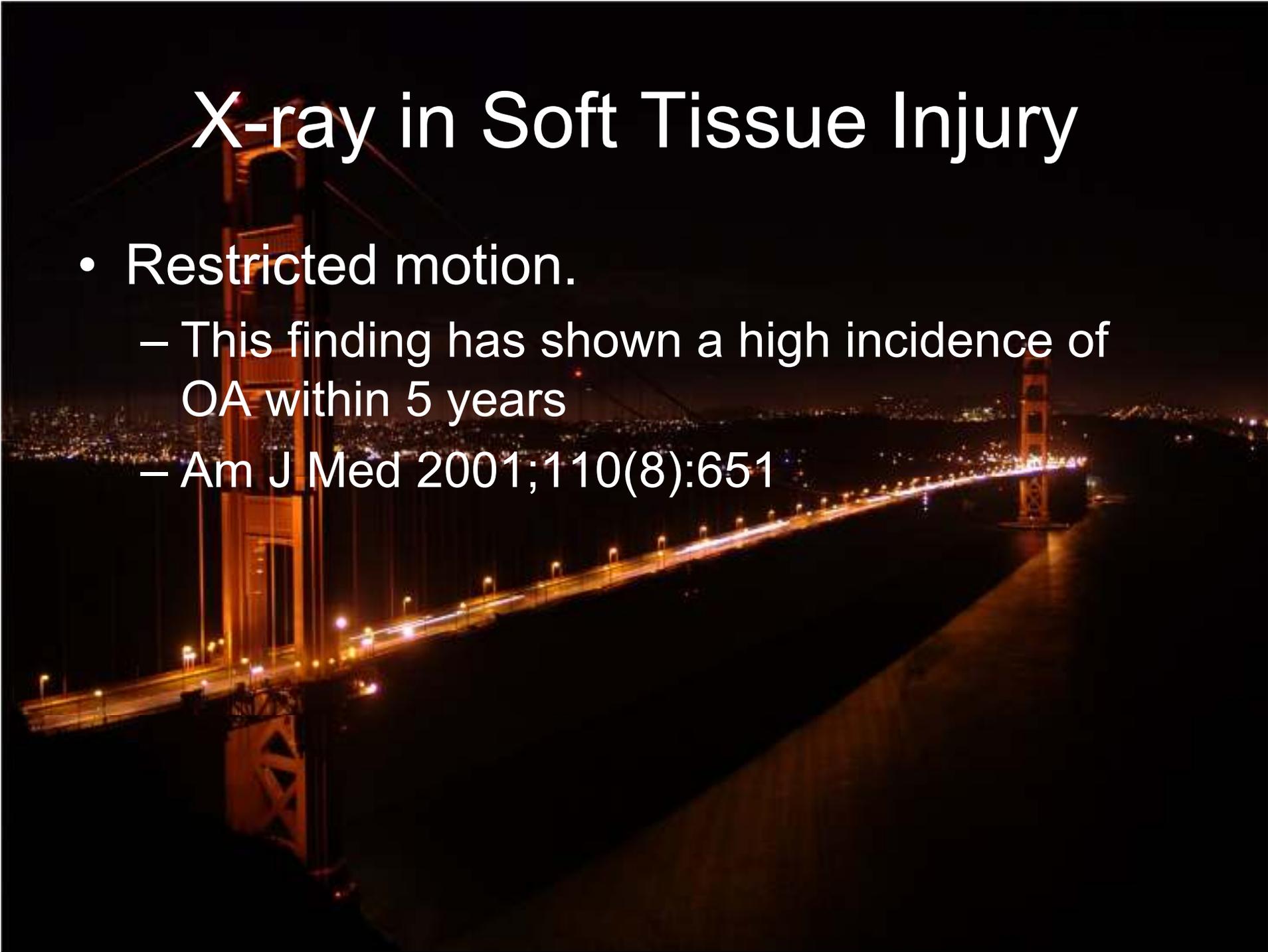
– Arth Rheum 1984; 14: 122

Lack of Motion and Degeneration



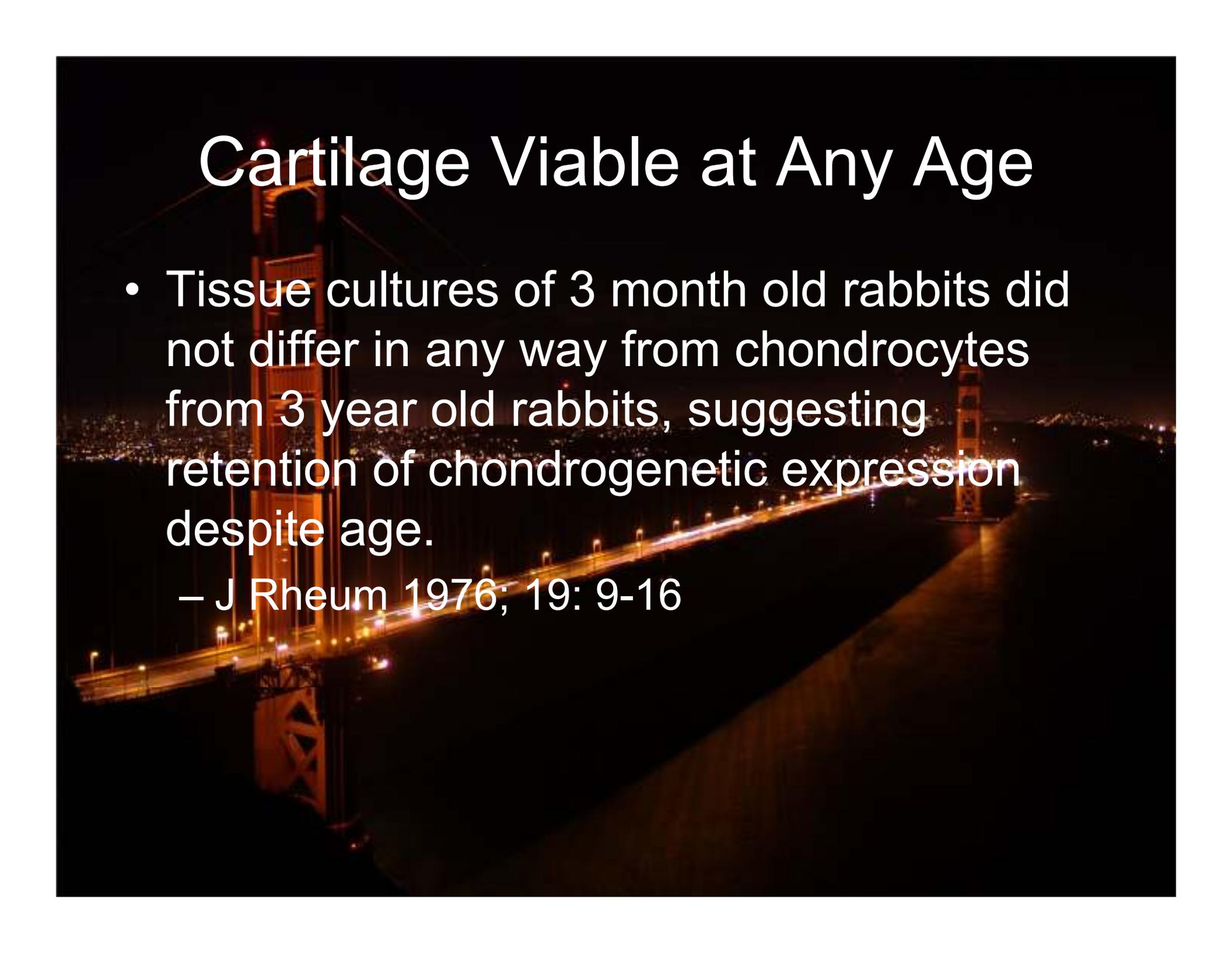
- Cartilage that is not mechanically stimulated will atrophy and even passive motion is beneficial to cartilage regeneration.
 - Arth Care & Rsrch 2006; 55: 493-500
 - J Rheum 1995; 22: 1714-21
 - Structure and Function of Articular Cartilage 2003. pp 73-95

X-ray in Soft Tissue Injury



- Restricted motion.
 - This finding has shown a high incidence of OA within 5 years
 - Am J Med 2001;110(8):651

Cartilage Viable at Any Age



- Tissue cultures of 3 month old rabbits did not differ in any way from chondrocytes from 3 year old rabbits, suggesting retention of chondrogenetic expression despite age.
 - J Rheum 1976; 19: 9-16

Cartilage Viable at Any Age

- A pilot study of human chondrocytes in tissue culture disclosed no differences in morphology in DNA-RNA turnover, proline hydroxylation of collagen, or proteoglycan synthesis in chondrocytes from subjects 65 and older and children under 15.
 - Clin Orth 1971; 75: 248-60

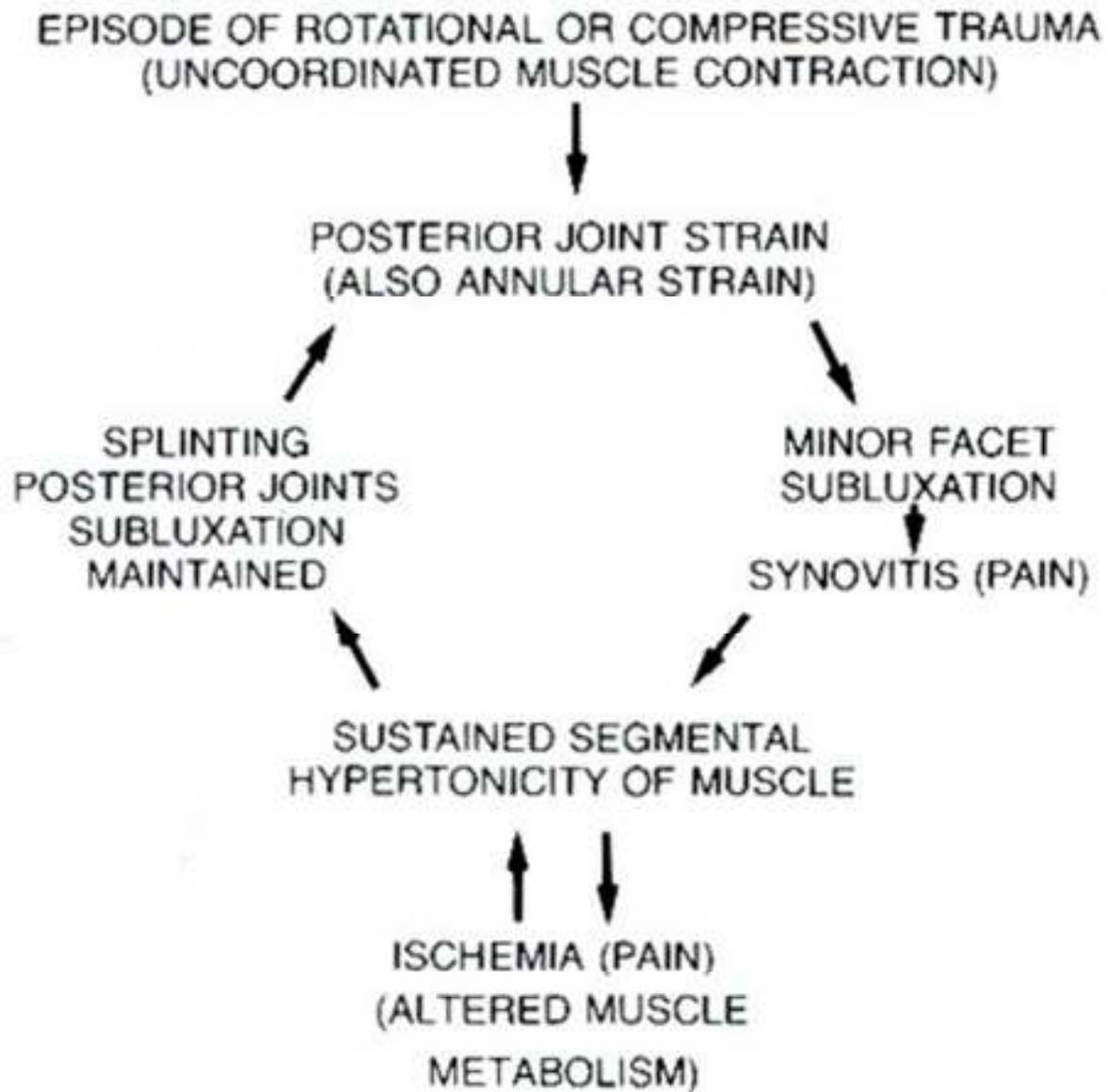


Fig. 9-2 Mechanics of dysfunction. (Courtesy of S. V. Paris.)

