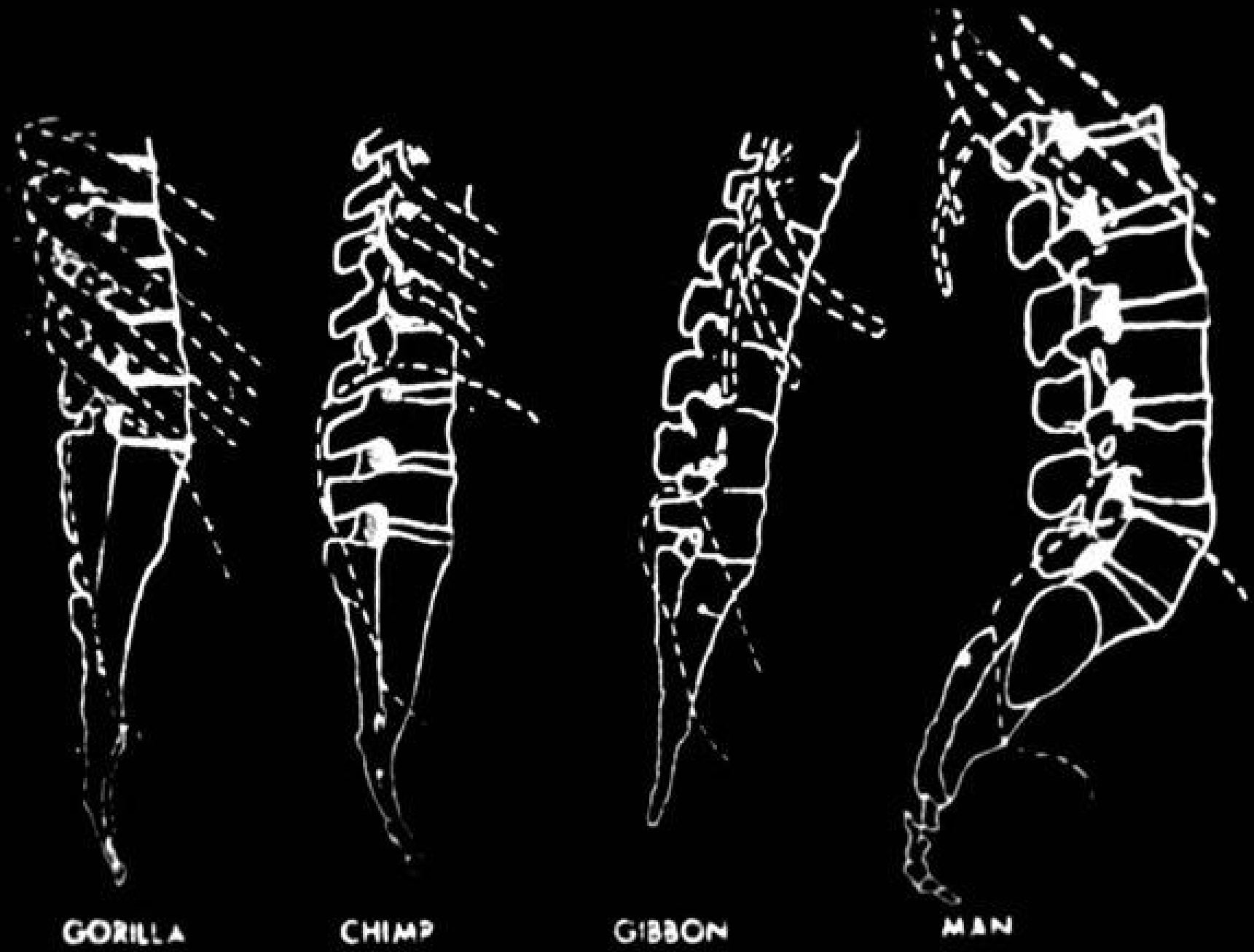
Management of Lumbar Spondylosis

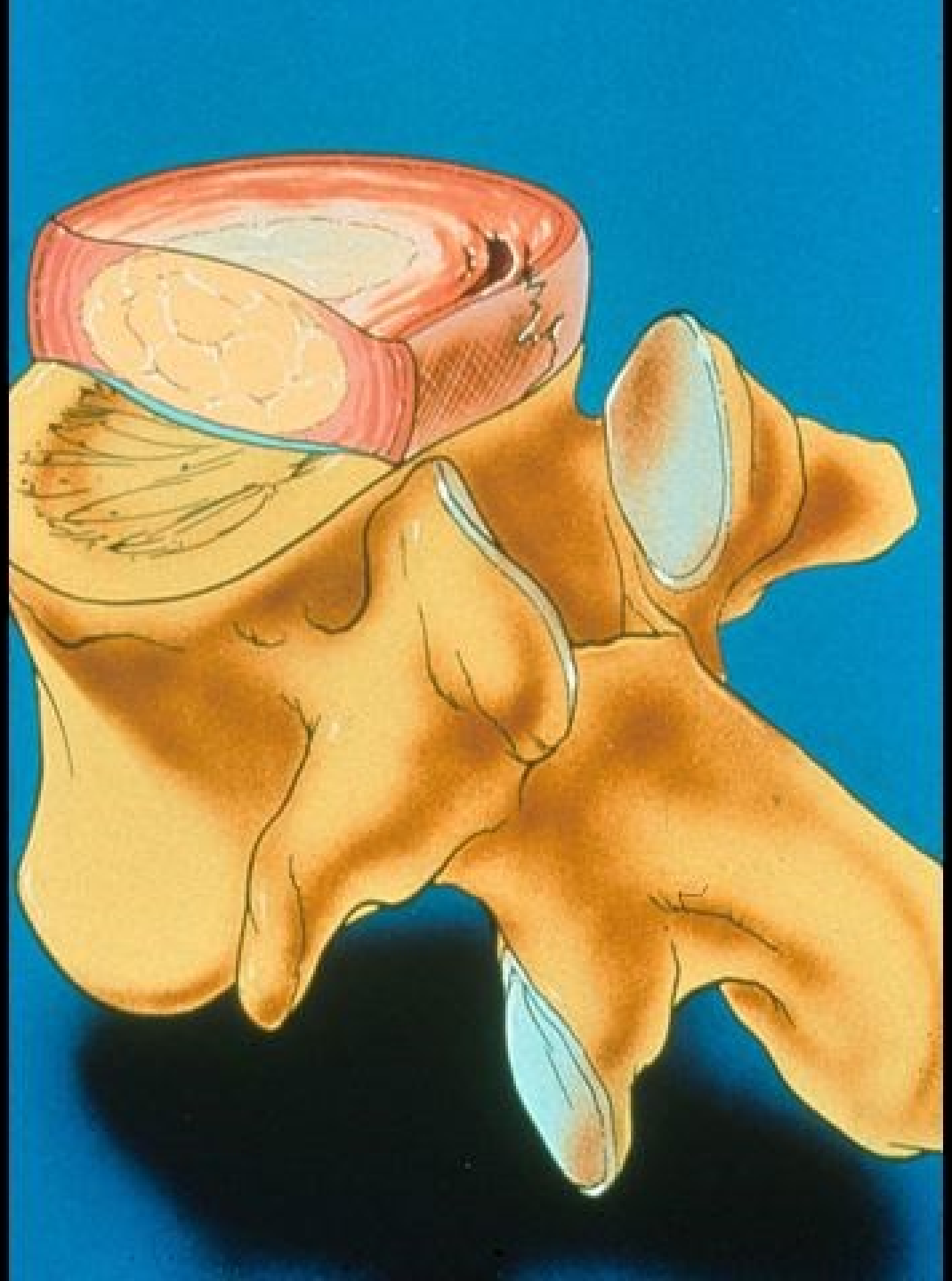
Decompression, Fusion, TDA

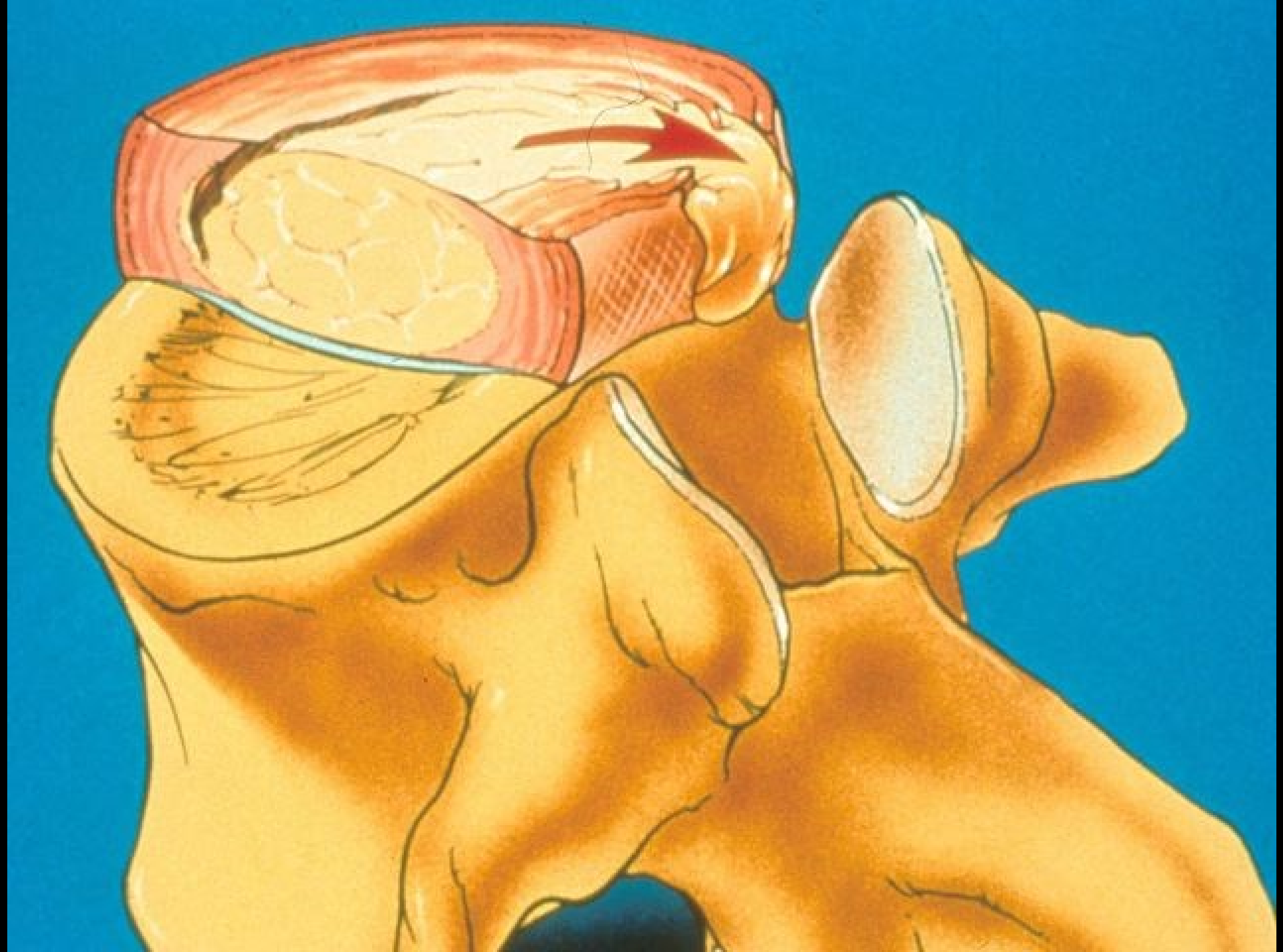
Ed Benzel
Cleveland Clinic

Lumbar Spondylosis

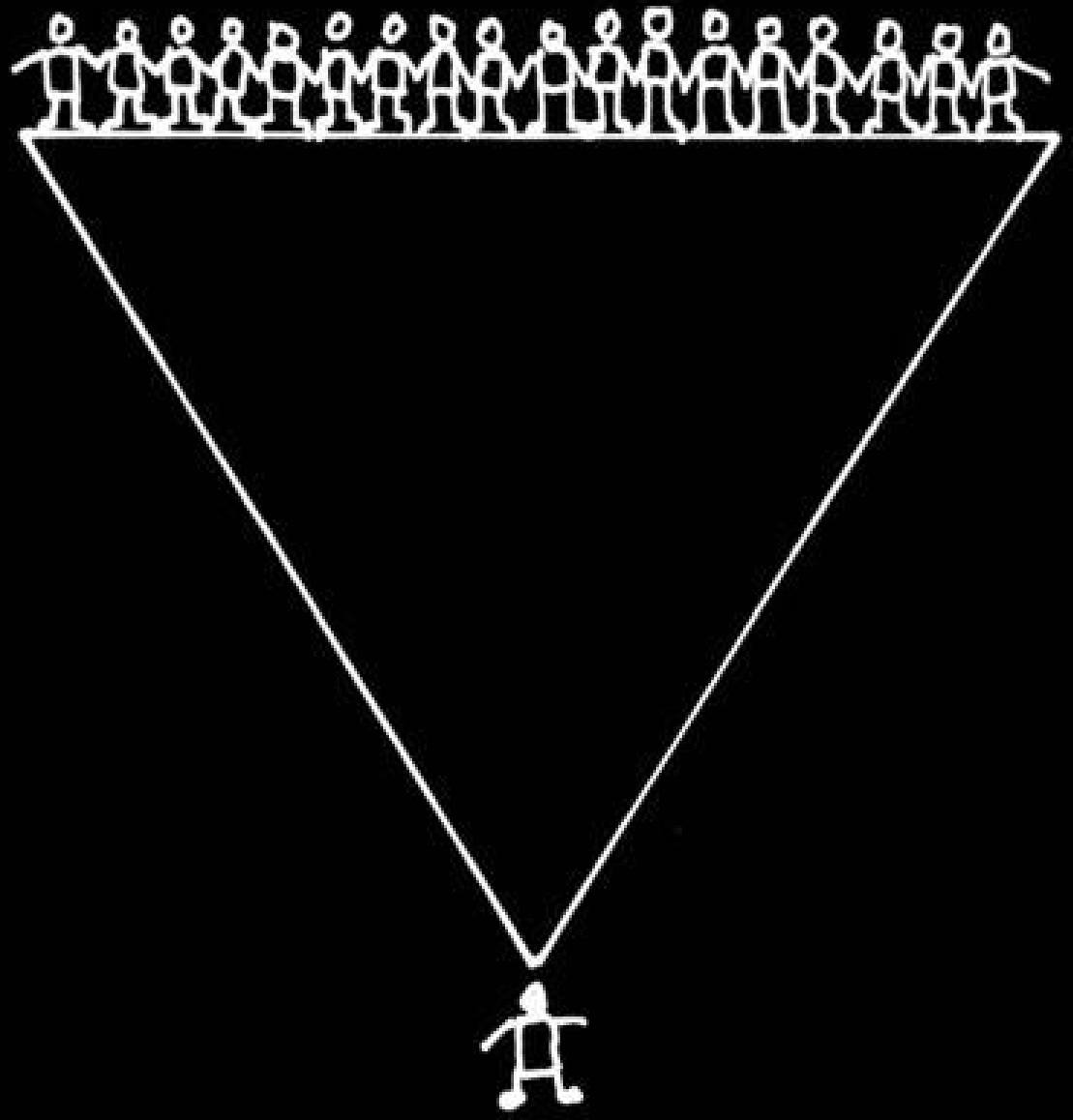

GORILLA
CHIMP
GIBBON
MAN

A
B
C

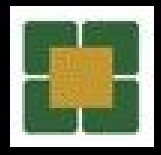




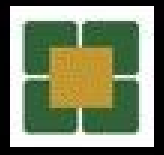

M
F
D
IAR


Surgery

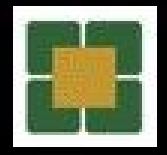
Deep, Agonizing Pain
Worsened with Loading
Improved with Unloading



MANAGEMENT



Non-Op



Conditioning

SMOKING

WEIGHT LOSS

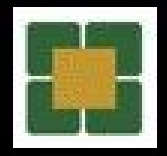
A
B
C

AEROBIC EXERCISE

Stretching

Strengthening

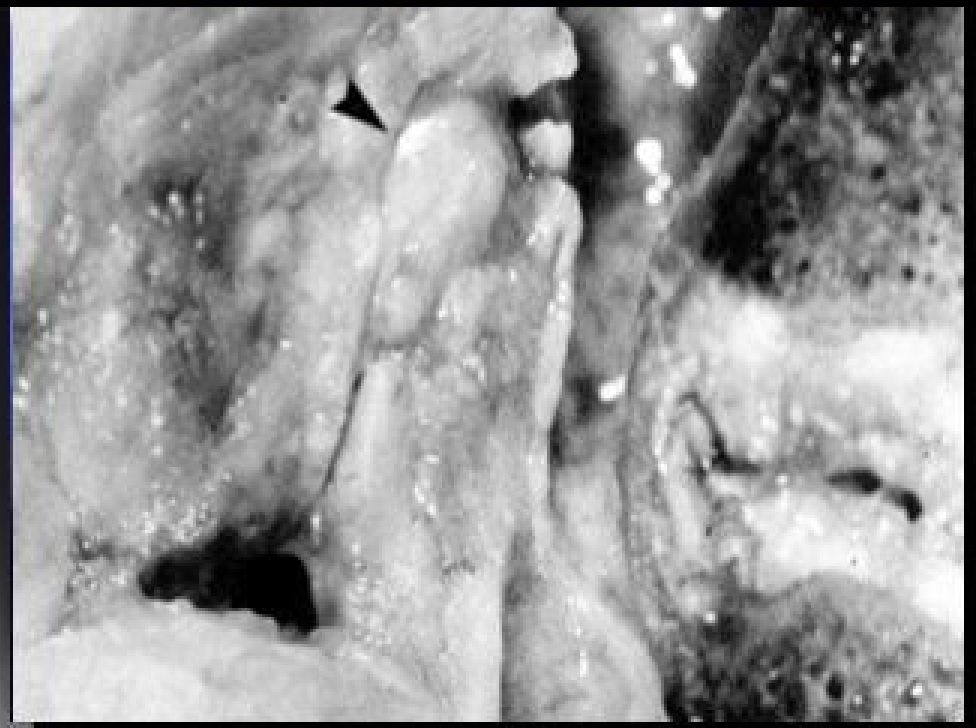
COMPLIANCE



THE ROLE of FUSION

PAIN GENERATOR ?

DYSFUNCTIONAL MOTION SEGMENT



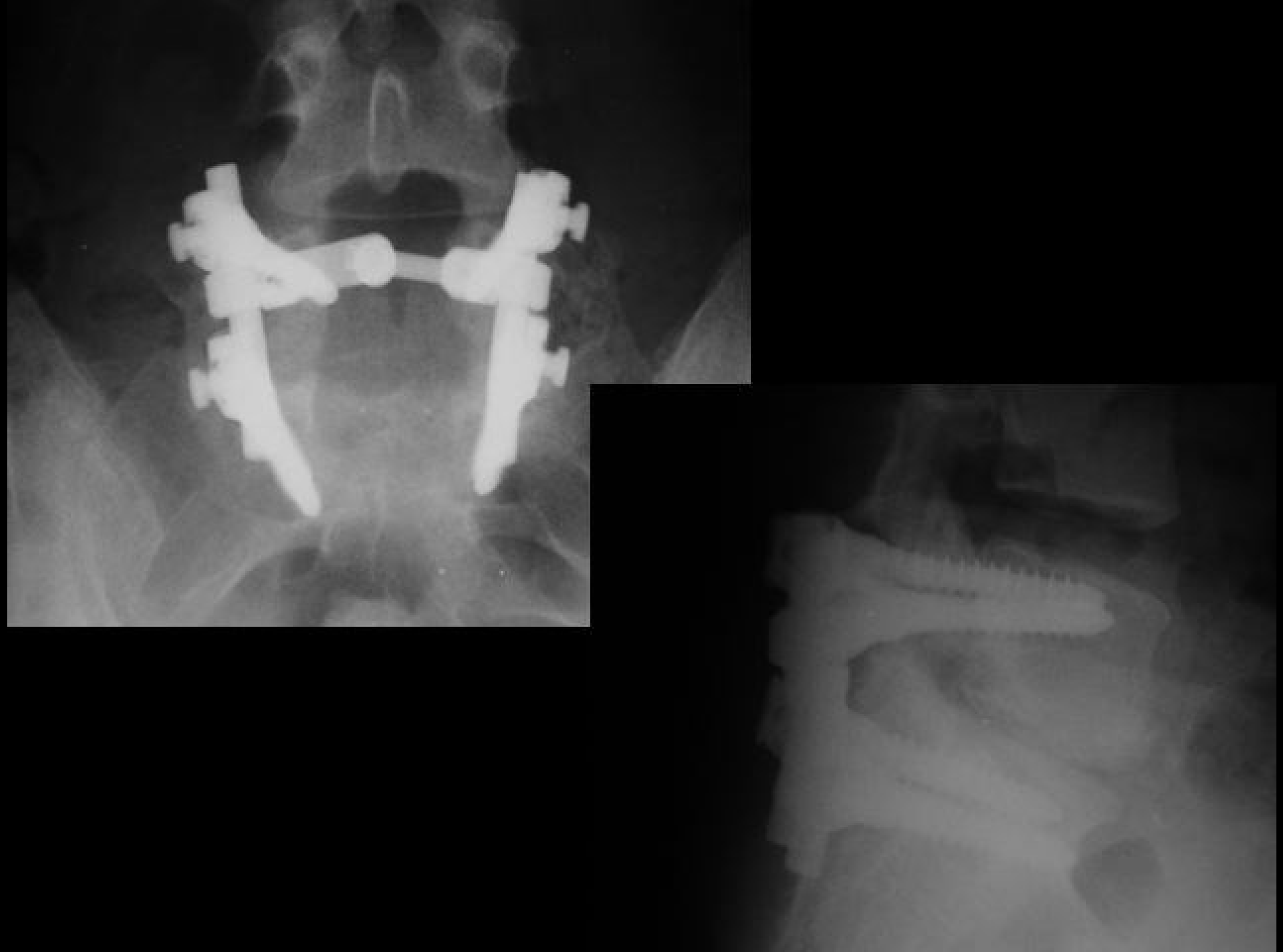
FUSION INDICATIONS

- Excessive or abnormal spinal motion
- Relationship of motion to pain
- Extent of pain
- Patient motivation

EXCESSIVE OR ABNORMAL MOTION

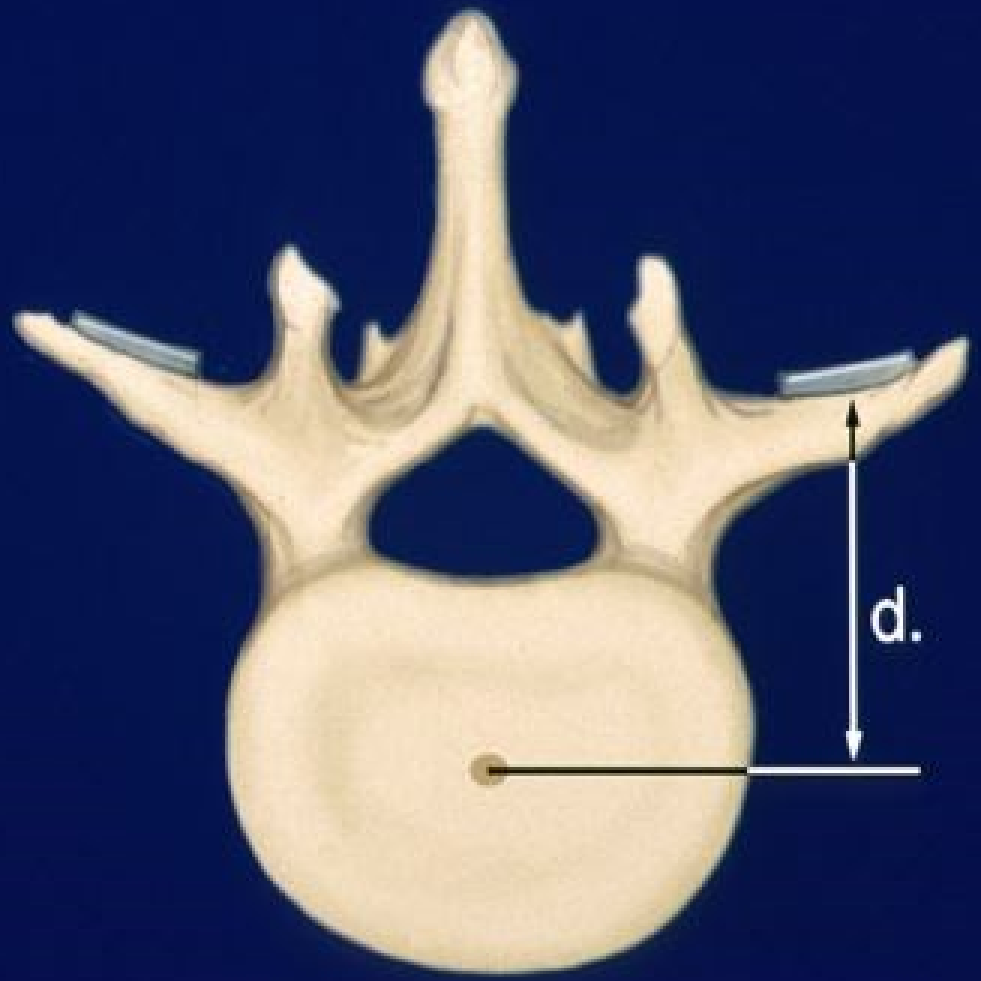
- Excessive mobility
- Fixed subluxation
- Significant degenerative changes