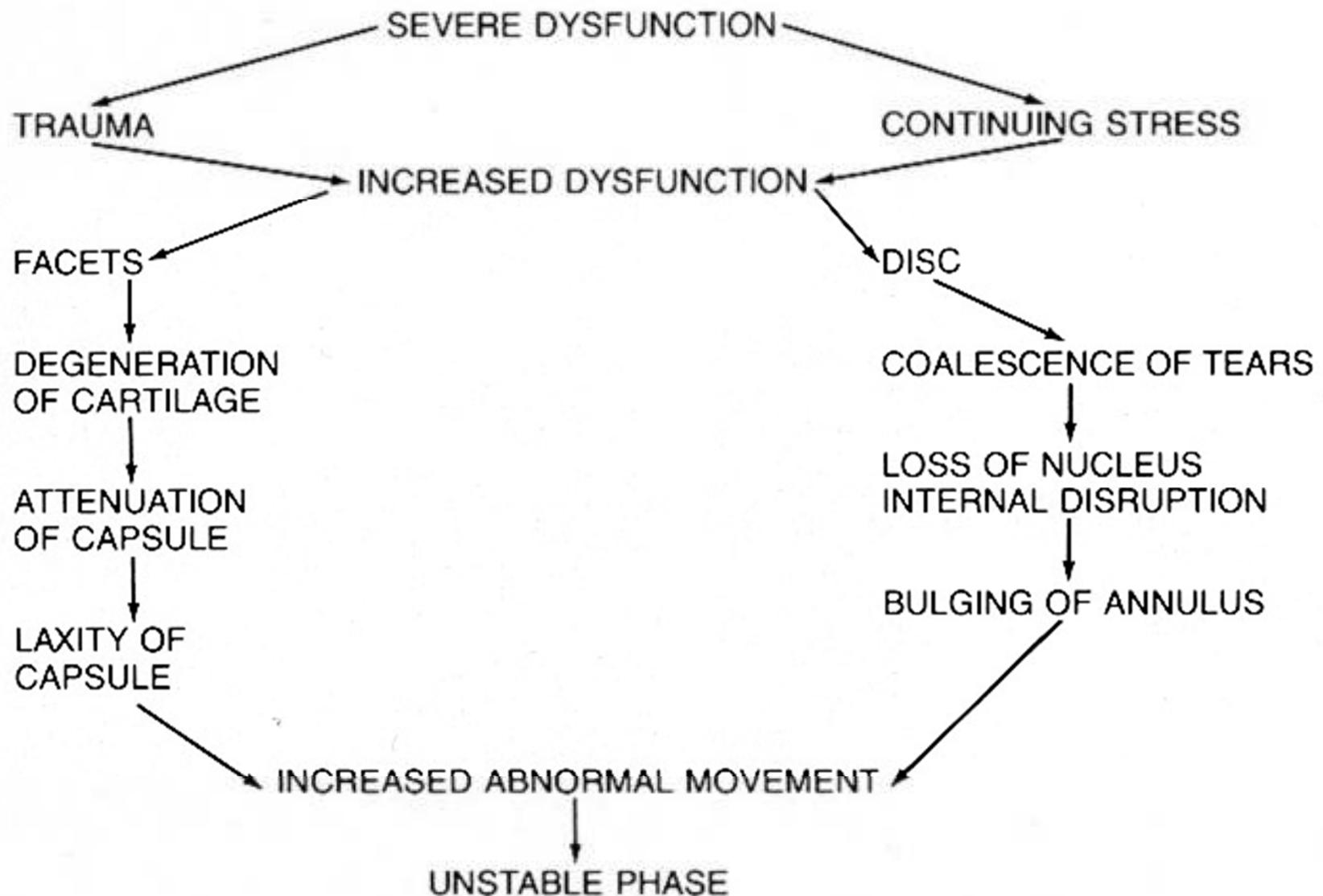


Fig. 9-4 Mechanisms of the unstable phase.

Kirkadly-Willis

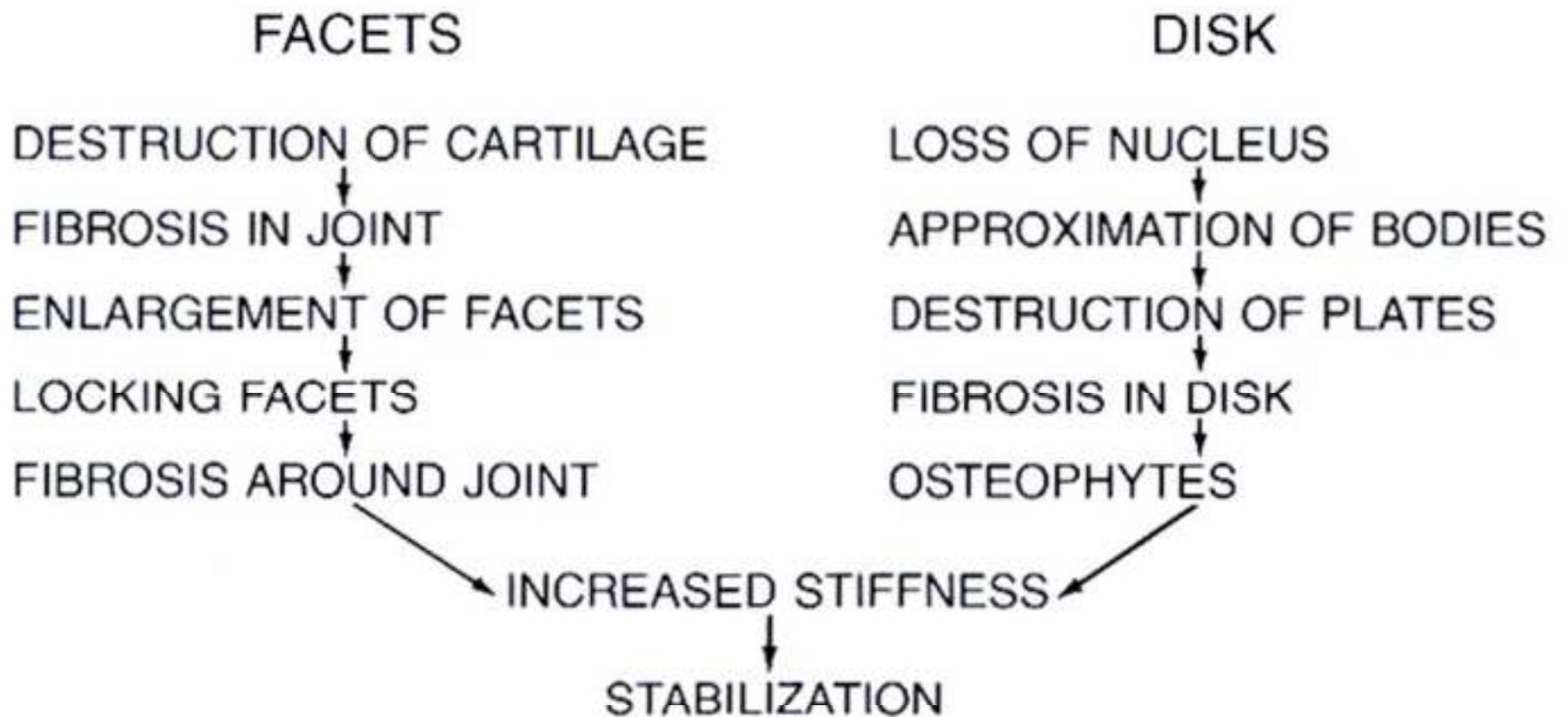


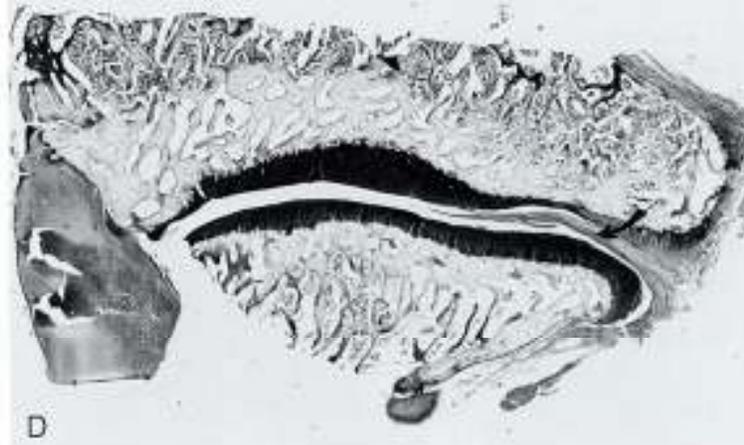
Fig. 9-6 Mechanisms of stabilization.

Kirkadly-Willis

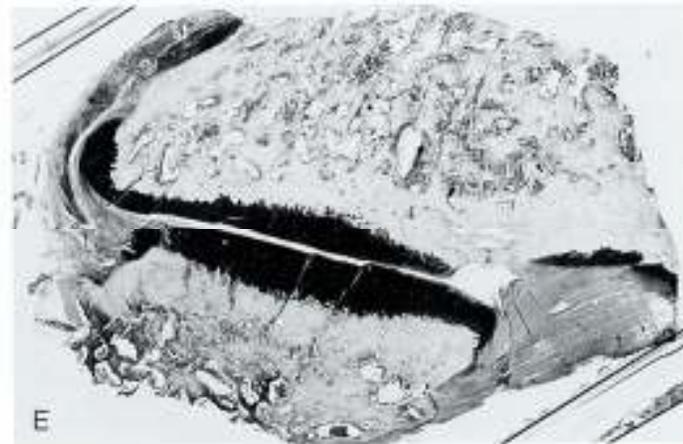
Facet OA

- Synovial villi may become entrapped w/in the joint with resulting joint effusions. The mechanism of pain may be related to nerve root compression from degenerative changes of the facets or by direct irritation of pain fibers from the innervated synovial linings and joint capsule.
 - Radiographics 1987; 7: 923-44

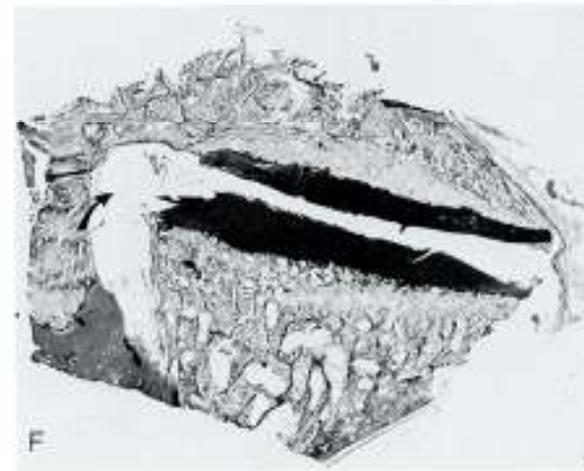
Trapped synovium



**Subluxed facets with
Cartilage narrowing**



**Cartilage narrowing and
lax synovium**



Synovial Cyst

- An uncommon complication of facet OA
- Often painful
- Can mimic disc herniation if it causes nerve compression

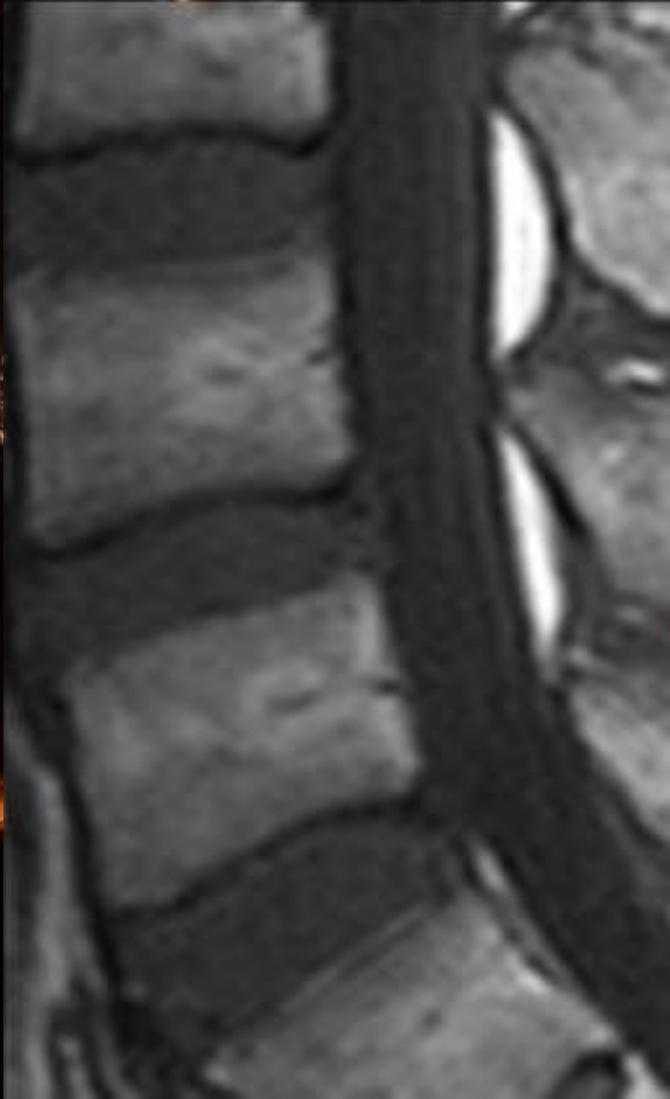


Disc Displacement



- Localized 0-25% of circumference
- Broad based 26%-50% of circumference
- Circumferential 51%-100%