E/M
A
P



TYPE OF FUSION


©UNM NEUROSURGERY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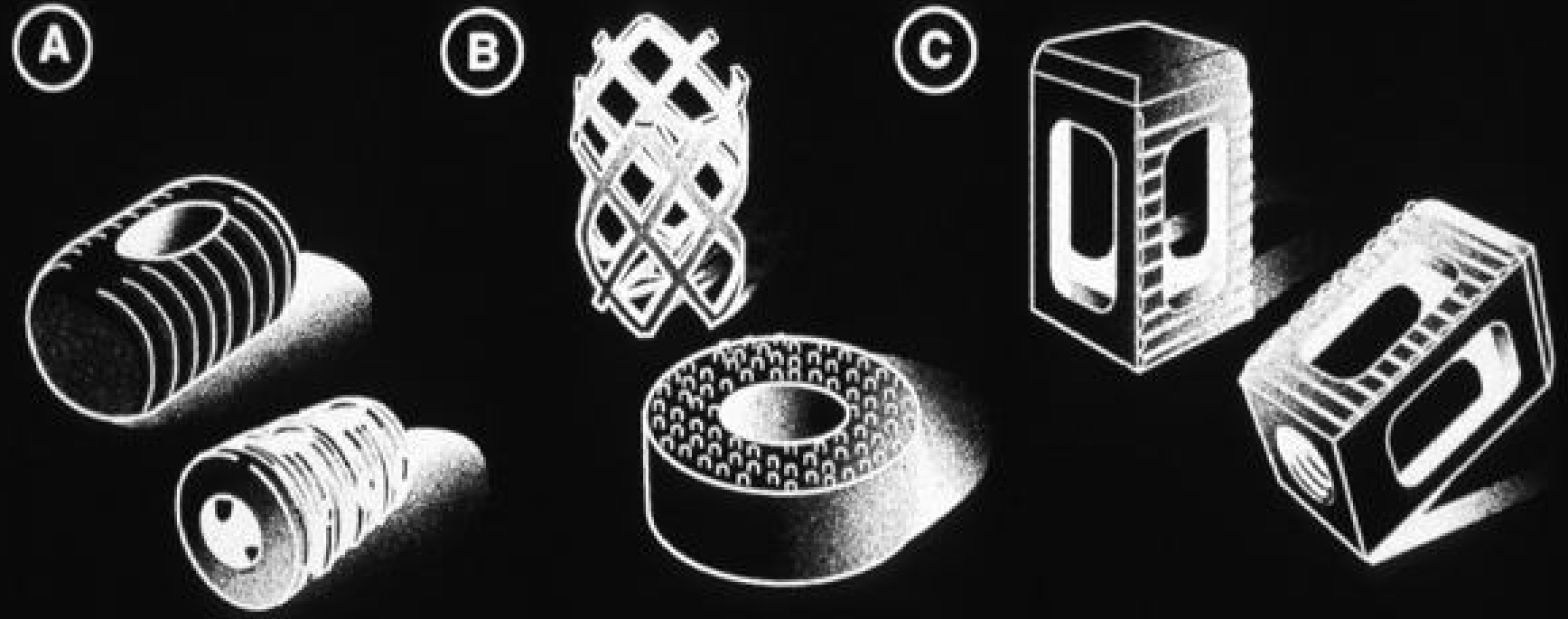
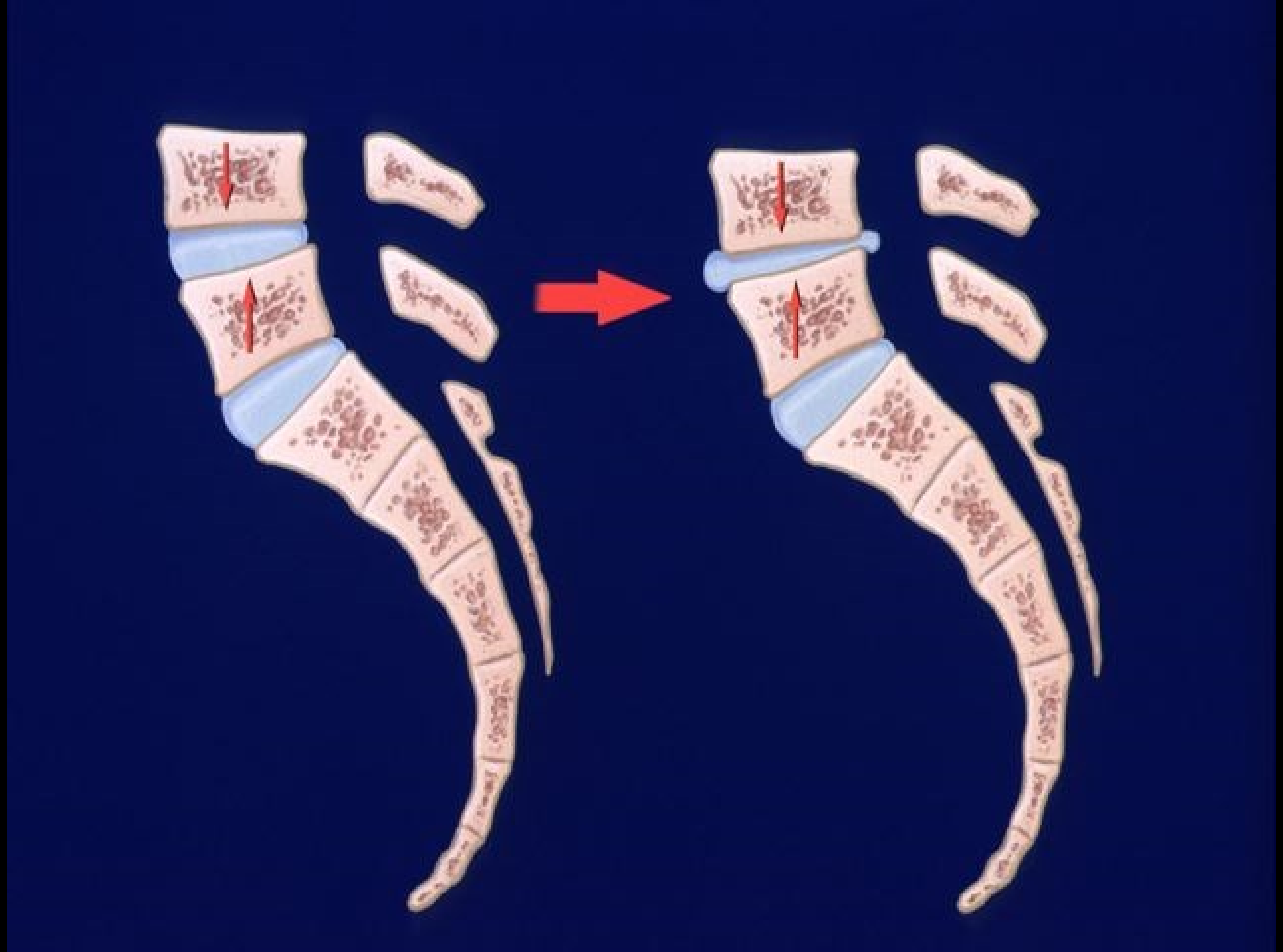
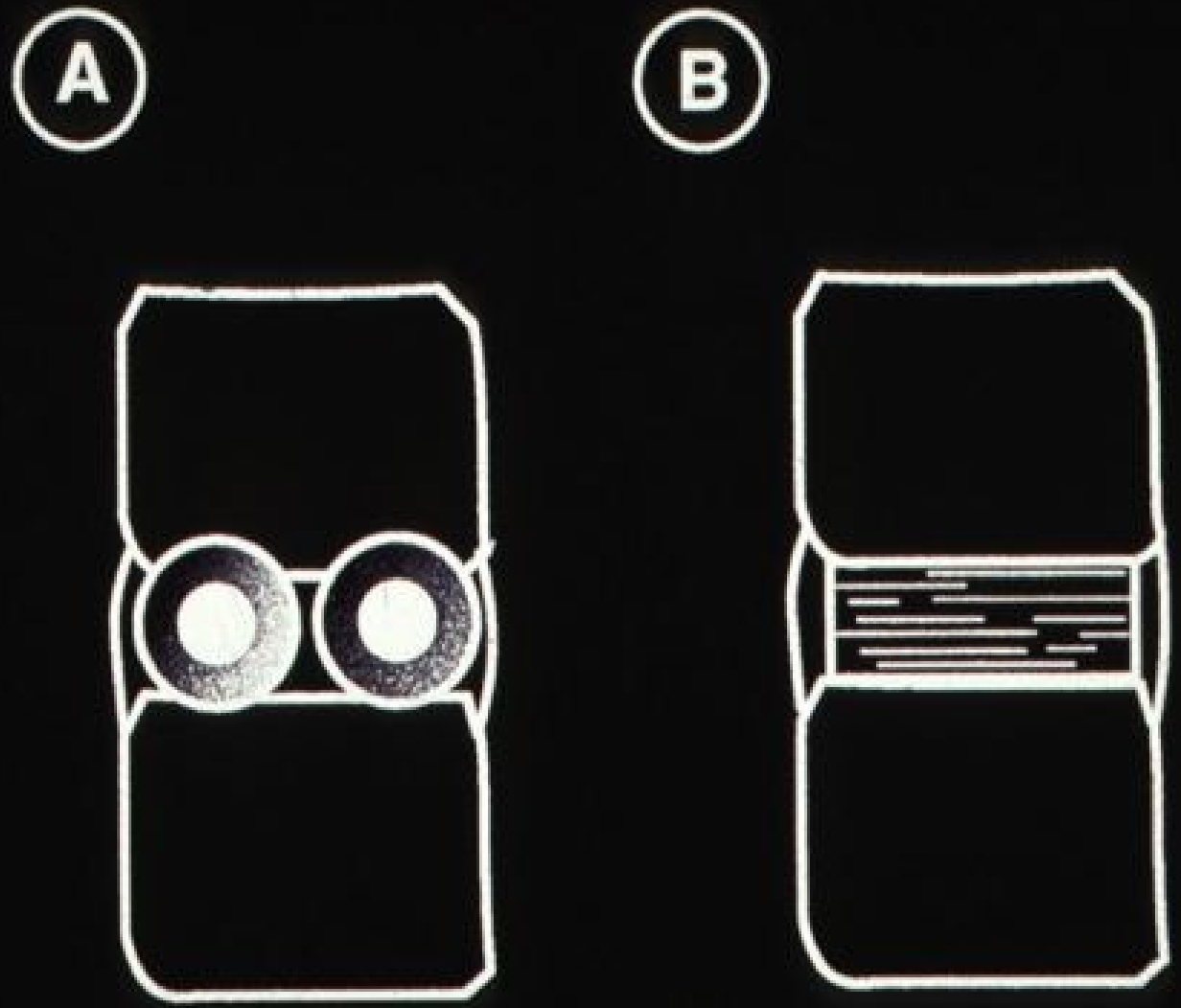
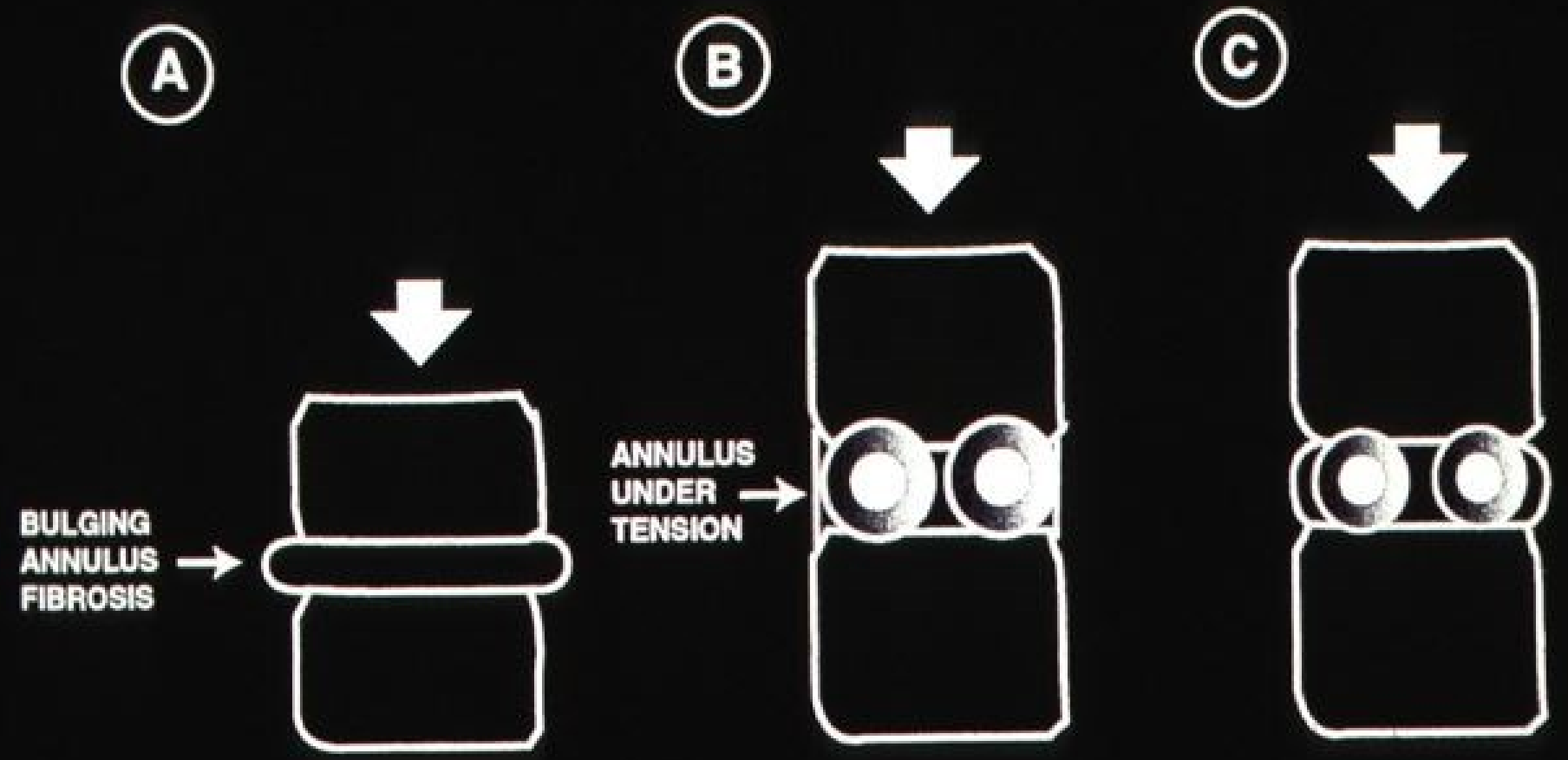
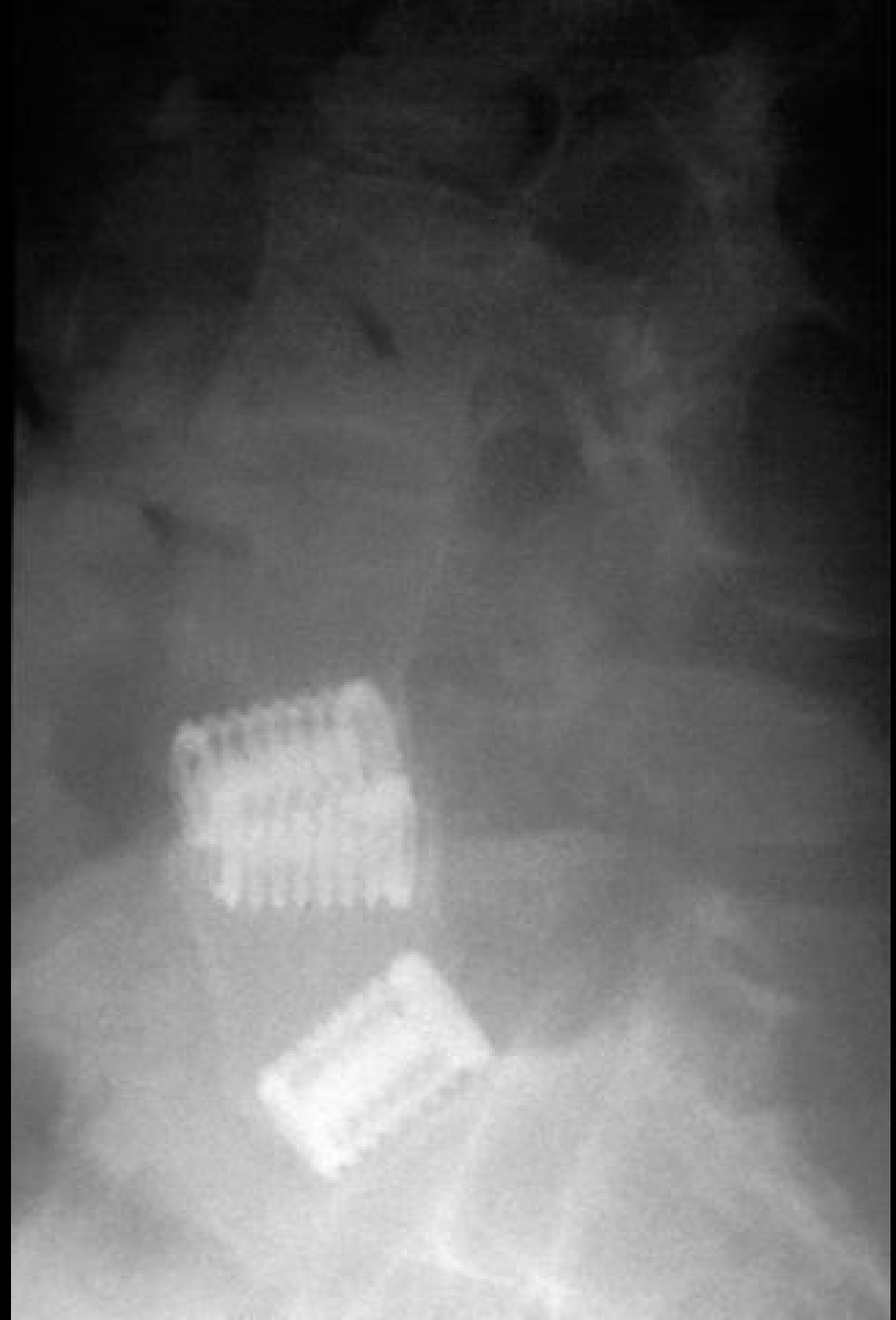
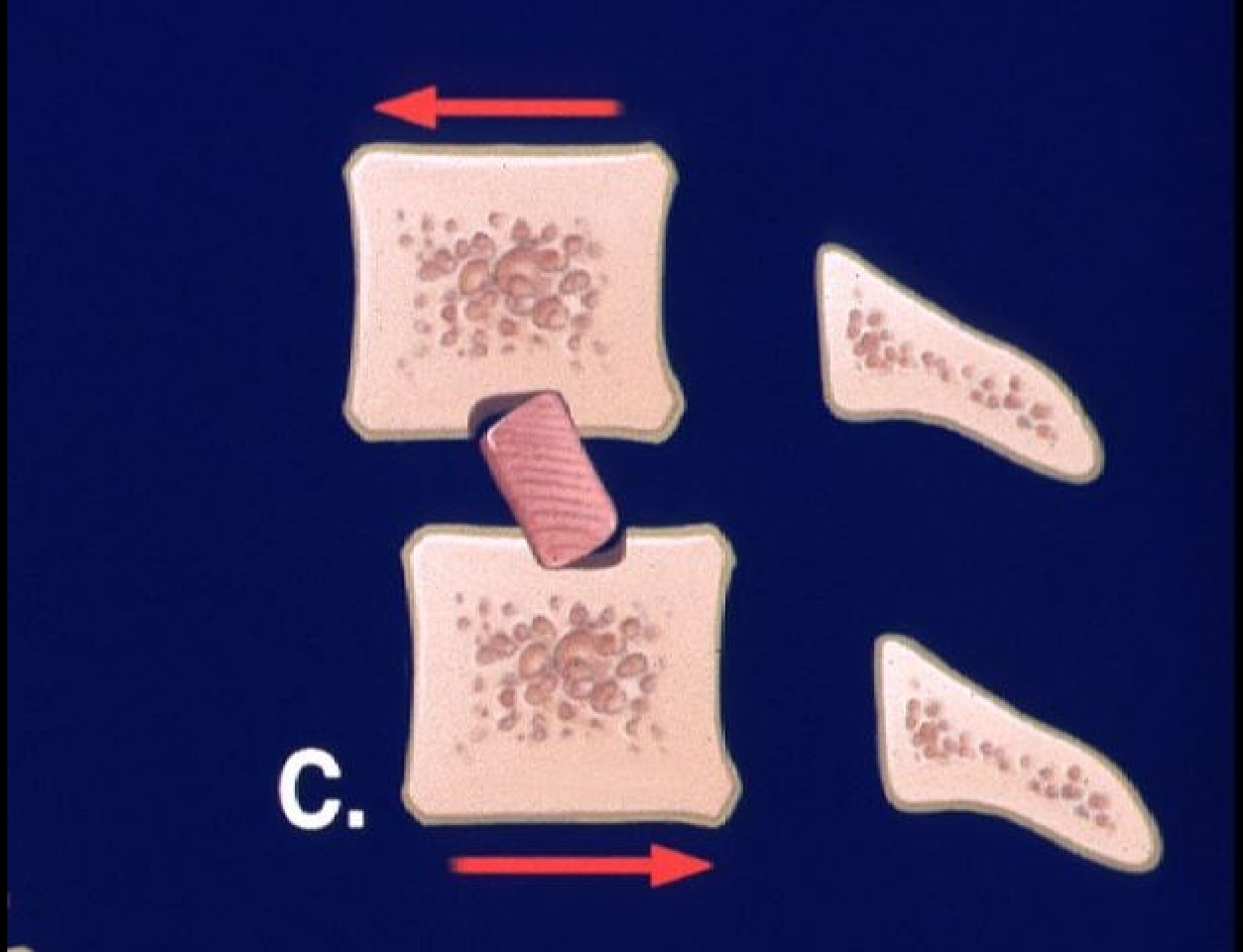