Disc Bulge



Disc Displacement

- **PROTRUSION**

- Present if the width of the base is wider than the length of the posterior extension



Disc Displacement

- **EXTRUSION**

- Present if the width of the base is narrower than the length of the posterior extension



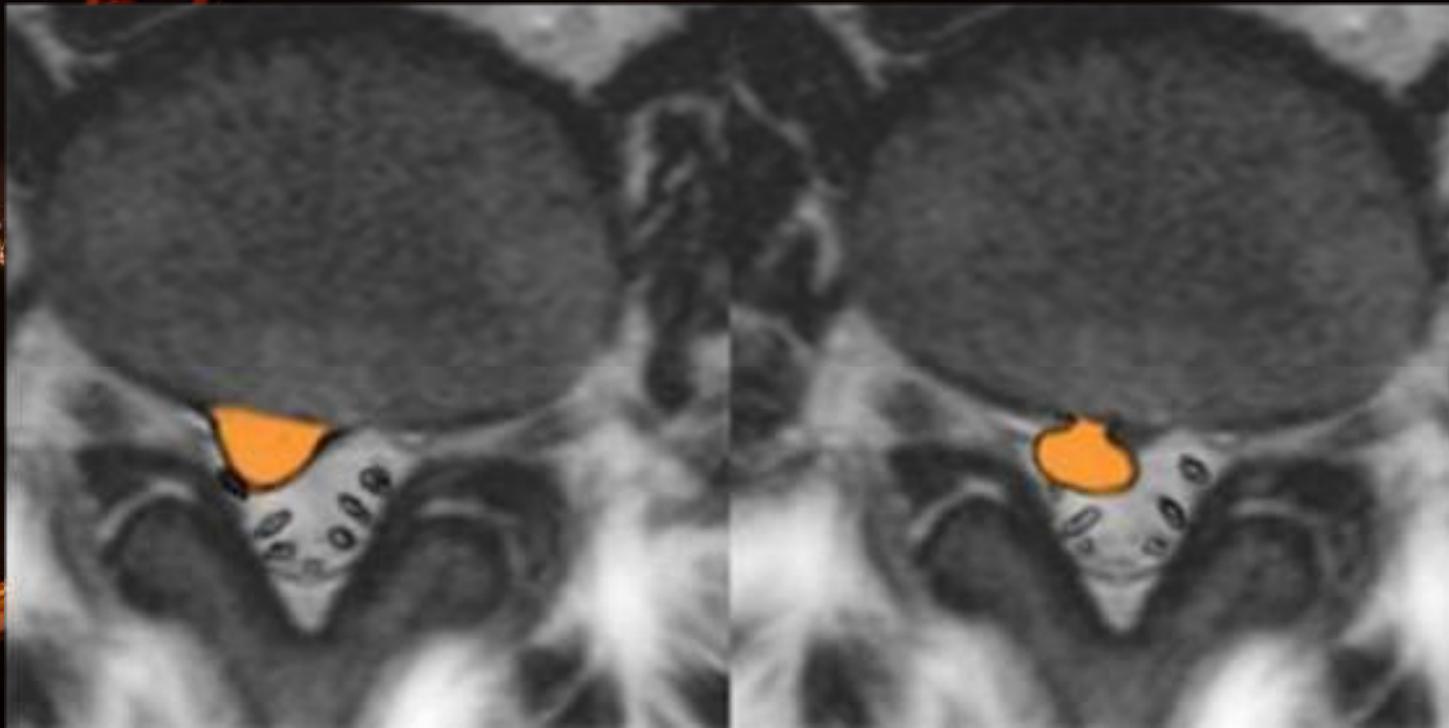
Disc Displacement



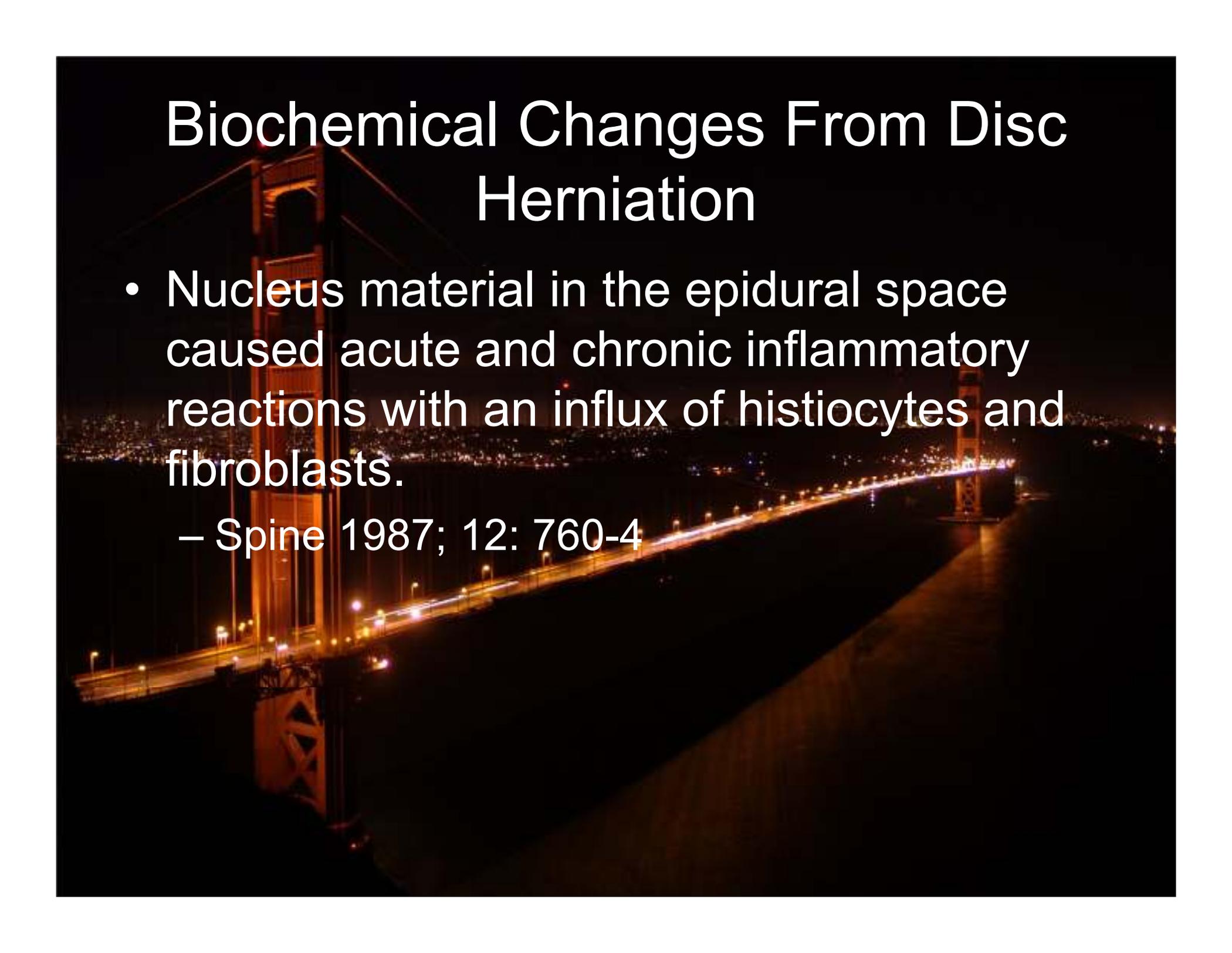
- **SEQUESTRATION**

- Present if the displaced disc material has lost completely any continuity with the parent disc. The sequestered disc may migrate.

Protrusion vs. Extrusion



Biochemical Changes From Disc Herniation



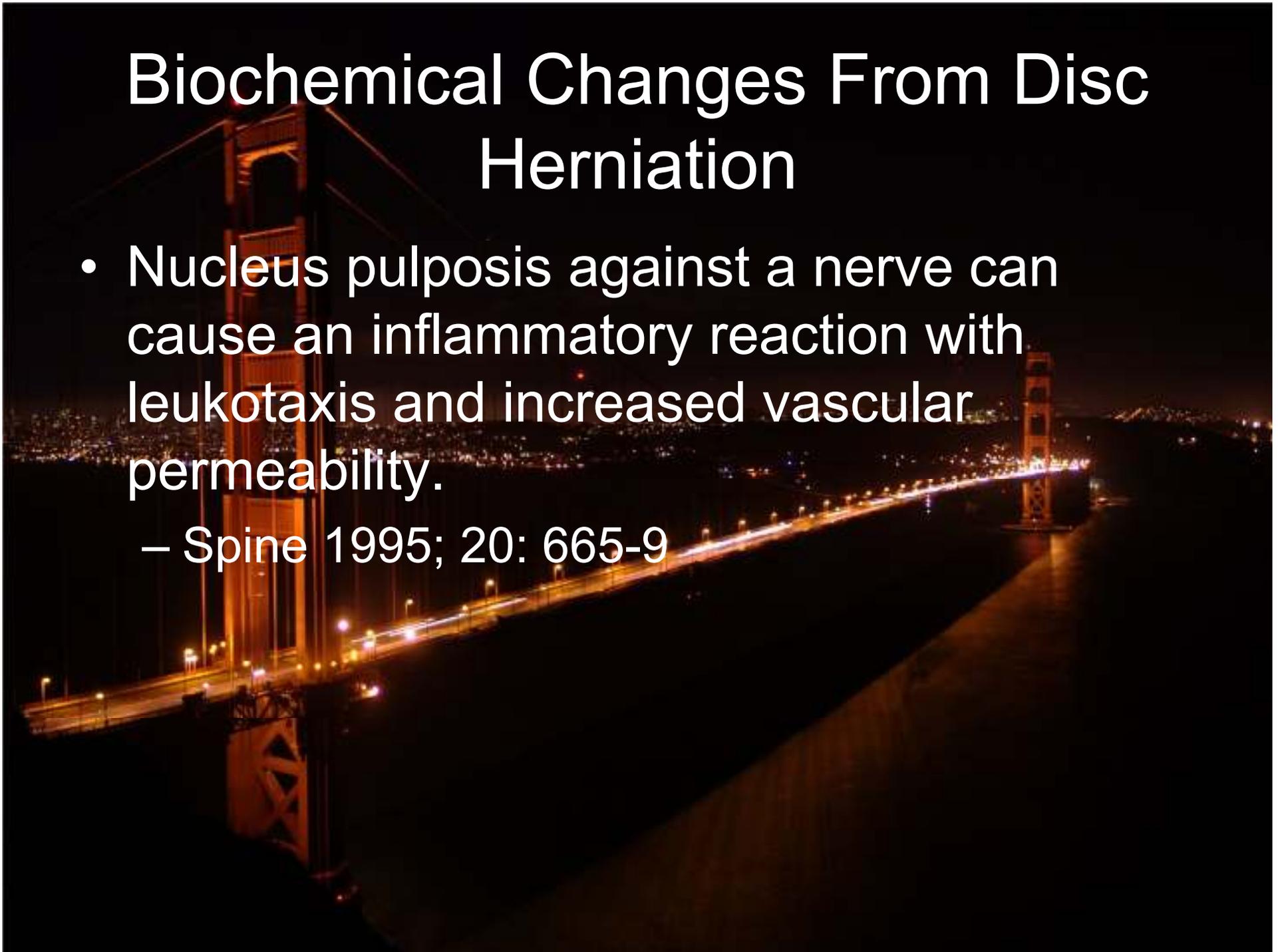
- Nucleus material in the epidural space caused acute and chronic inflammatory reactions with an influx of histiocytes and fibroblasts.
 - Spine 1987; 12: 760-4

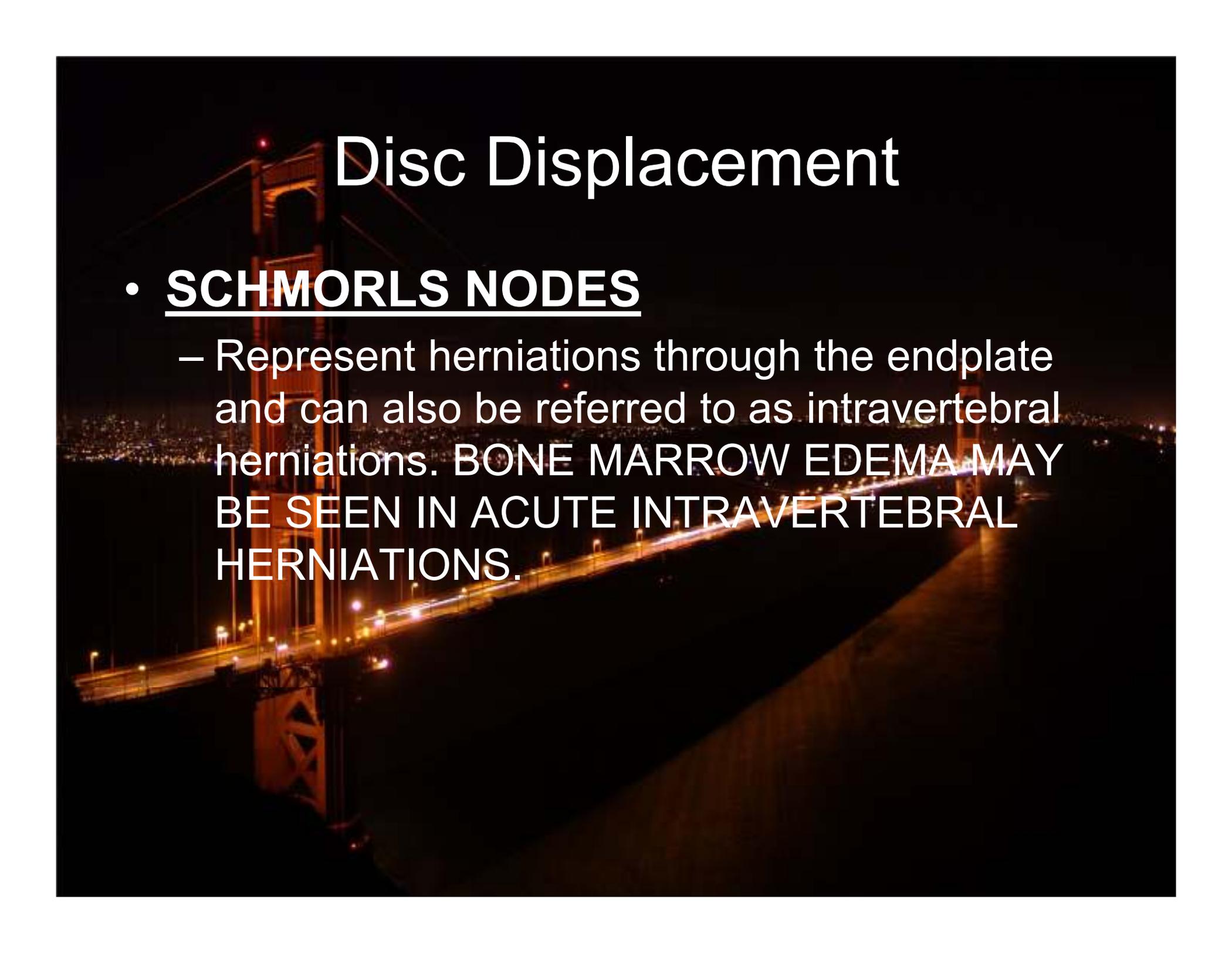
Biochemical Changes From Disc Herniation

- Nucleus applied to a spinal nerve induces a wide variety of functional, vascular, and morphologic abnormalities often followed by intraradicular fibrosis and neural atrophy.
 - Spine 1996; 21: 2539-43
 - Spine 1996; 21: 411-14

Biochemical Changes From Disc Herniation

- Nucleus pulposus against a nerve can cause an inflammatory reaction with leukotaxis and increased vascular permeability.
 - Spine 1995; 20: 665-9