A
B
C




A
B


A
B
C
BULGING
ANNULUS
FIBROSIS
ANNULUS
UNDER
TENSION

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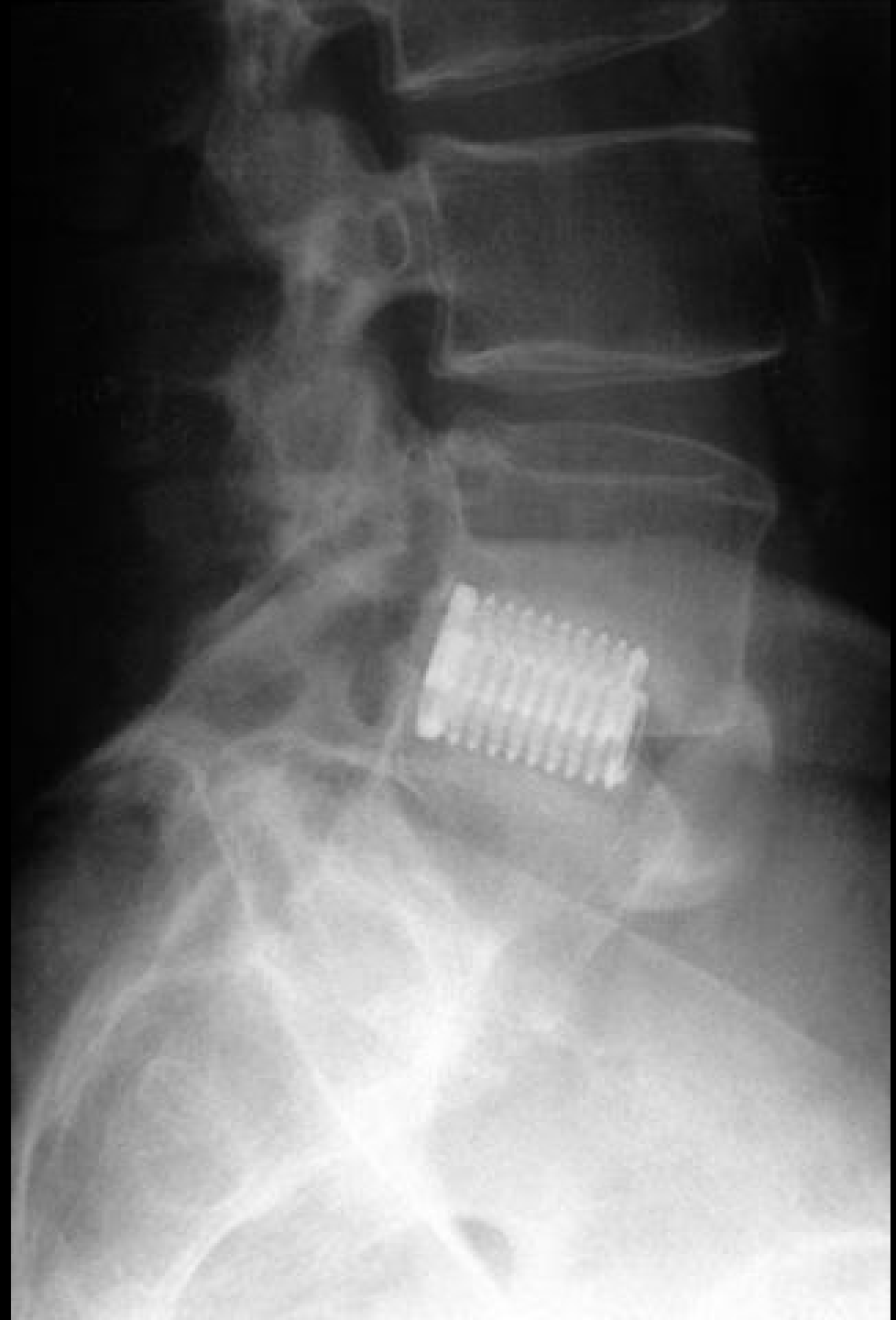
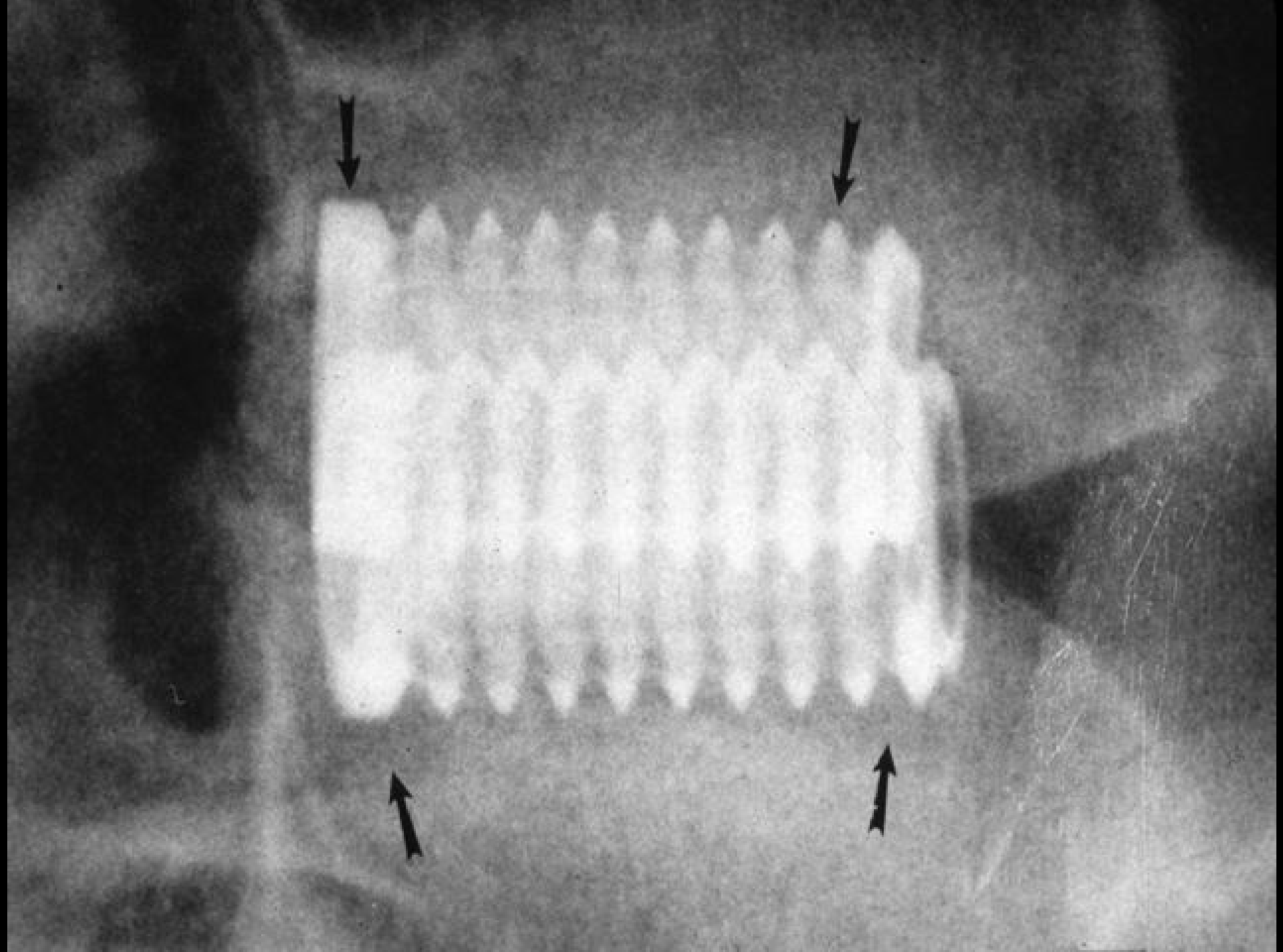
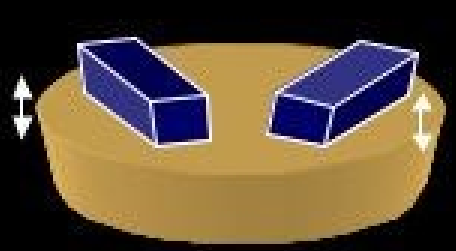
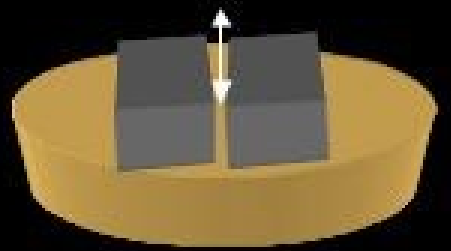


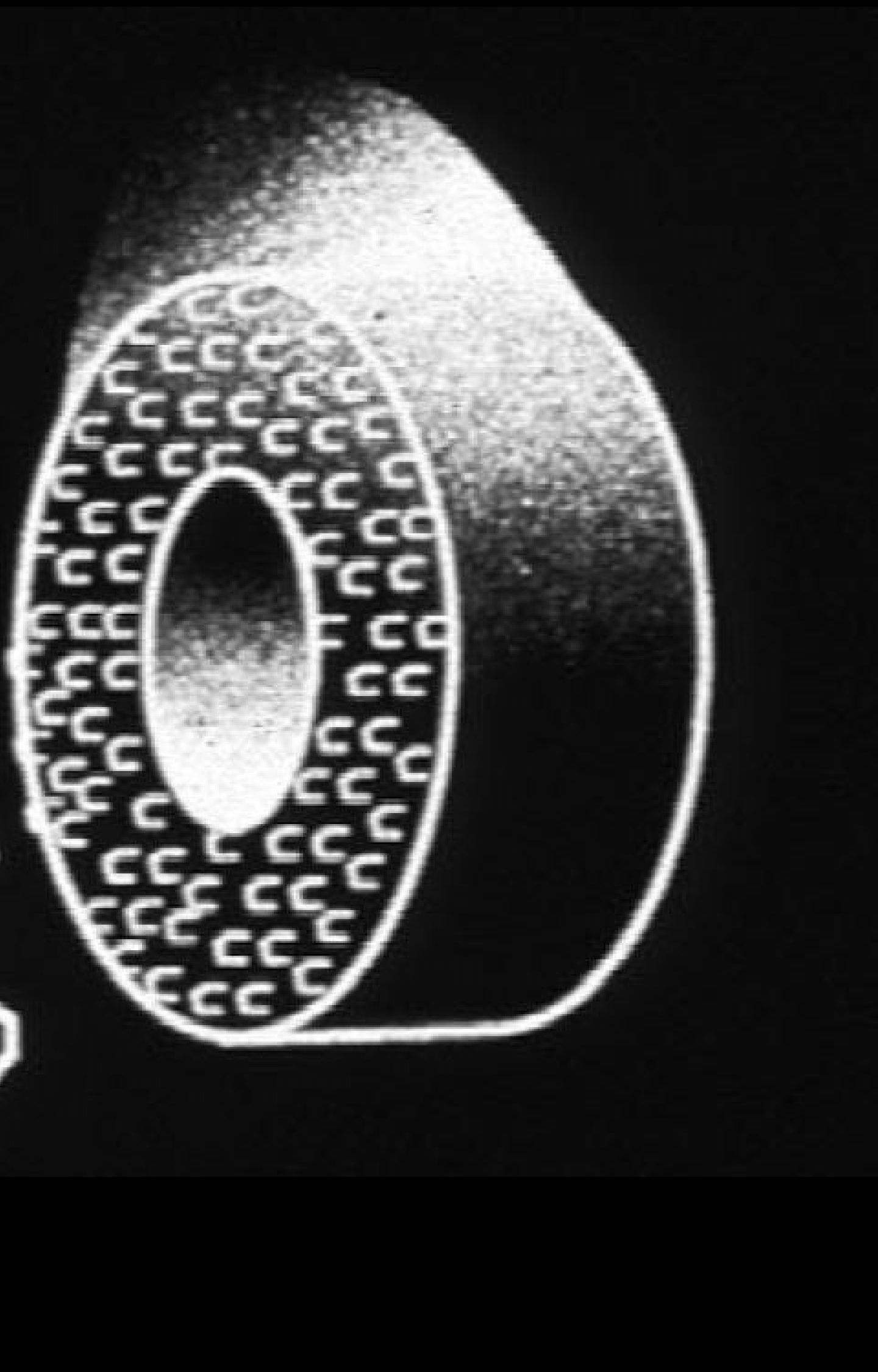




ELIF: Eccentric

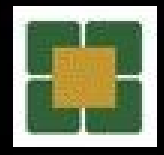


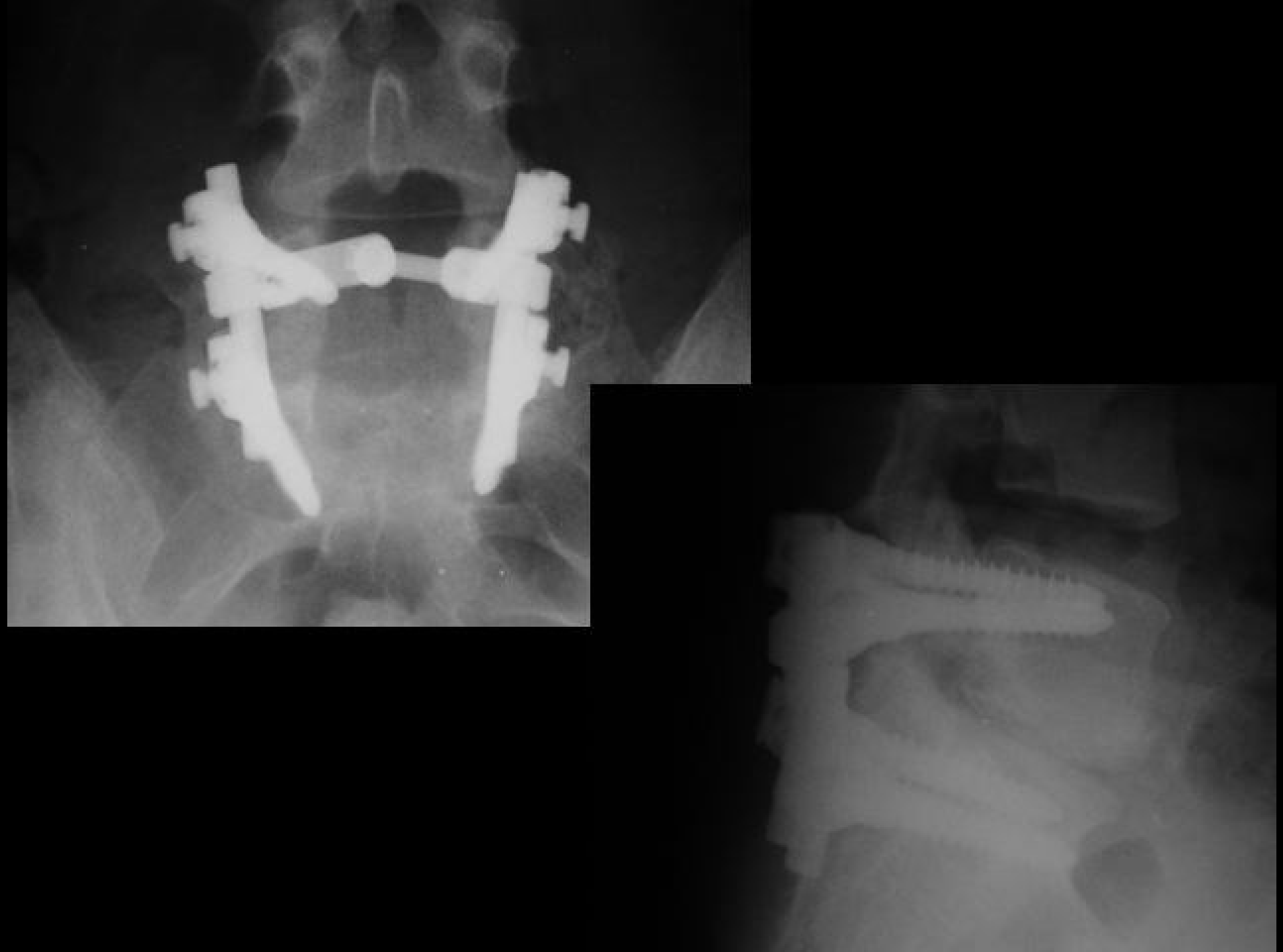
ALIF: Central



Must Have
or
Must Provide

Ventral Axial Load Bearing Ability



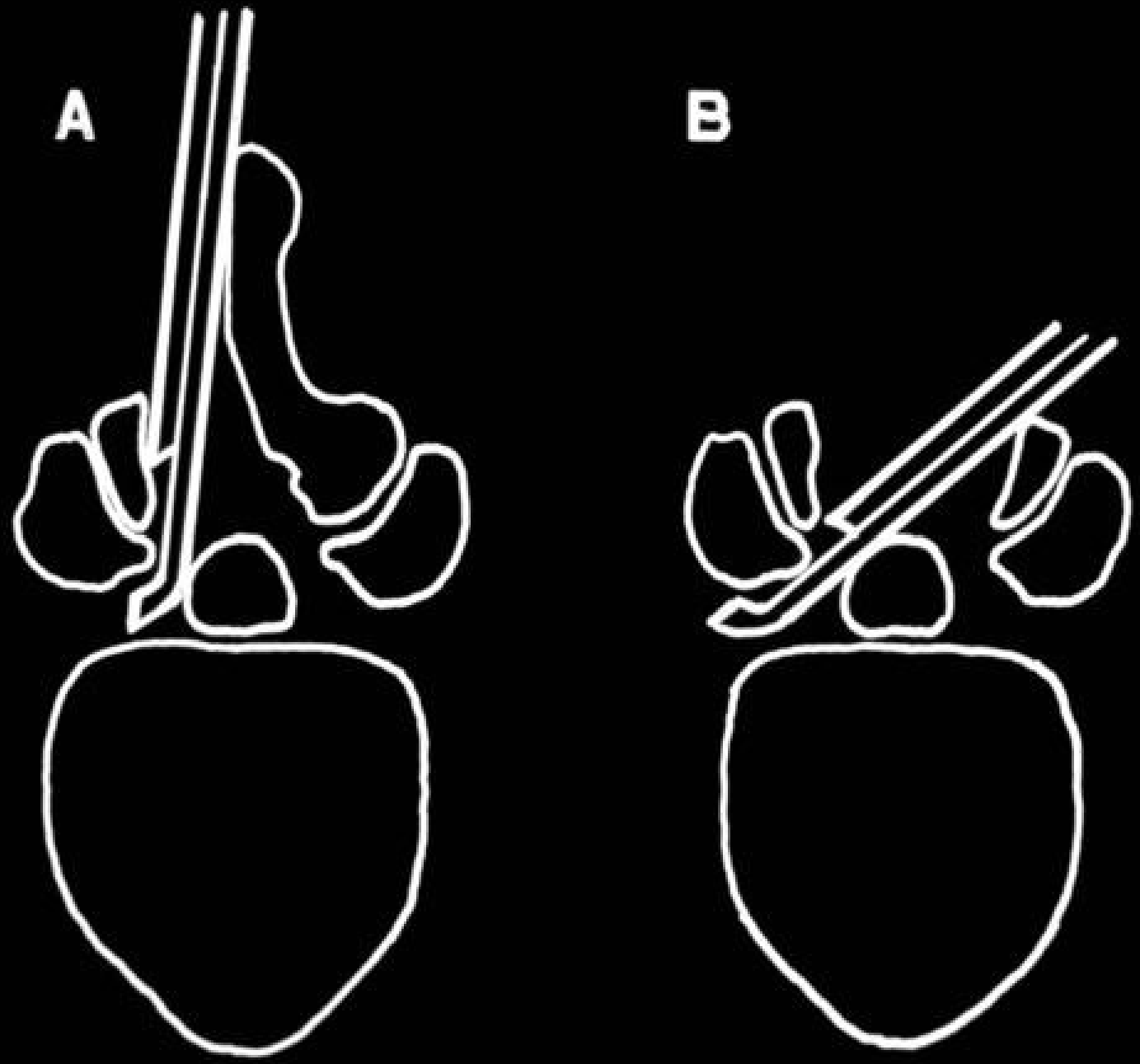


Fritzell

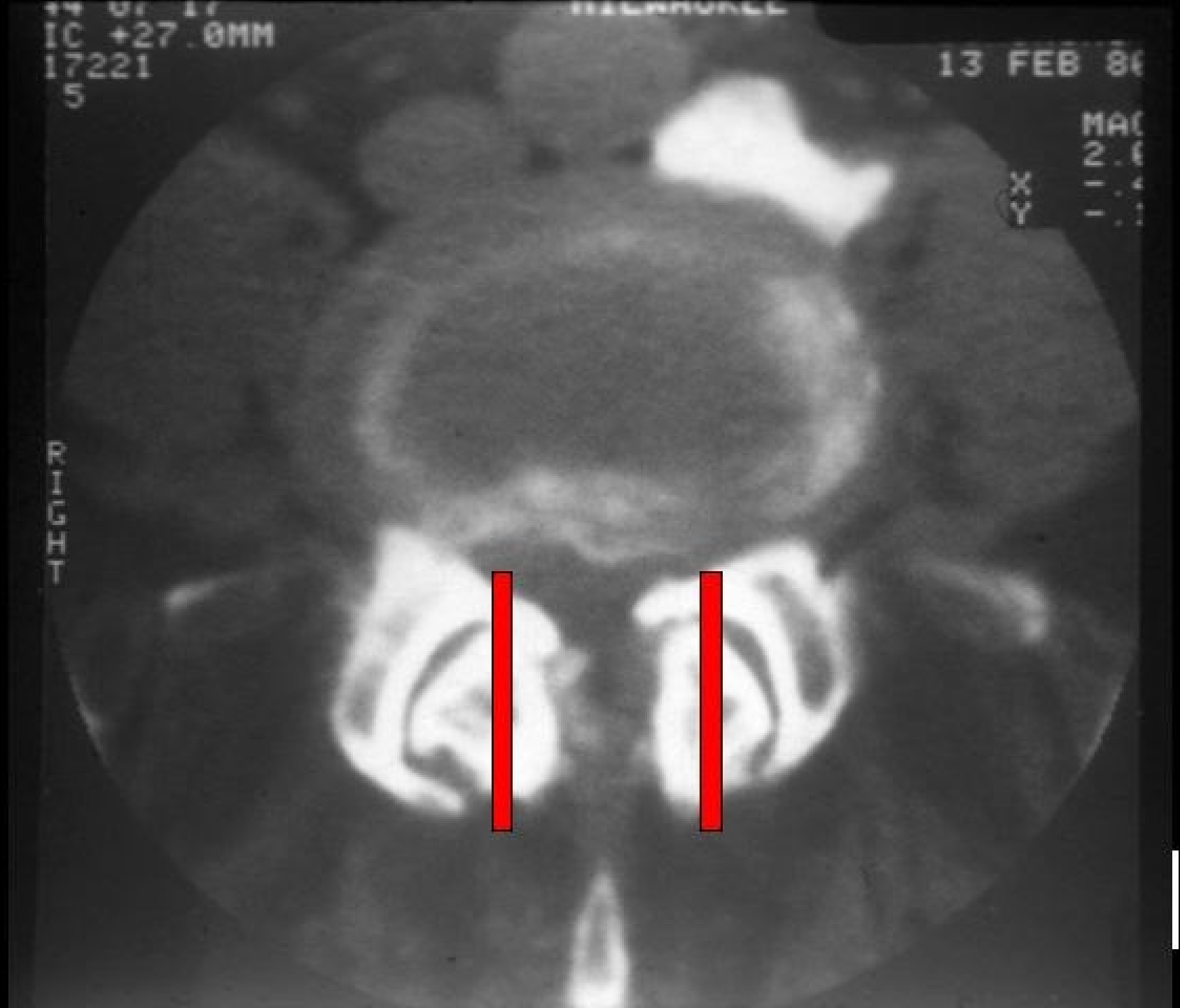
The Act of Fusion

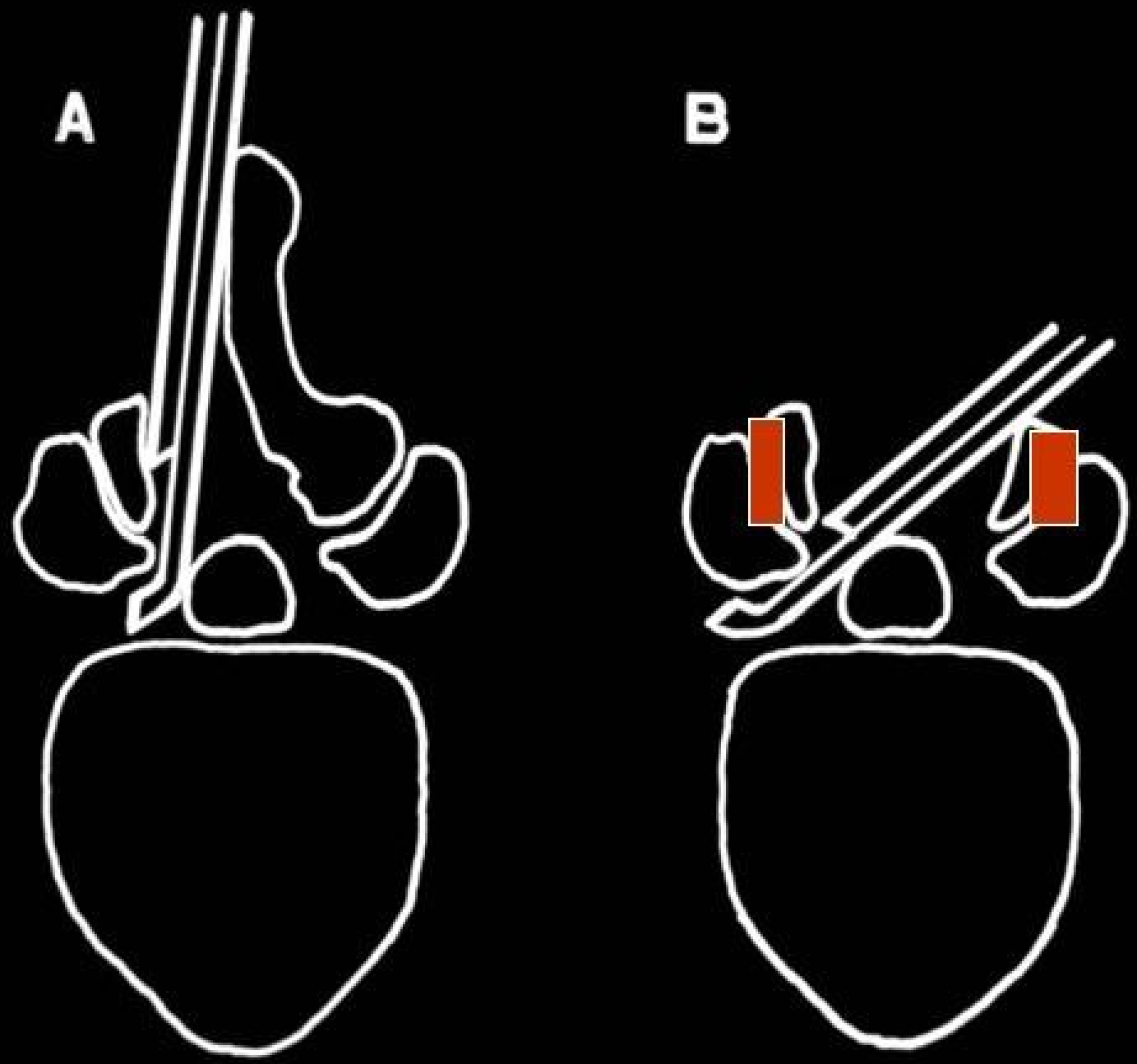
vs

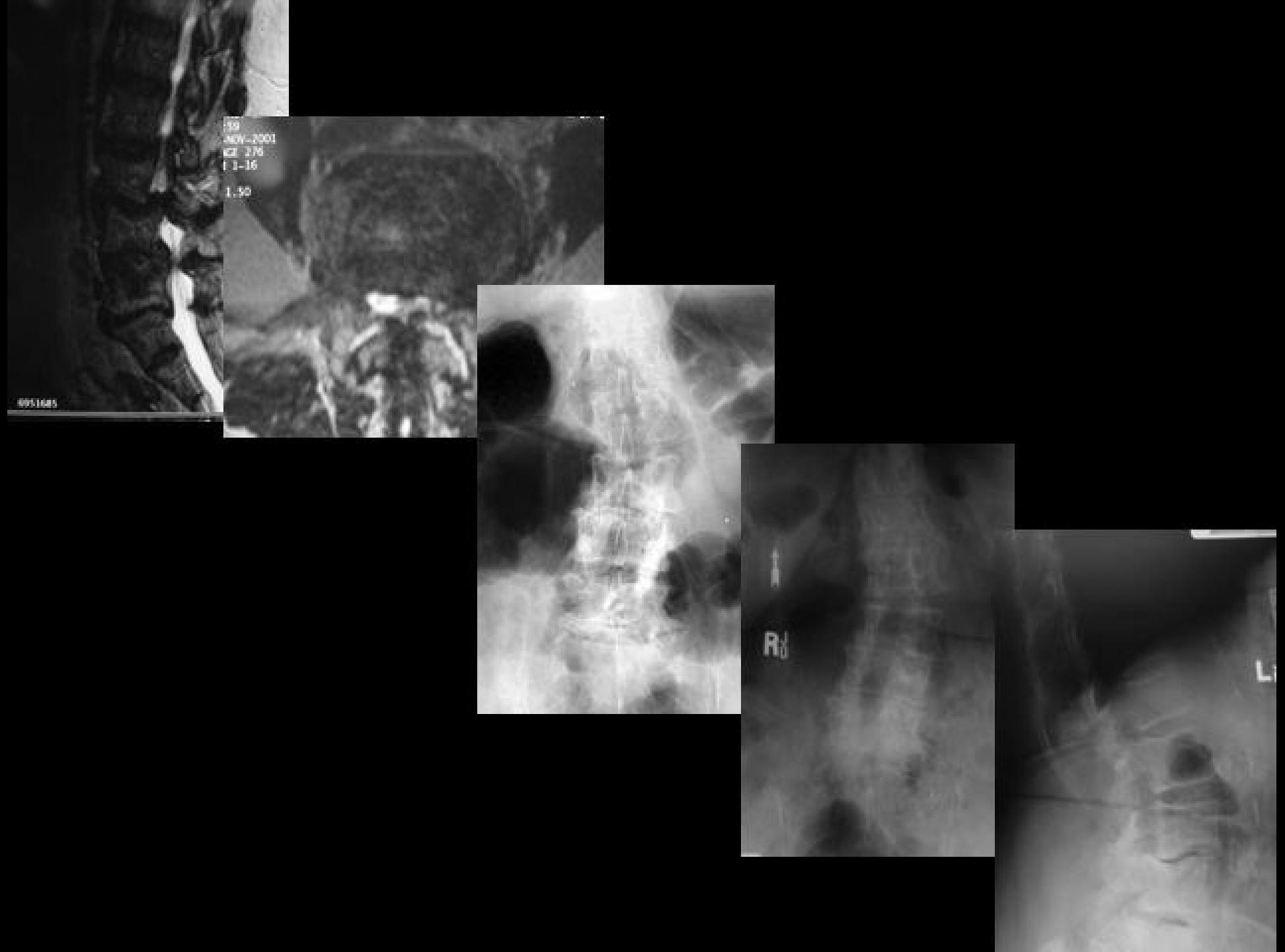
The Acquisition of Arthrodesis


A
B

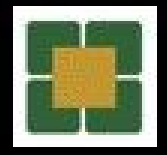

IC +27.0MM
17221
5
13 FEB 8
RIGHT

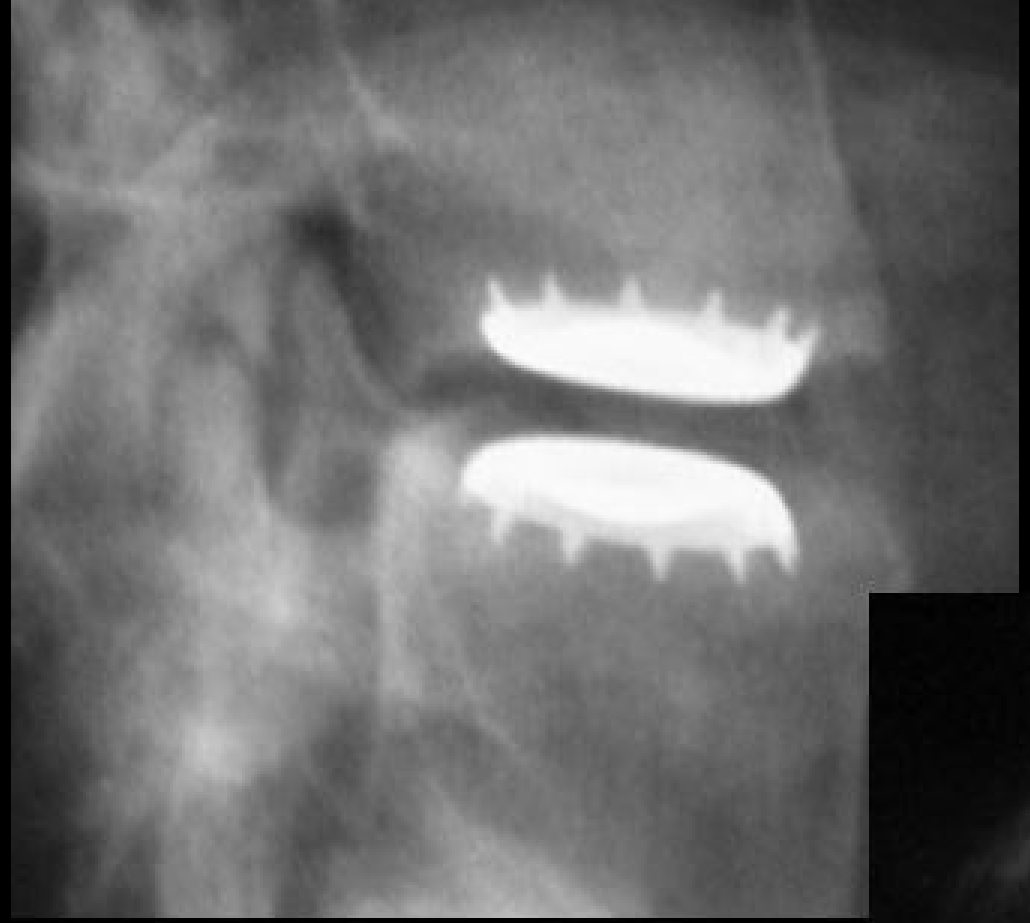

IC +27 0MM
17221
5
13 FEB 8
RIGHT


A
B


59
NOV-2001
KZ 276
1 1-16
1.50
R

TDA

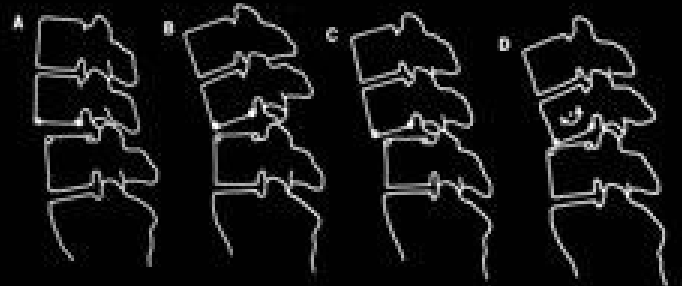


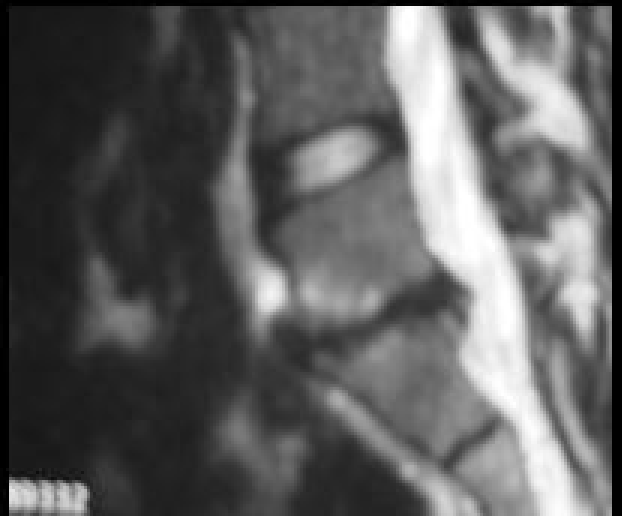


Pain Generator
??????????

Dysfunctional Motion Segment

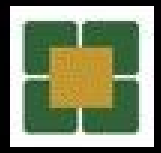
Excessive Motion
Fixed Subluxation
Significant Degenerative Changes





Mechanical BACK PAIN

Deep, Agonizing Pain Worsened with Loading Improved with Unloading



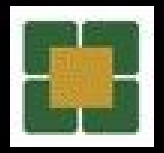
Define the Patient?