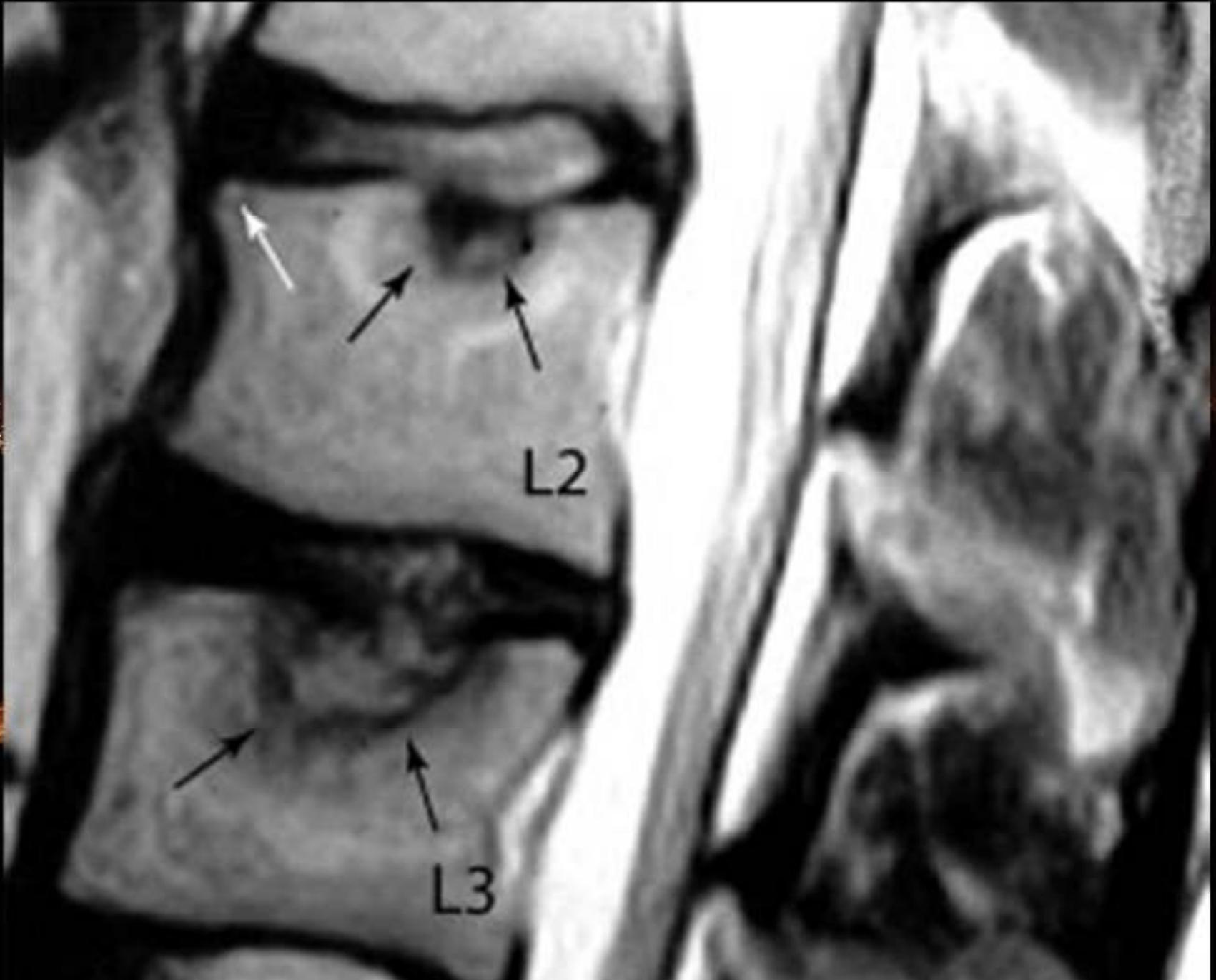




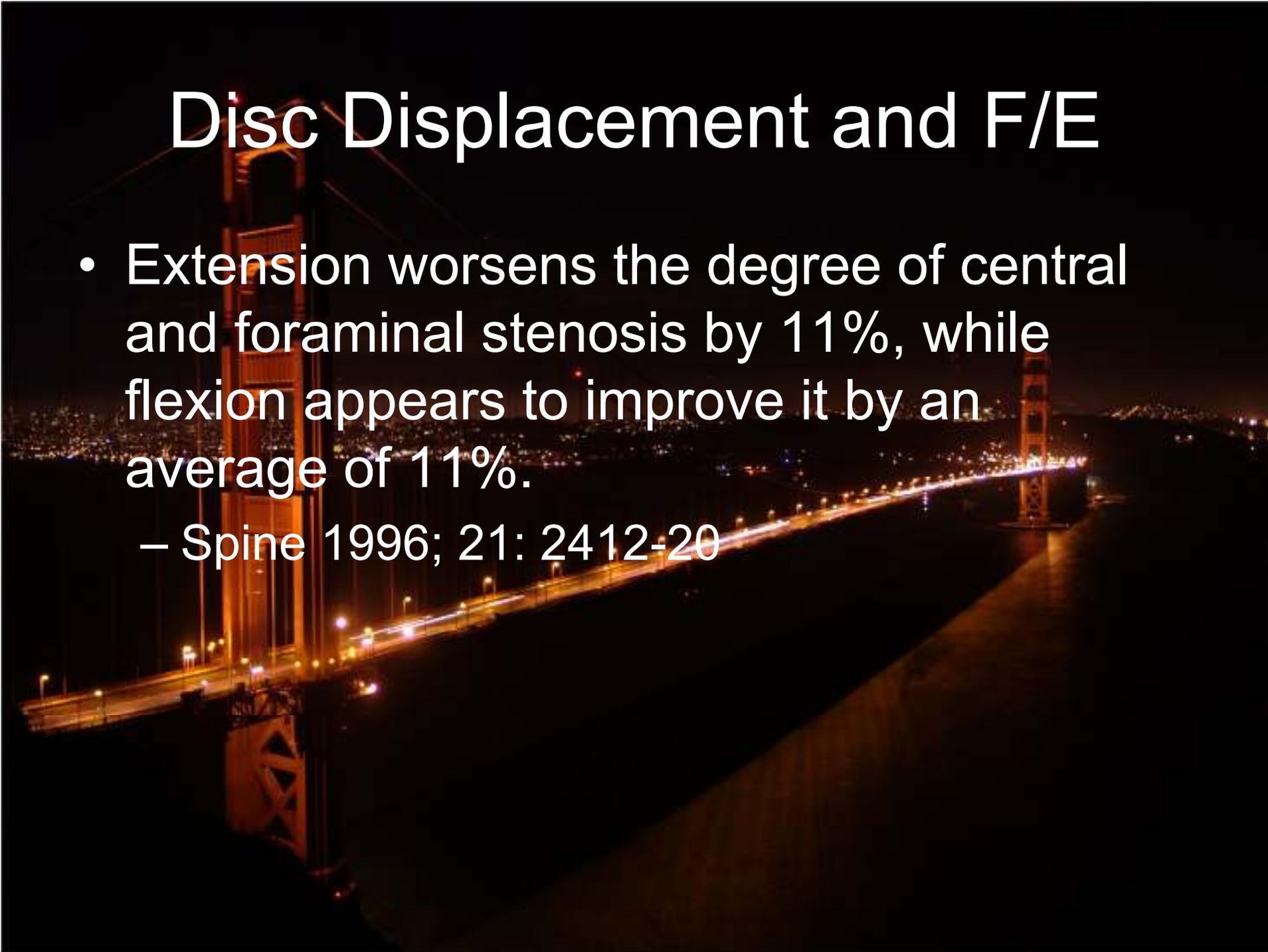
Disc Displacement

- **SCHMORLS NODES**

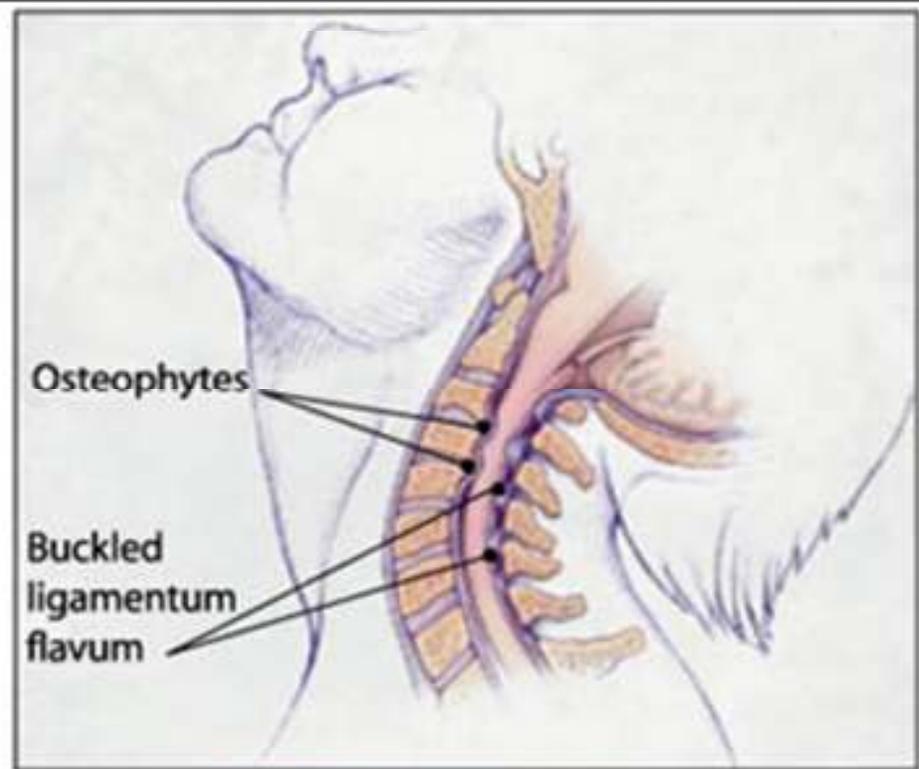
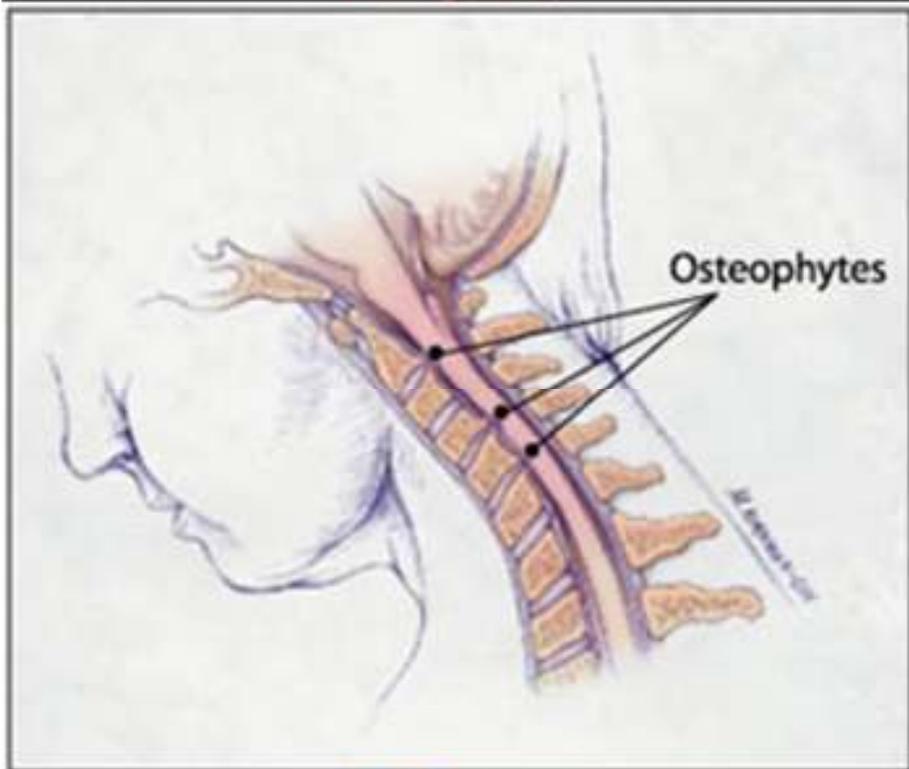
- Represent herniations through the endplate and can also be referred to as intravertebral herniations. BONE MARROW EDEMA MAY BE SEEN IN ACUTE INTRAVERTEBRAL HERNIATIONS.



Disc Displacement and F/E



- Extension worsens the degree of central and foraminal stenosis by 11%, while flexion appears to improve it by an average of 11%.
 - Spine 1996; 21: 2412-20



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Cause of Pain in Spinal DJD



- Instability with associated disc degeneration, facet or uncovertebral arthropathy
- Mechanical compression of nerve by bone, ligament, or disc
- Biochemical mediators of inflammation and/or pain

Cause of Pain in Spinal DJD

- Mechanical nerve compression results in venous stasis, edema, and eventually fibrosis. The intraneural edema can occur even at low compression pressure levels.
 - Spine 1989; 14: 569-73



Cause of Pain in Spinal DJD

- Mechanical compression itself may also be capable of producing changes in nerve impulses, which could be interpreted by the CNS as pain.
 - Pain 1977; 3: 25-41



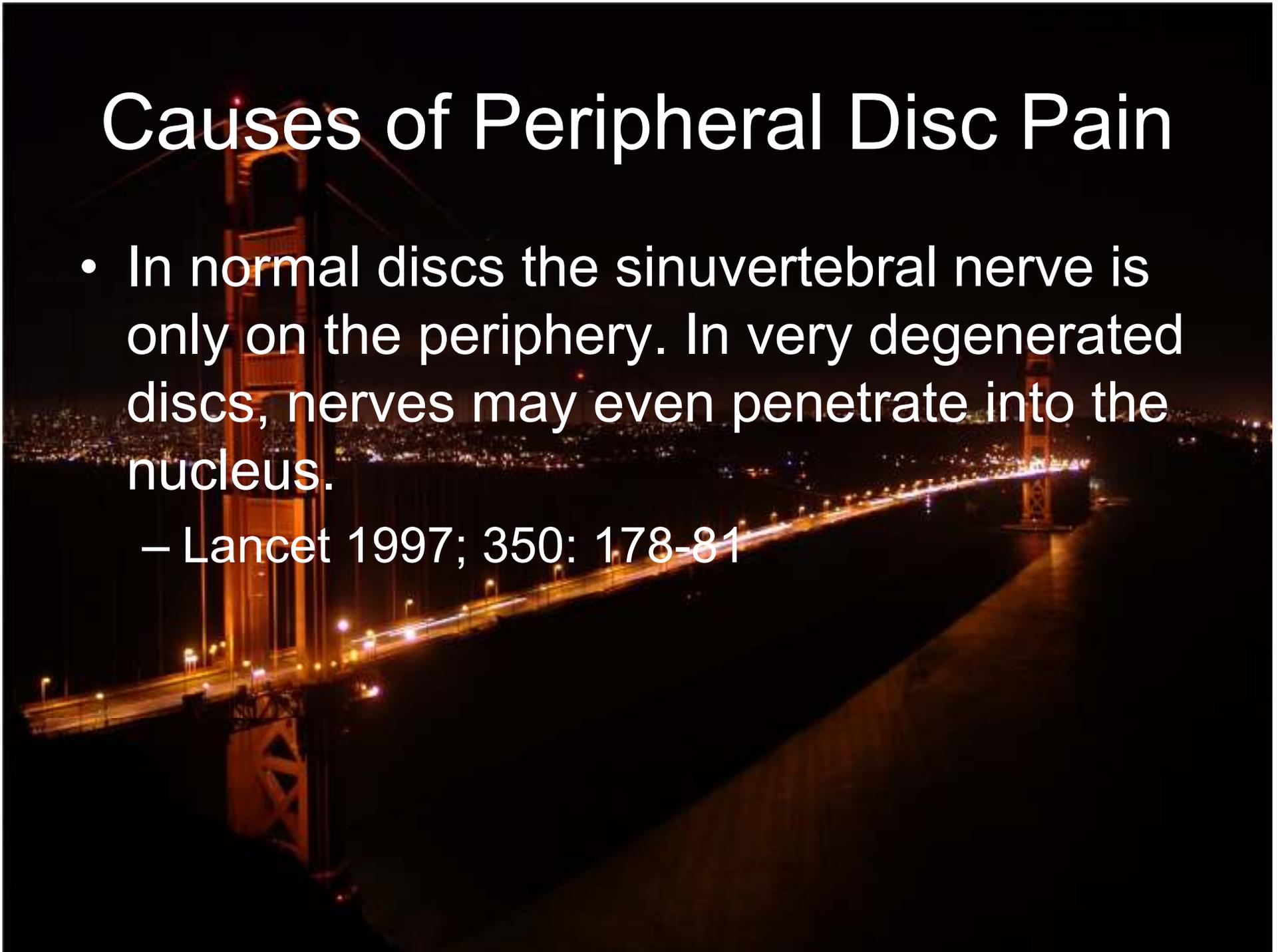
Causes of Peripheral Disc Pain



- All AKA's
 - Annular tear
 - Chronic internal disc disruption syndrome
 - Discogenic pain
 - Black disc disease

Causes of Peripheral Disc Pain

- In normal discs the sinuvertebral nerve is only on the periphery. In very degenerated discs, nerves may even penetrate into the nucleus.
 - Lancet 1997; 350: 178-81

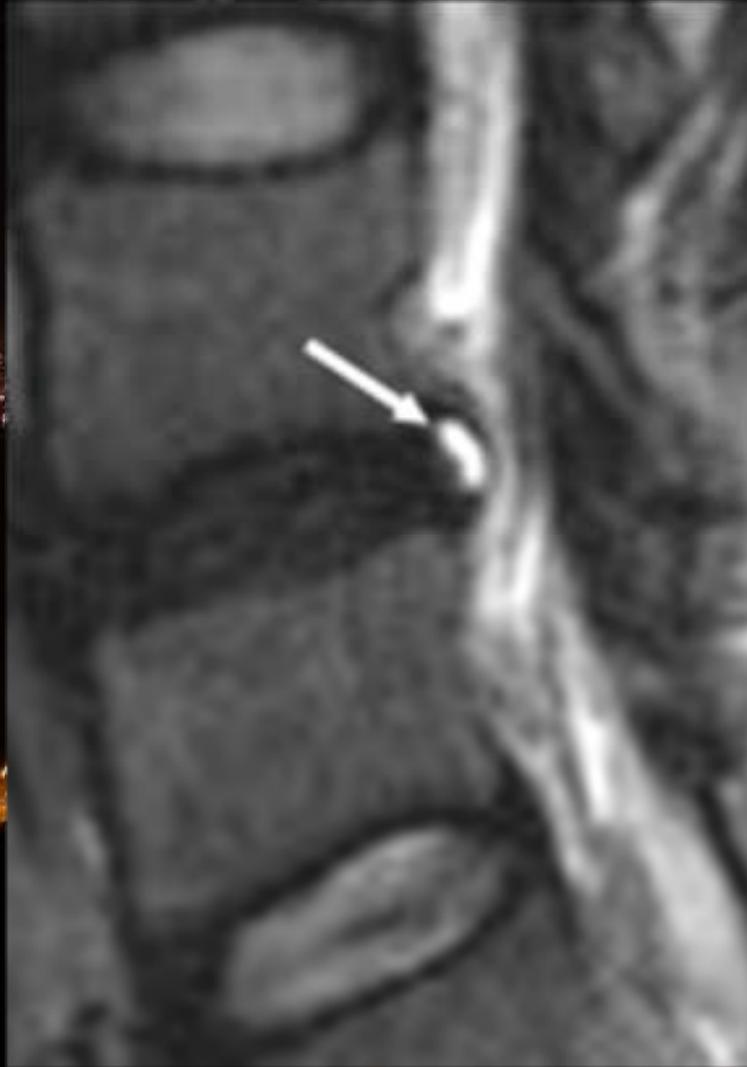


Significance of Annular Tears

- Simply an incision of the annulus can produce morphologic and functional changes in the adjacent nerves, such as increased capillaries and reduced nerve conduction velocities.

– Spine 1996; 21: 2539-43

Annular Tear





Radiographic Findings of Common Spinal Arthritides

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Degenerative Disc Disease



Posterior spurs

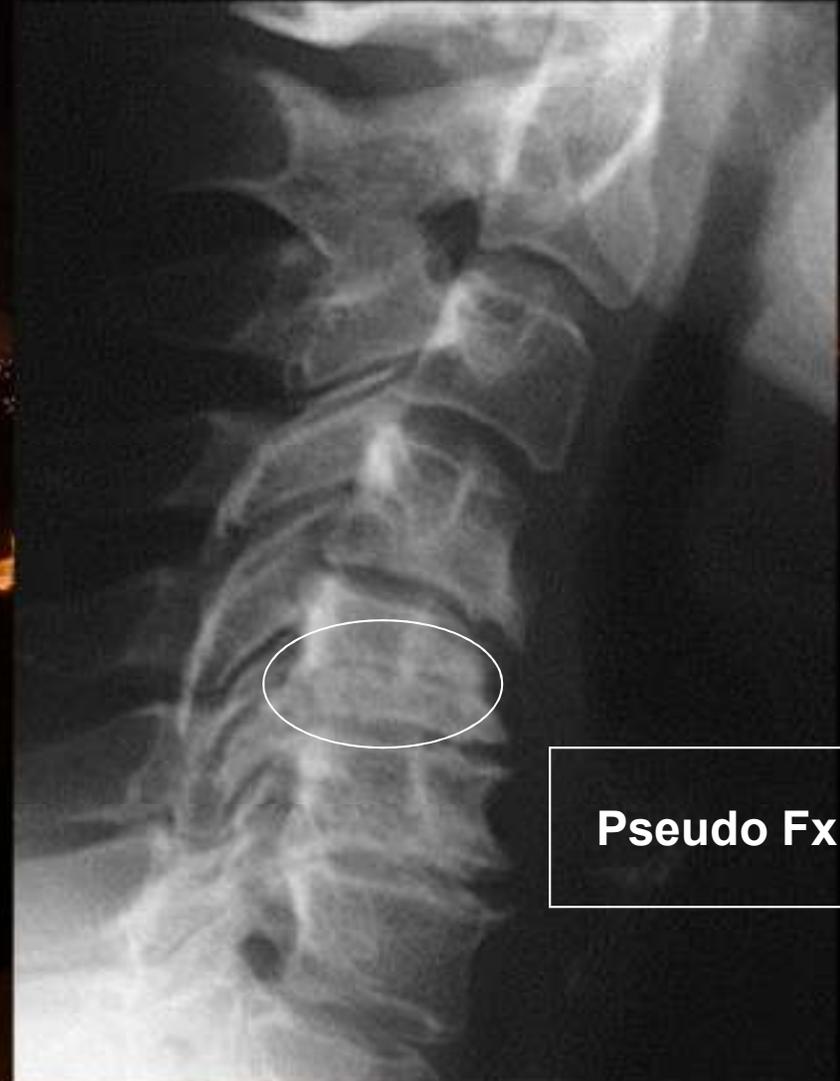


SPURS

Disc narrowing

Vacuum phenomenon

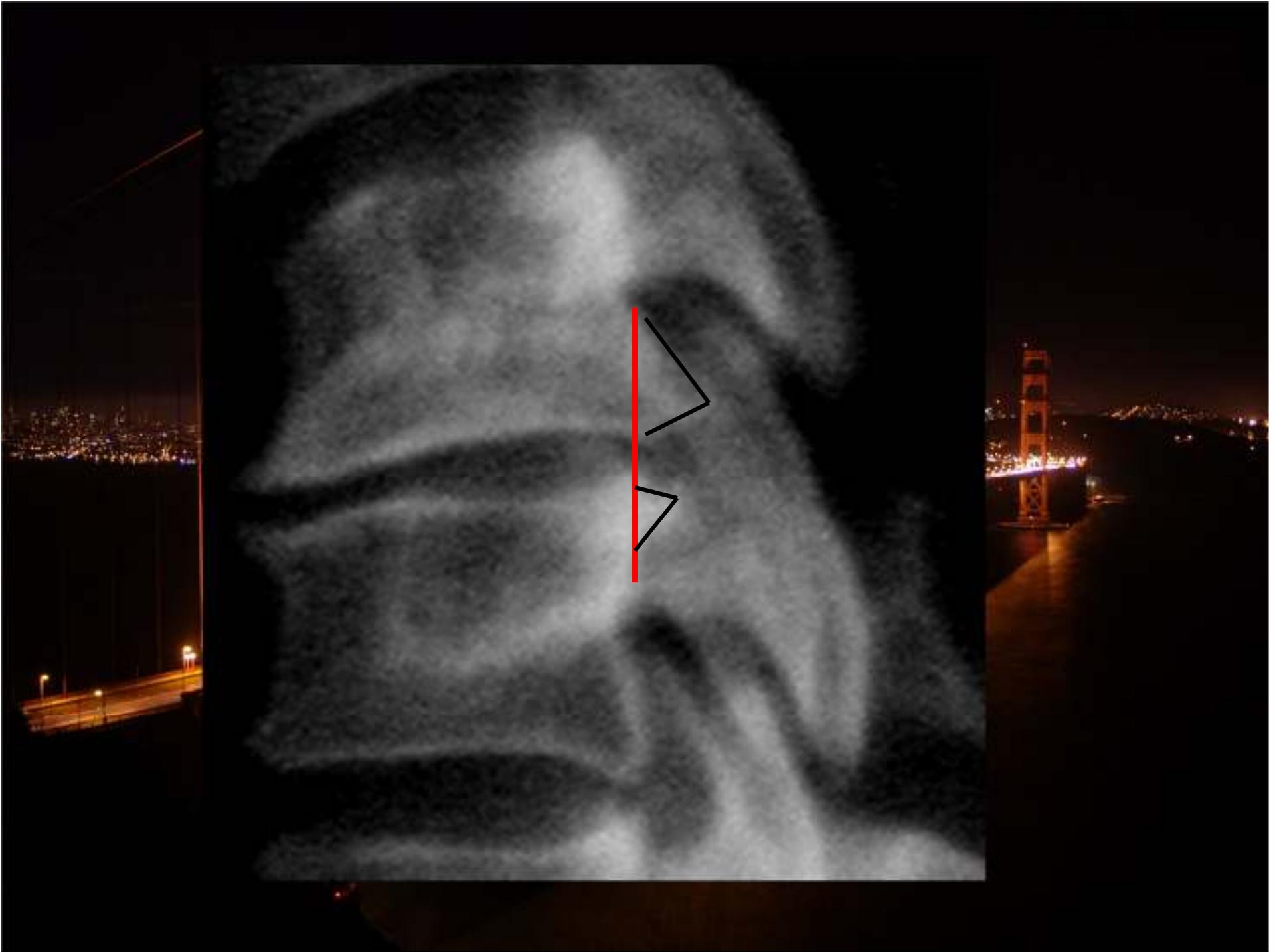
Uncovertebral OA



Pseudo Fx

Posterior Spur With Stenosis

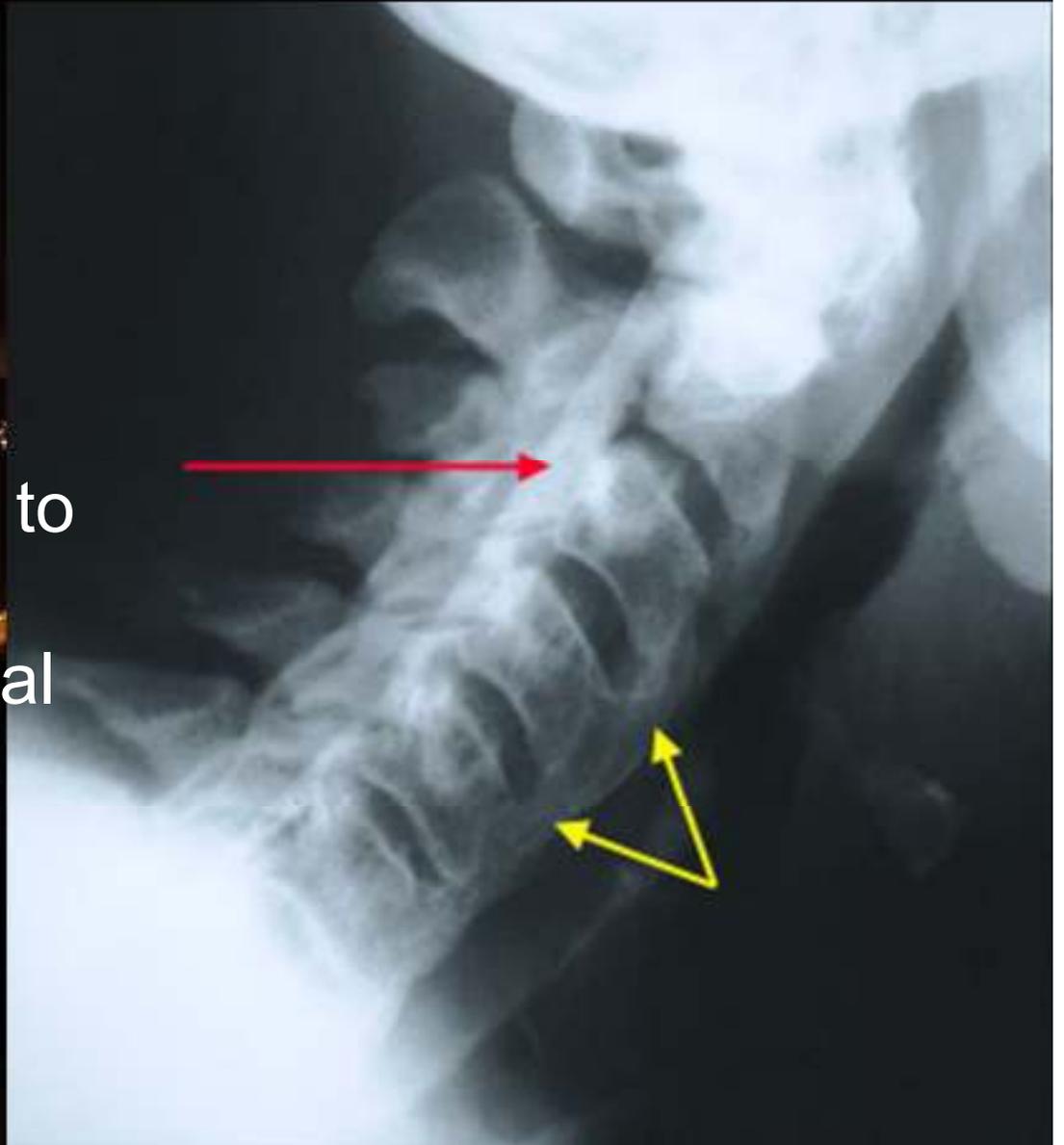






DISH

- Thick flowing ossification with relative disc preservation
- Red arrow pointing to ossification of the posterior longitudinal ligament (OPLL)



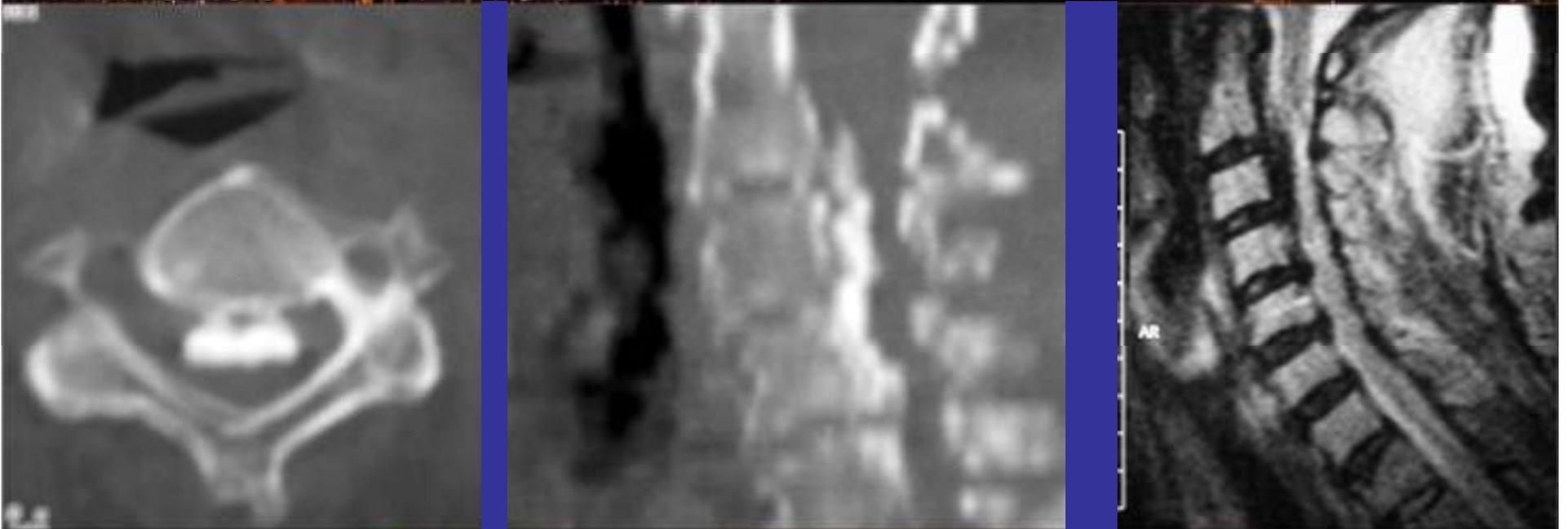
DISH



Yochum

DISH with OPLL

- Causes stenosis
- Contraindication to manual adjusting in the area



DISH



Ankylosing Spondylitis (AS)