Treat the Disc?

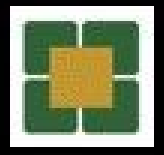
DISCOGENIC BACK PAIN ?

ATTRIBUTES

Replicates Anatomy
Replicates Motion
Replicates Mechanics
Minimal Complications
Acceptable Revision Strategies
Longevity
Retardation of Degenerative Changes
Symptom Relief

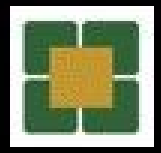


REPLICATES ANATOMY



REPLICATES ANATOMY

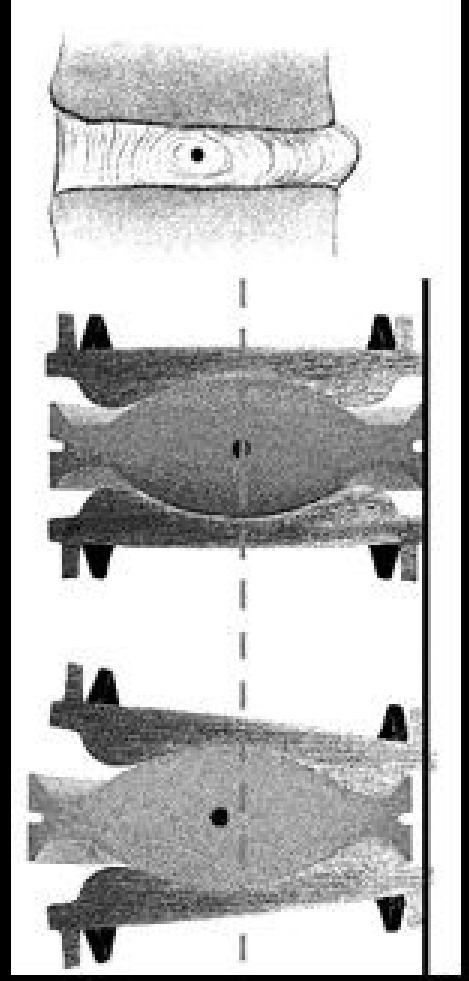
Disc Interspace Height
Disc Interspace Angle



REPLICATES MOTION

Translation
Angular

Axial
Coronal
Sagittal

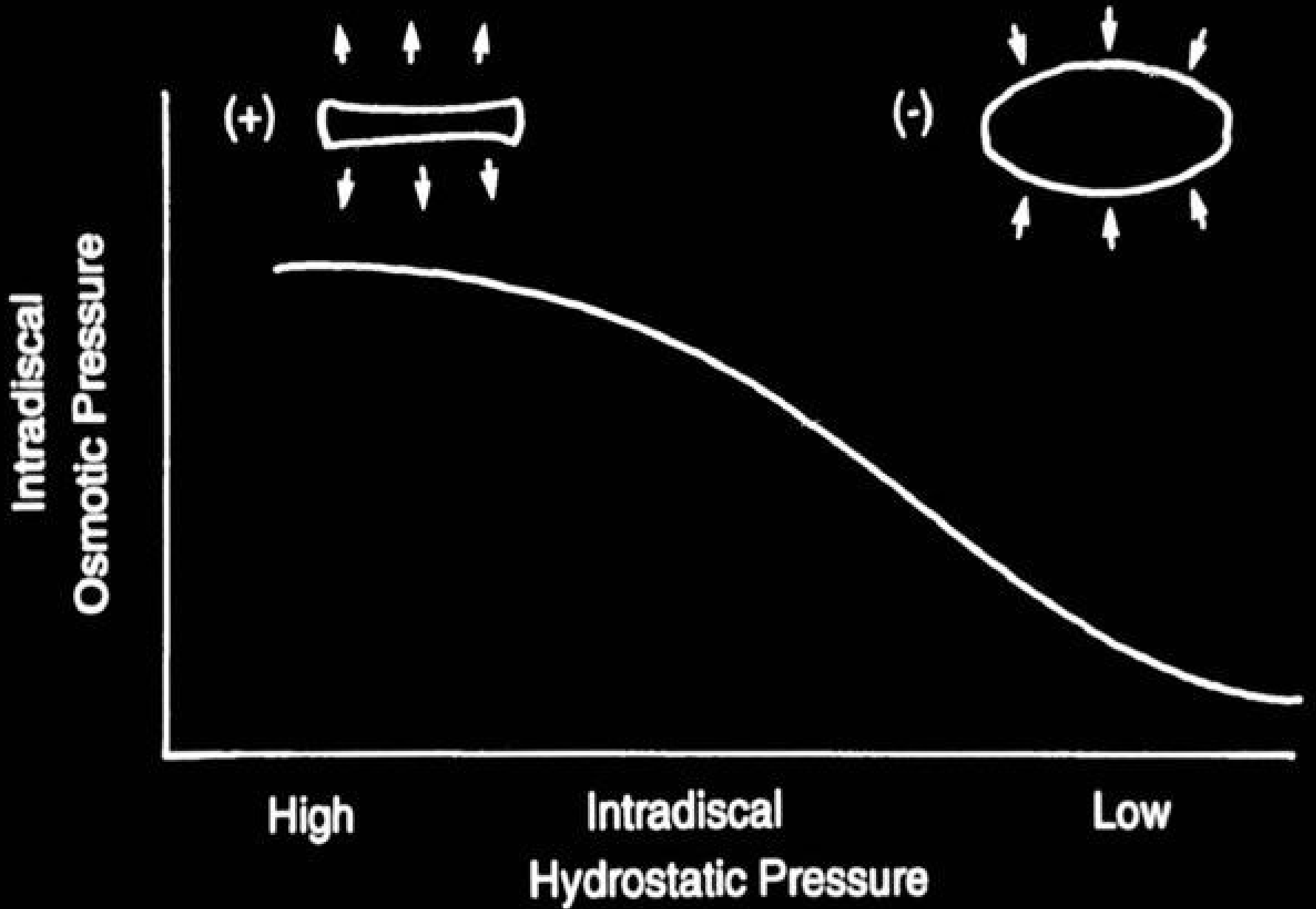


In Which Plane?

Axial?
Translational?
Bending?

Along Which Axis?

Axial
Coronal
Sagittal

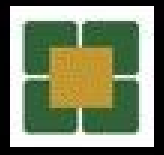

(+)
(-)
Intradiscal
Osmotic Pressure
High
Intradiscal
Low
Hydrostatic Pressure

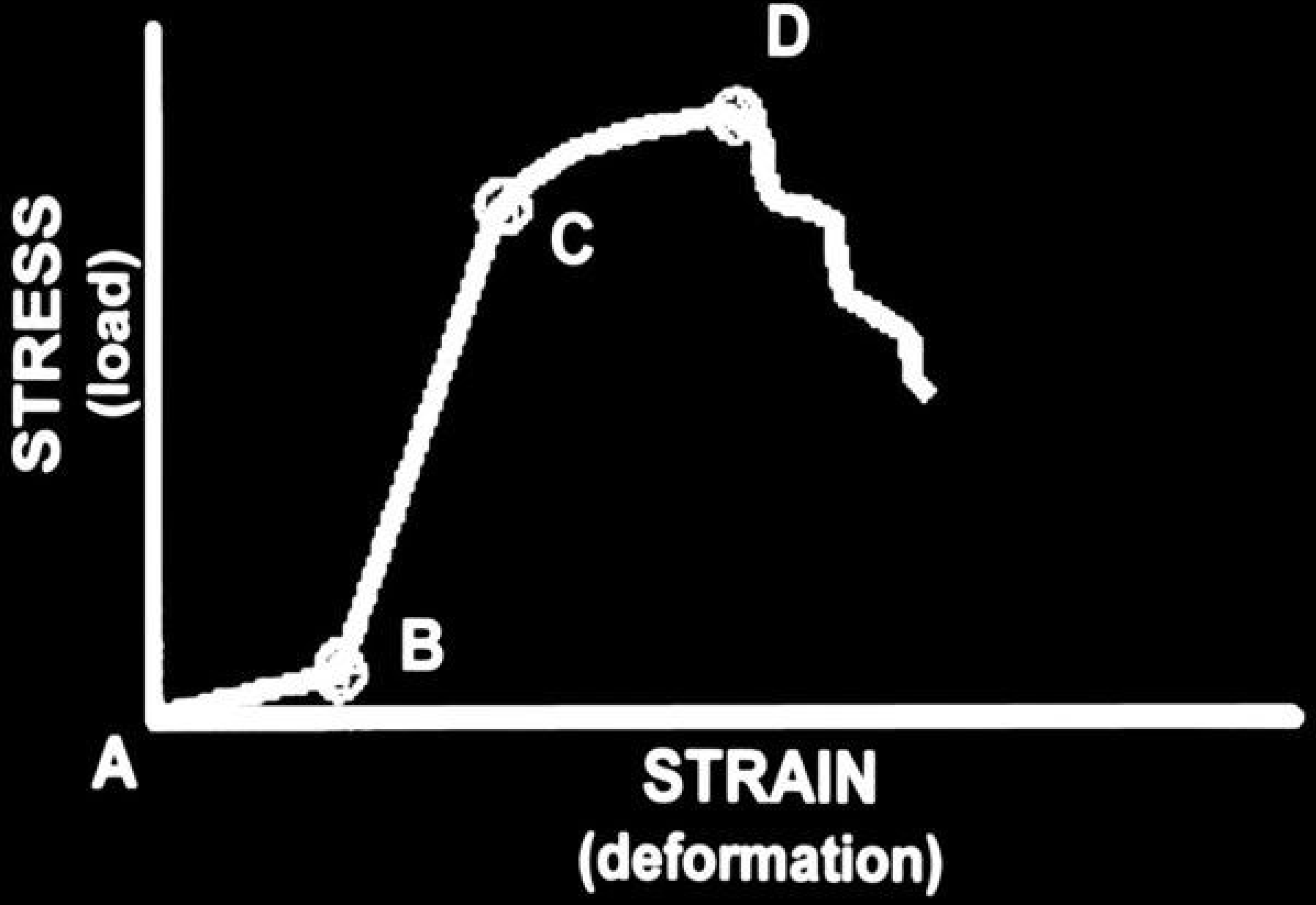
REPLICATES MECHANICS

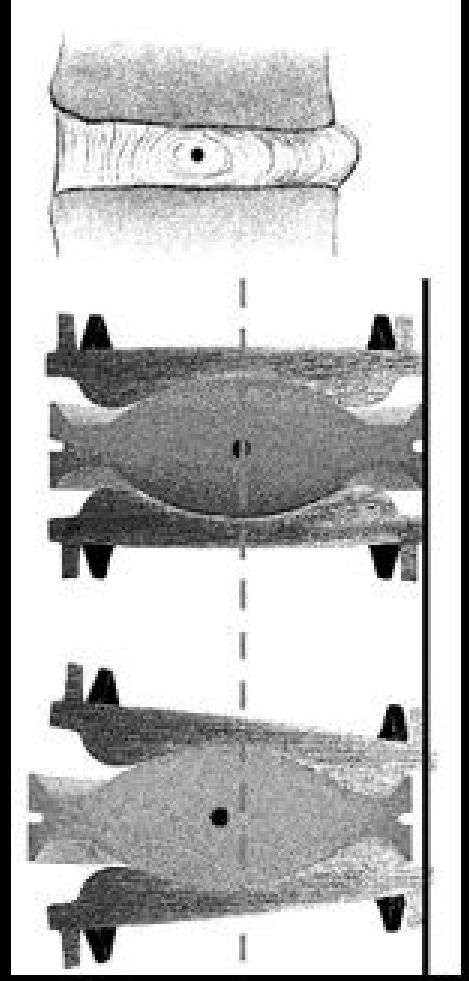
Stiffness
Shock Absorption
Creep

Stiffness

Unconstrained
Semiconstrained
Constrained

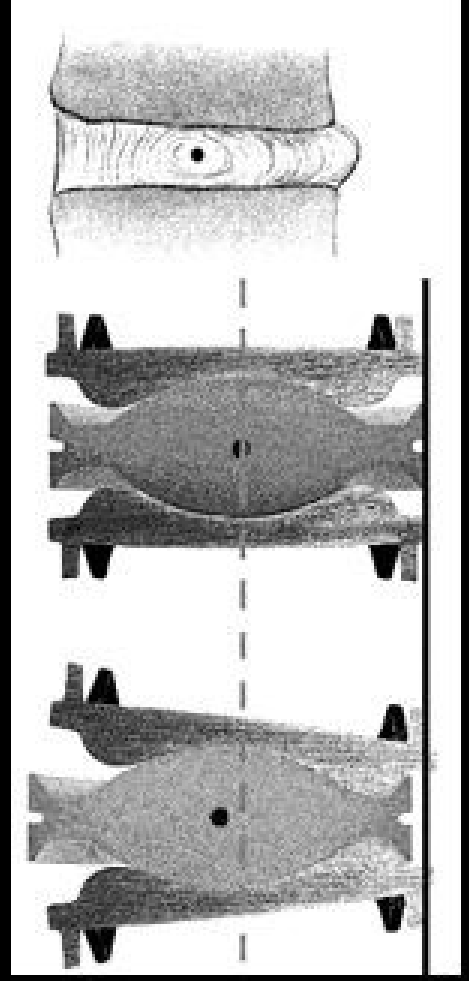



D
C
B
A
STRESS
(load)
STRAIN
(deformation)



In Which Plane?