- Thin anterior ossification
- Facet ossification



AS



AS

- Thin anterior ossification



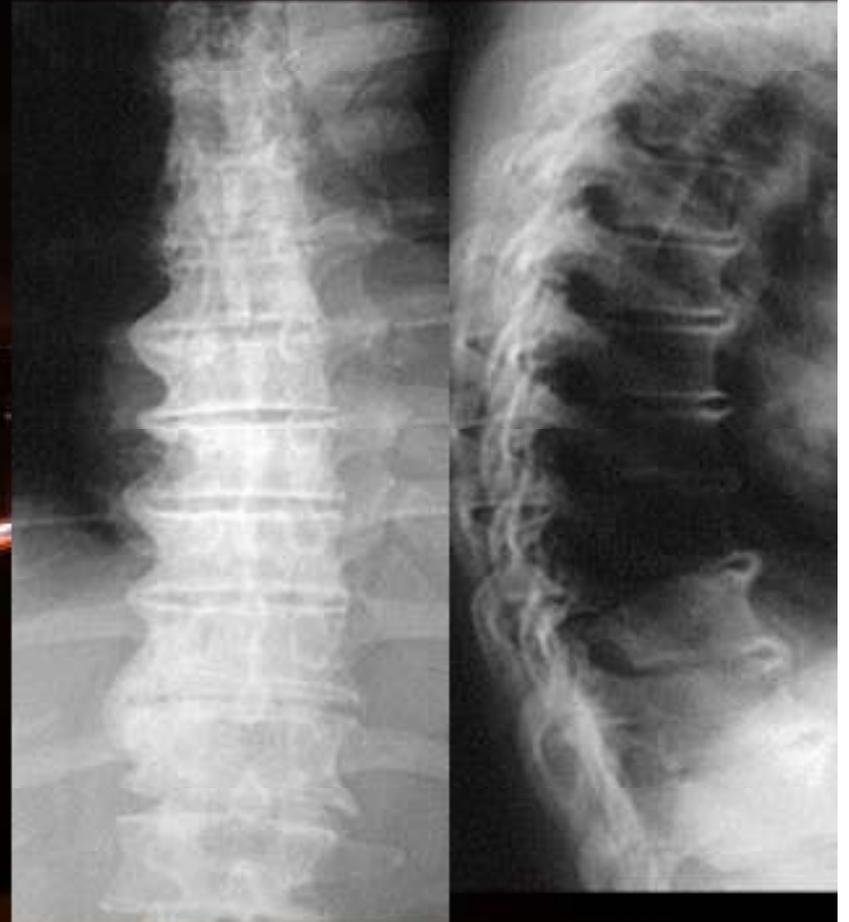
RA

- Stair stepping
- Facet erosions
- Whittled odontoid with upper cervical instability



DISH versus DDD?

- Early in the process impossible to differentiate



Definite DISH

- Thick ossification which involves the mid body as well as the disc space



DJD

Retrolisthesis



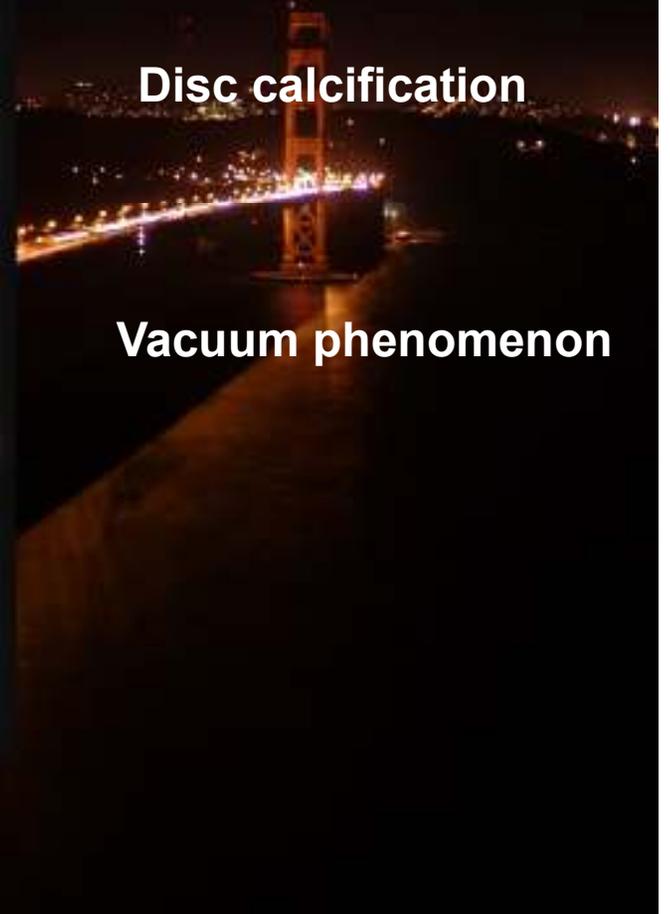
Posterior spur



Spurs

Disc calcification

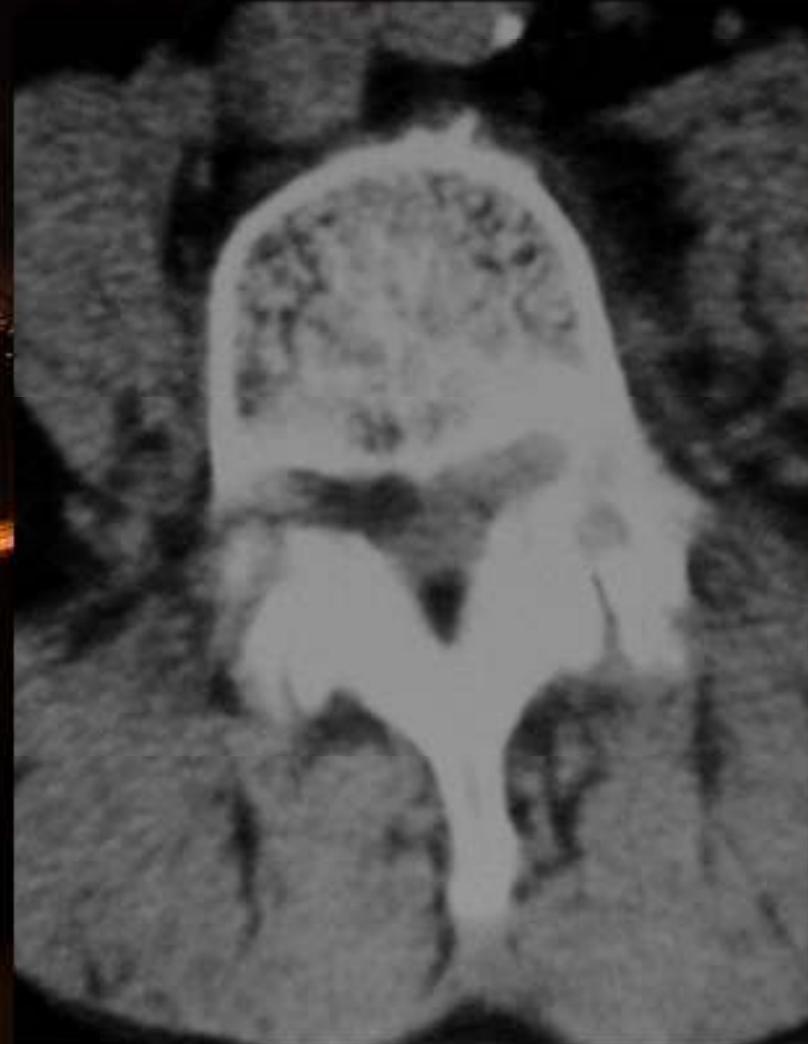
Vacuum phenomenon



Degenerative Spondylolisthesis



Central and Lateral Recess Stenosis From Previous Slide



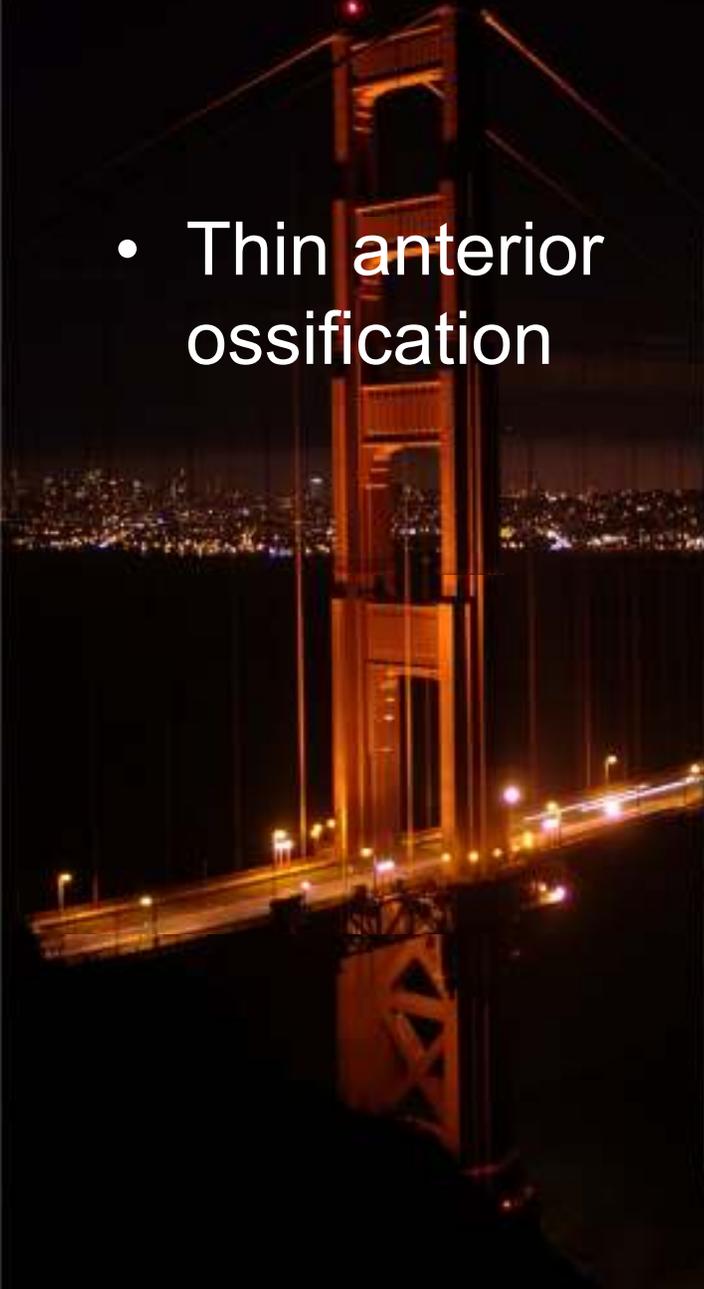
DISH

- Thick ossification with disc preservation
- Involves mid body as well as disc

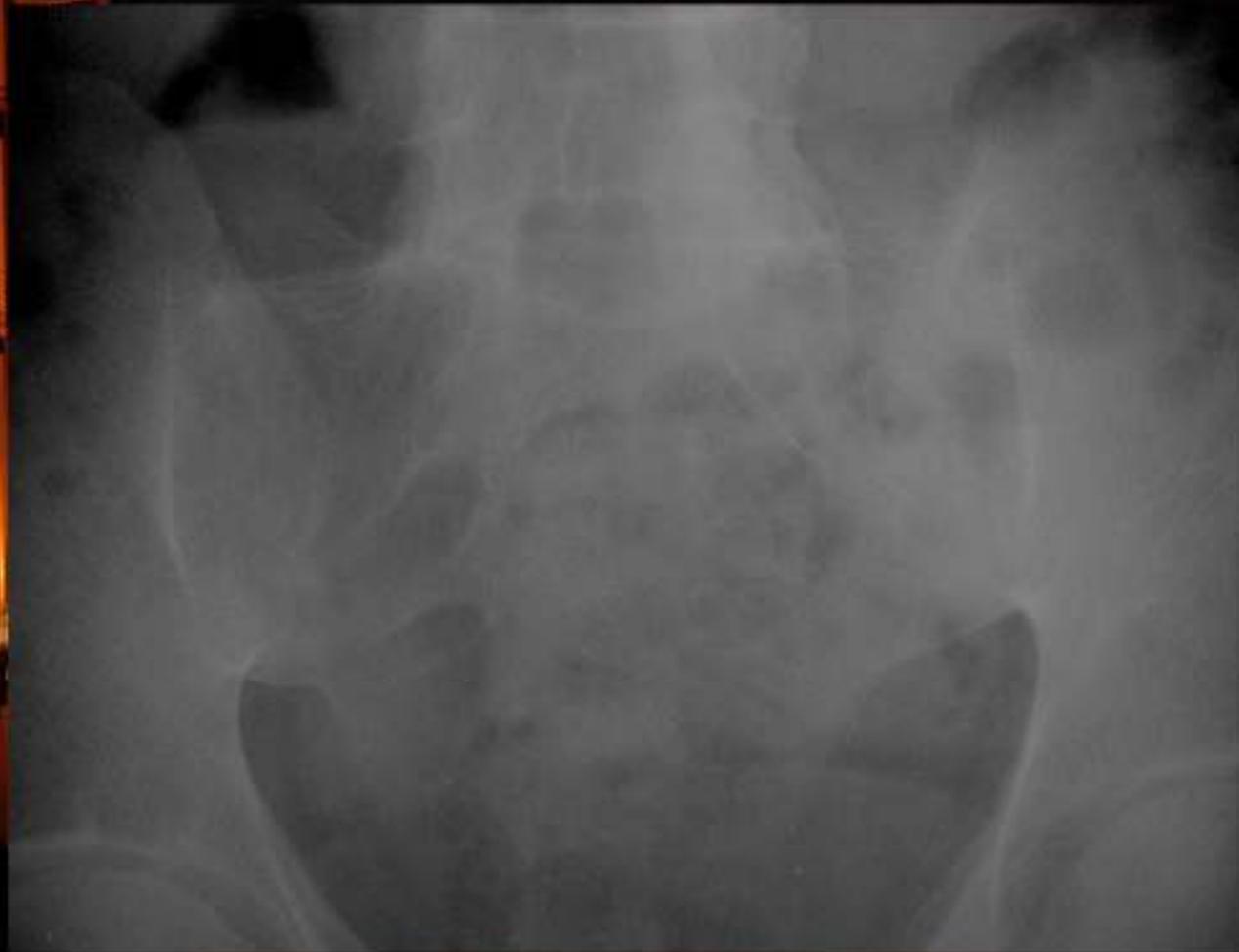


AS

- Thin anterior ossification



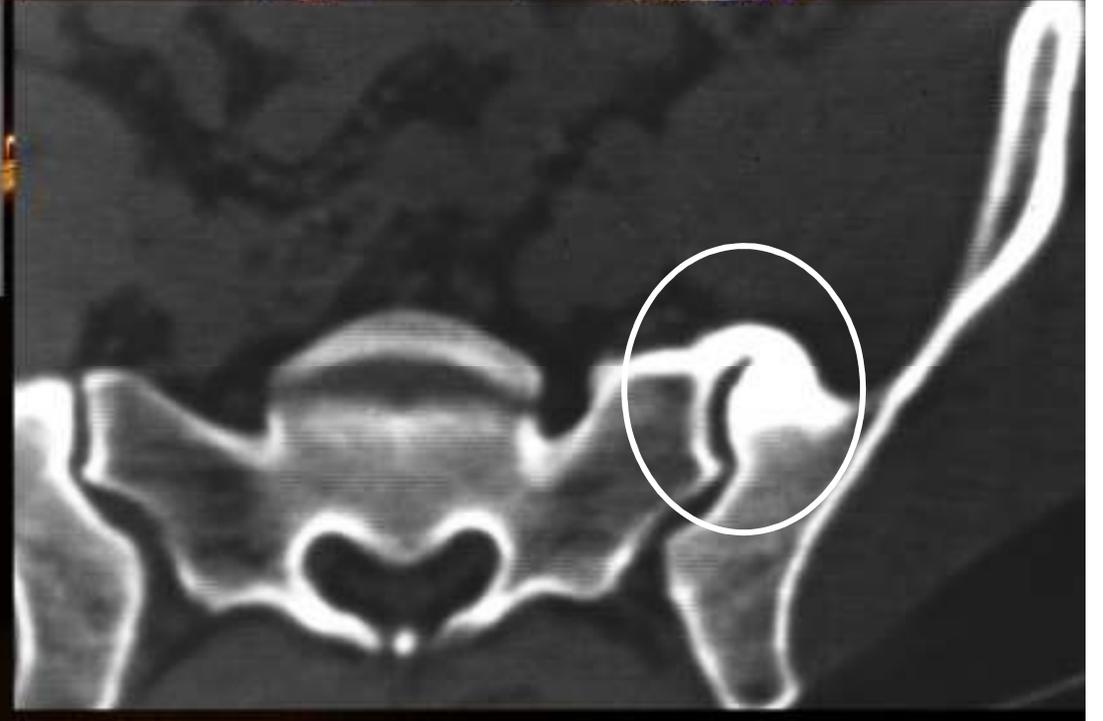
Late AS With SI Fusion



SI Joint Arthrosis

- Most common at junction of upper 1/3rd to lower 2/3^{rds} of the SI joint





Early AS

- Erosions
- Sclerosis
- Bilateral and symmetric



Late AS With Fusion



A night-time photograph of the Golden Gate Bridge in San Francisco. The bridge's towers and suspension cables are illuminated with warm orange lights, and the roadway is lit with streetlights. The city lights of San Francisco are visible in the background under a dark sky.

Extremity Arthritis

Common Findings In A
Chiropractic Practice

AC Joint OA

- May cause local pain but no longer considered to be a cause of impingement syndrome



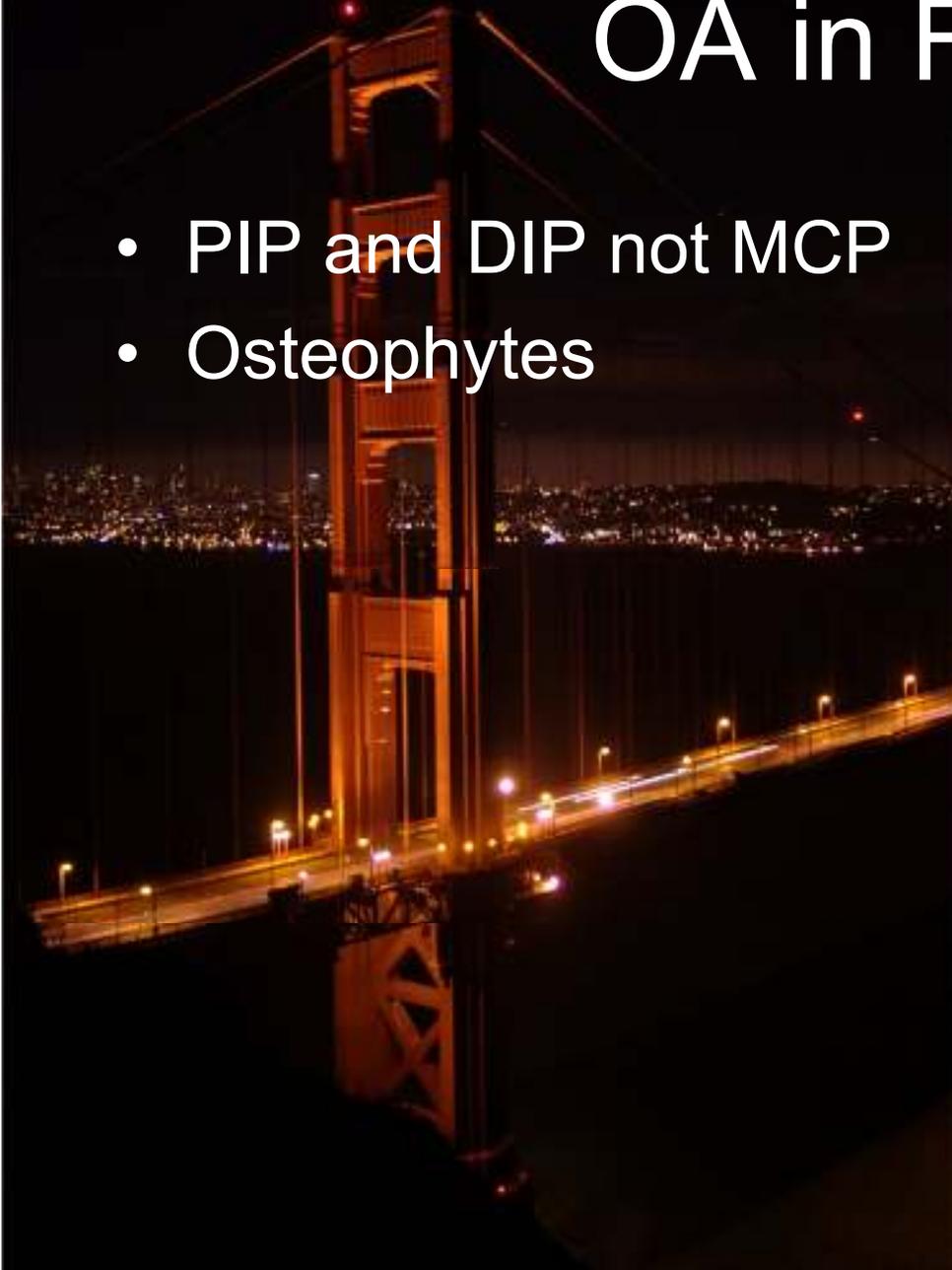
OA Wrist

- 1st carpal metacarpal joint
- Osteophytes
- Radial subluxation common



OA in Fingers

- PIP and DIP not MCP
- Osteophytes



OA Hand



Early RA Erosions



RA

- MCP, PIP, rarely DIP
- Universal wrist involvement
- Erosions
- Uniform joint narrowing
- Joint deformities
- Ulnar styloid erosion



CPPD

- Triangular fibro cartilage calcification
- OA in MCP joints



OA Hip



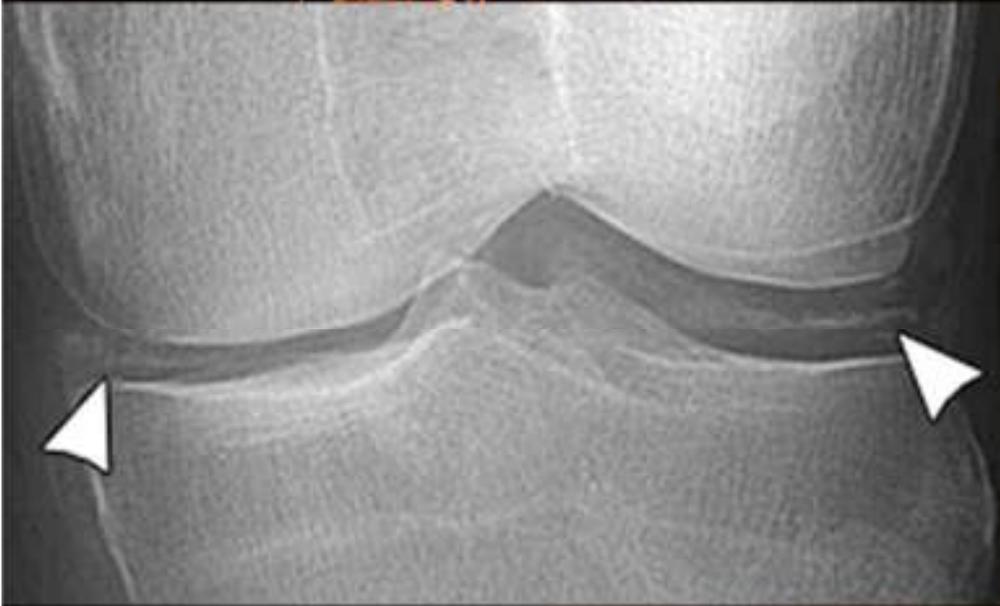
OA Knee

- Non-uniform joint narrowing
- Osteophytes (often small for such a large joint)



CPPD

- Cartilage calcification is hallmark
- Accelerates degeneration and OA



RA

- Uniform joint narrowing
- Erosions



OA Great Toe

- 1st MTP joint
- Osteophytes



Gout

- Random joints other than 1st MTP
- Peri-articular erosions with overhanging margins sign
- Relative preservation of the joint