Axial?
Translational?
Bending?

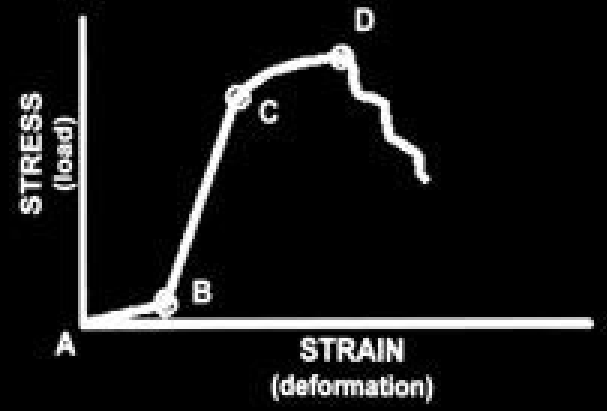


In Which Plane?

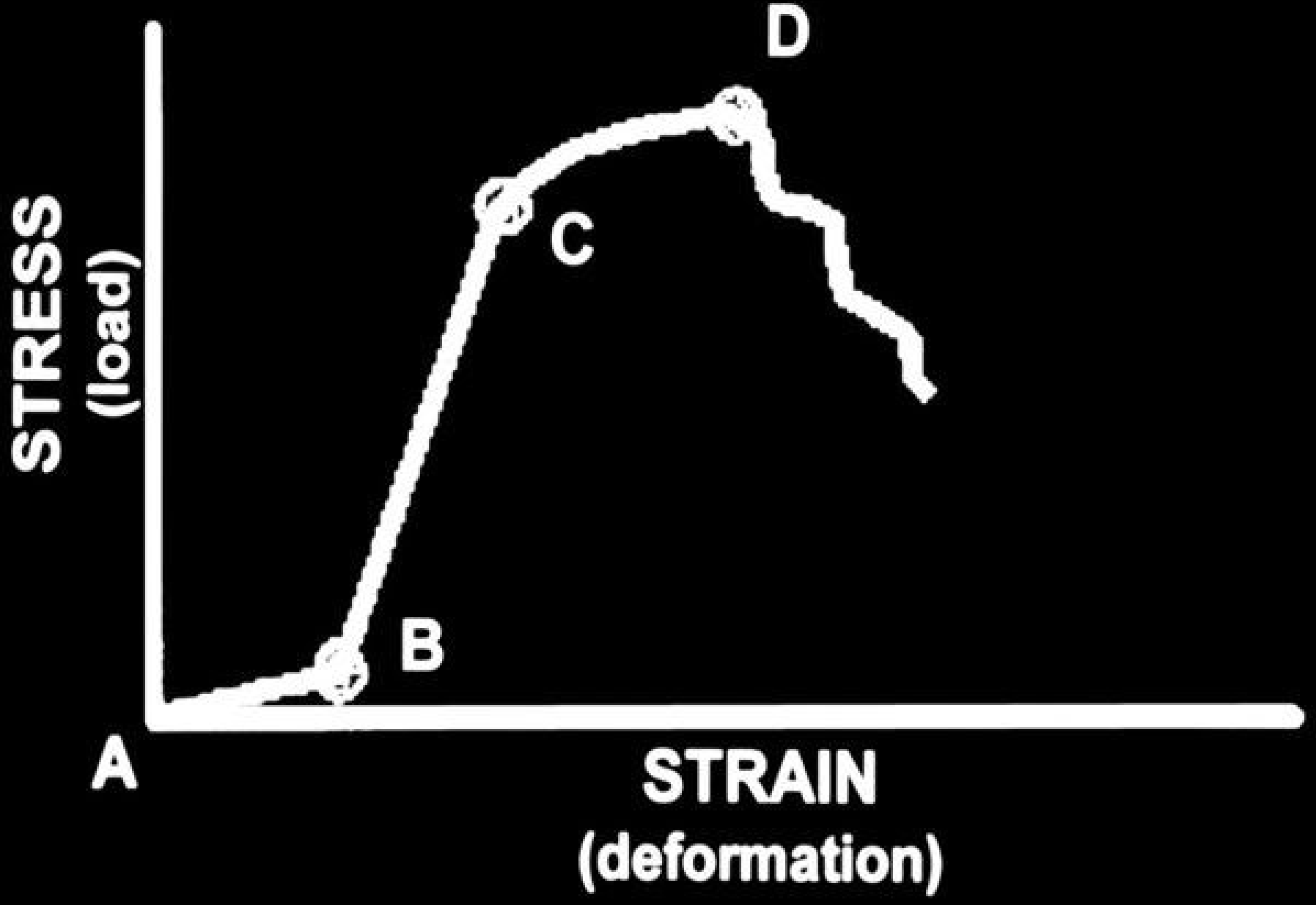
Axial – Very High
Translational – ±Very Low
Bending – Very Low

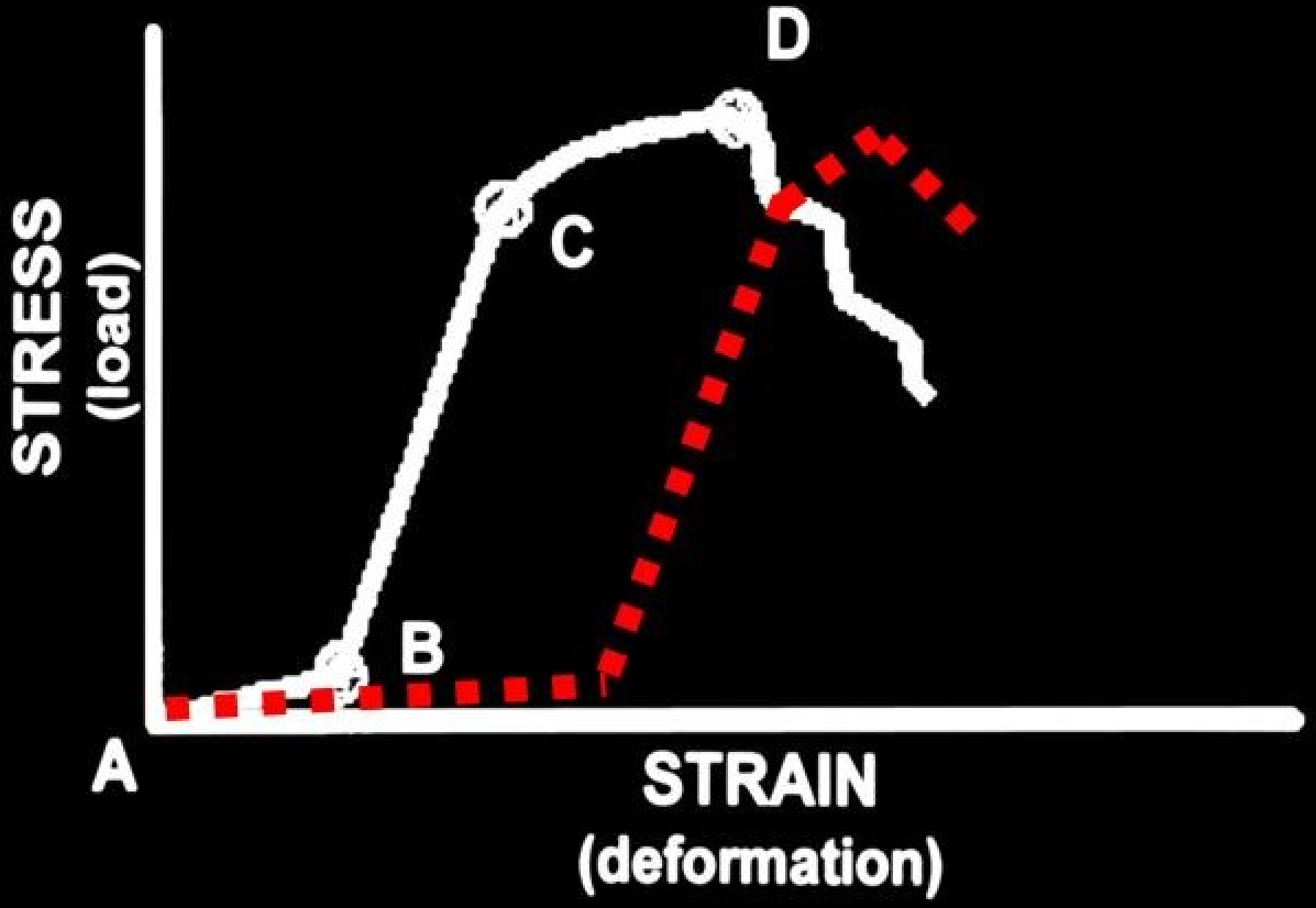
Stiffness of Joint

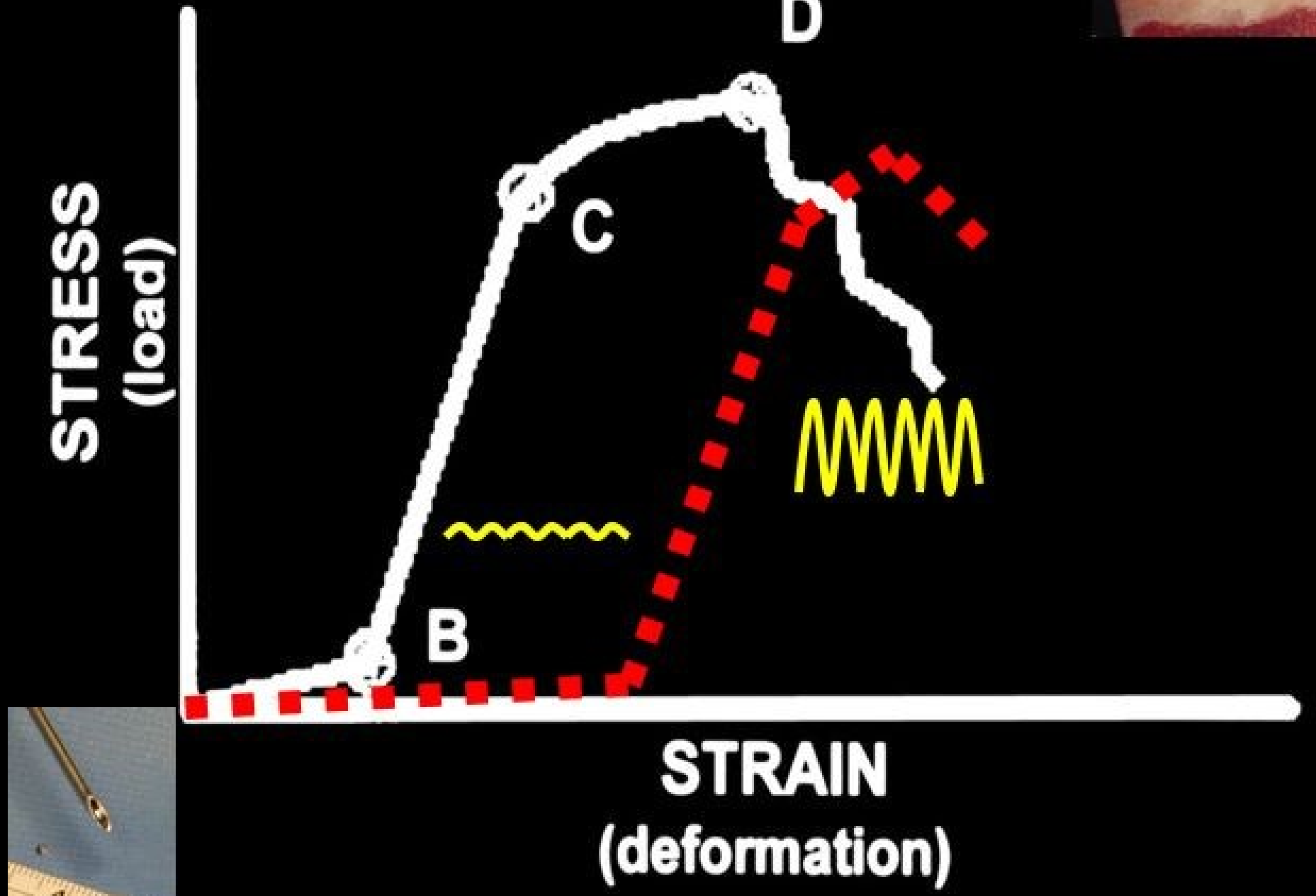
Unconstrained **Semiconstrained** **Constrained**

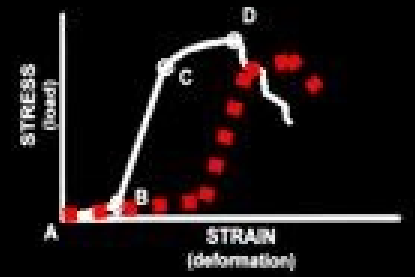


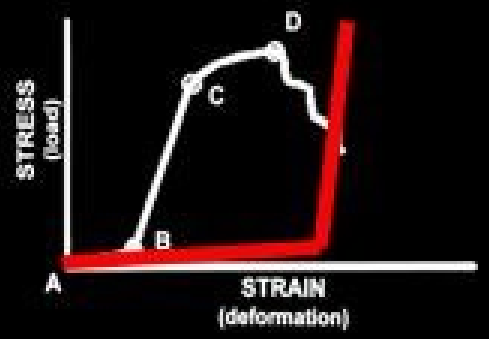
Disengagement **Engagement**

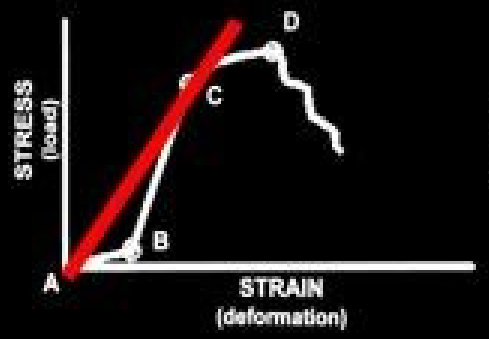

D
C
B
A
STRESS
(load)
STRAIN
(deformation)

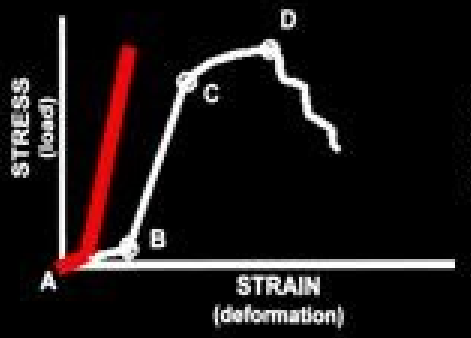

D
C
B
A
STRESS
(load)
STRAIN
(deformation)

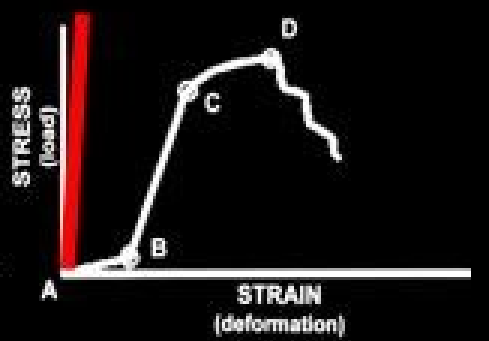

D
C
B
STRESS
(load)
STRAIN
(deformation)

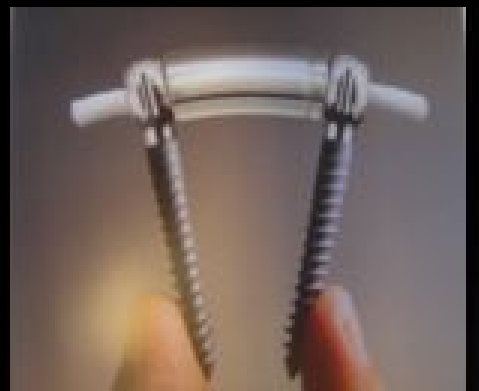










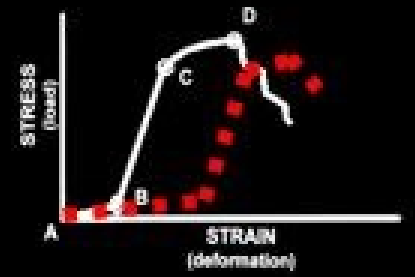


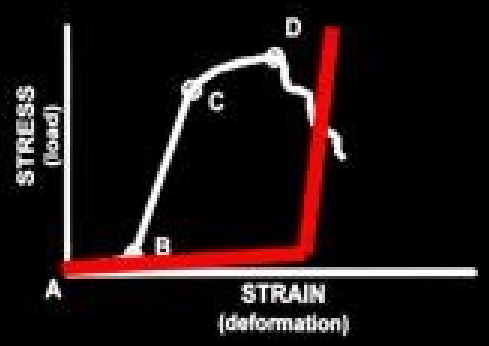
Stiffness

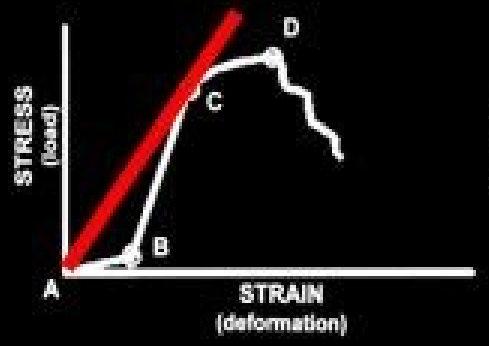
D
C
B
A
STRESS
(load)
STRAIN
(deformation)

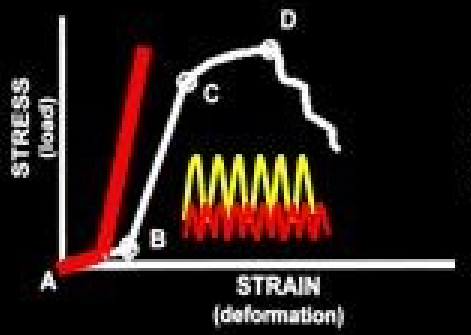
D
C
B
A
STRESS
(load)
STRAIN
(deformation)
D
C
B
A
STRESS
(load)
STRAIN
(deformation)
D
C
B
A
STRESS
(load)
STRAIN
(deformation)
D
C
B
A
STRESS
(load)
STRAIN
(deformation)

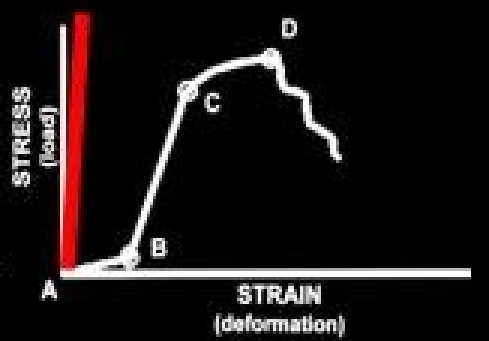
Stiffness and Pressure





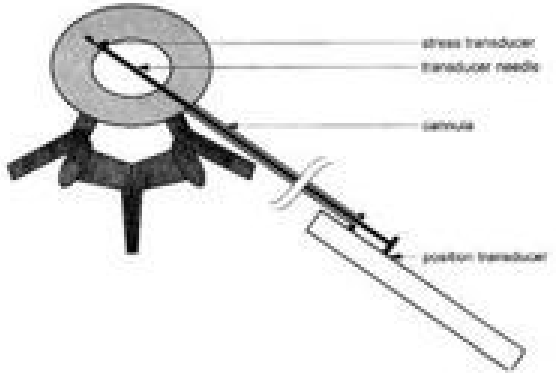


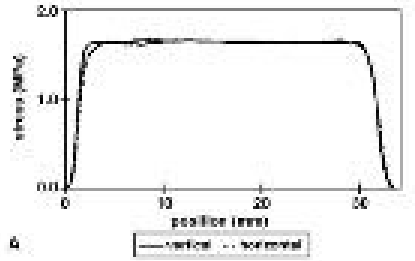




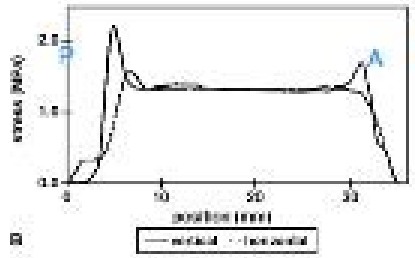
Load Transfer

Stress Profilometry

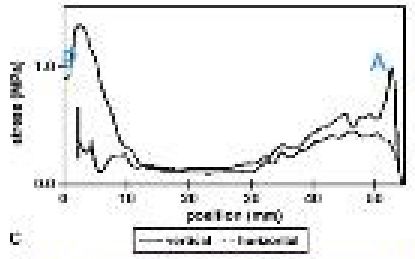




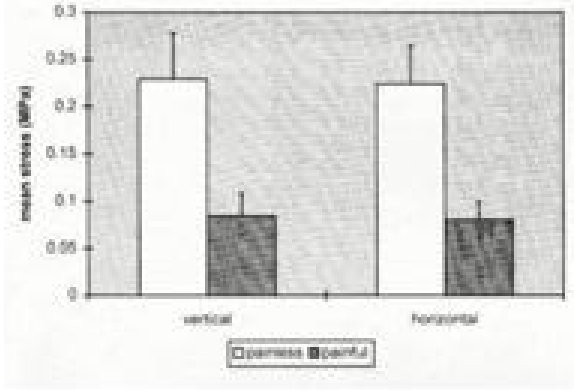
Normal

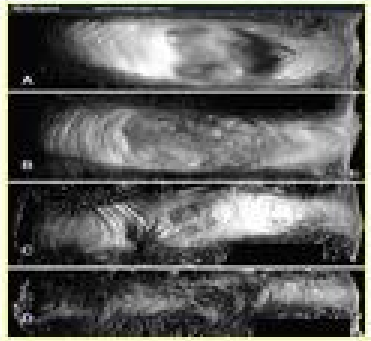


Moderately Degenerated

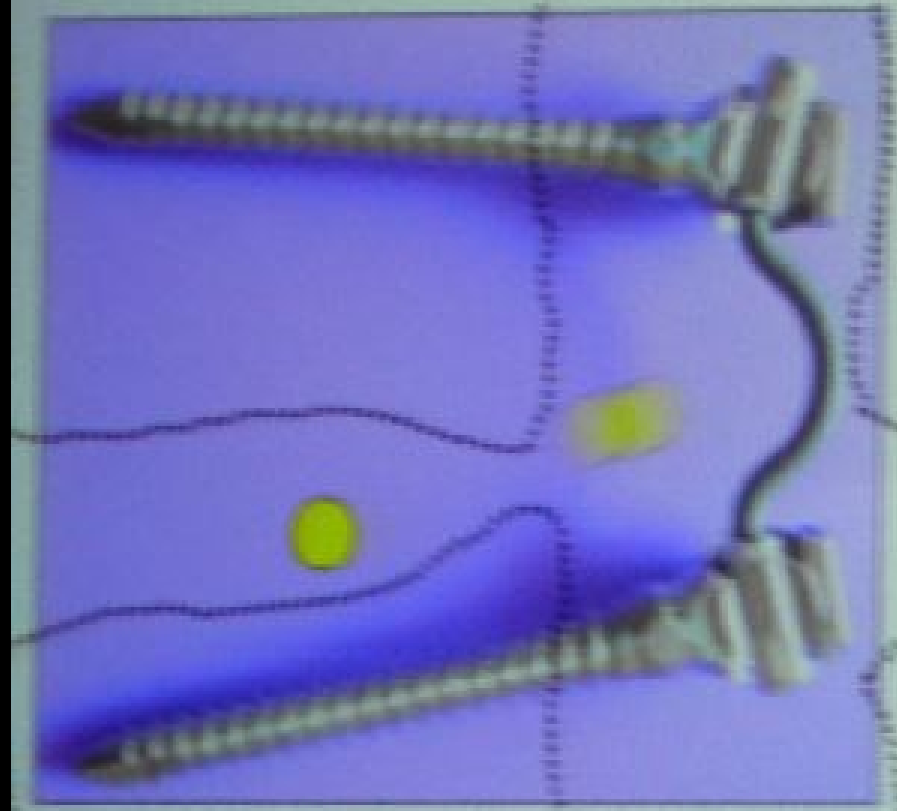


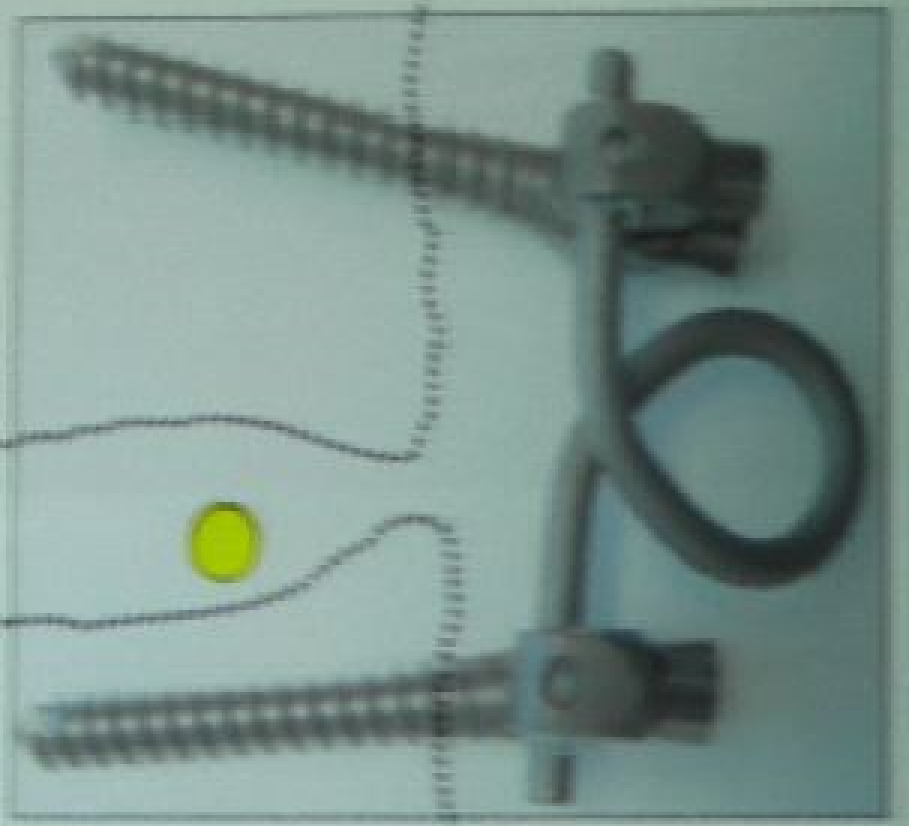
Significantly Degenerated

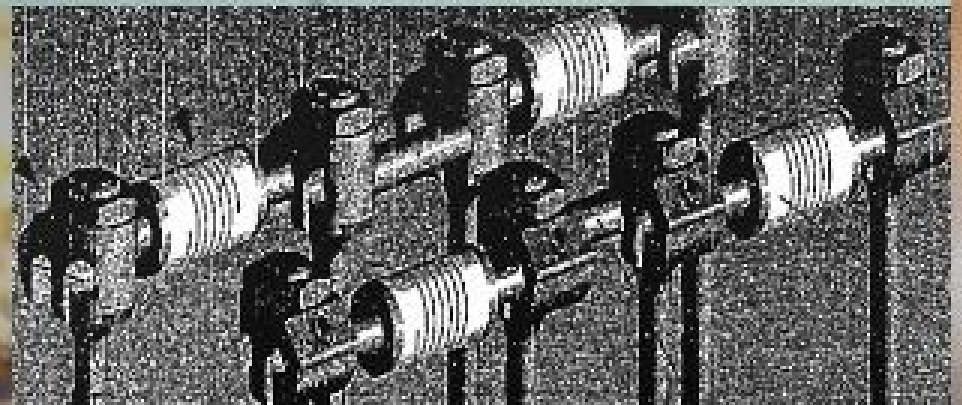


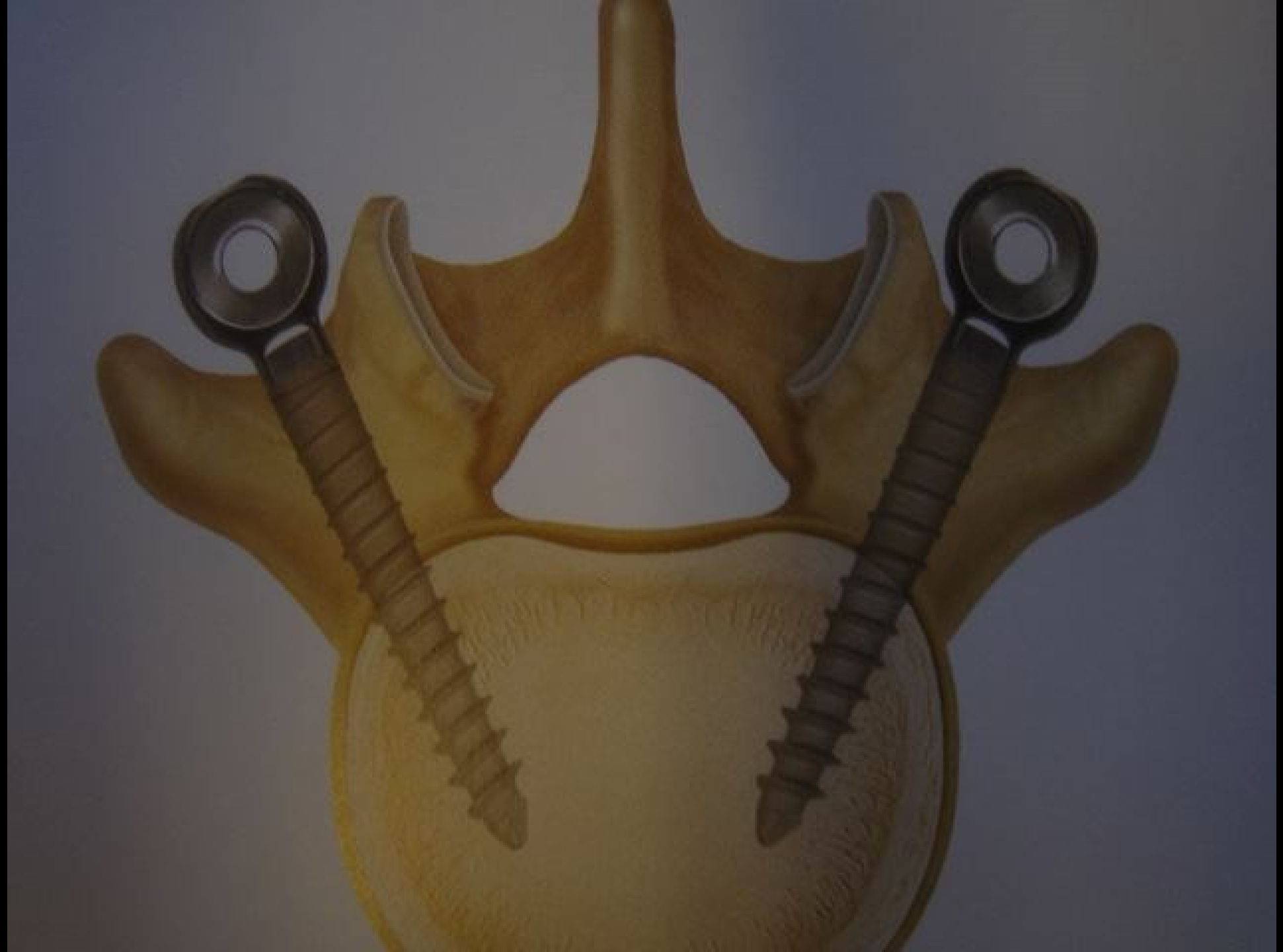


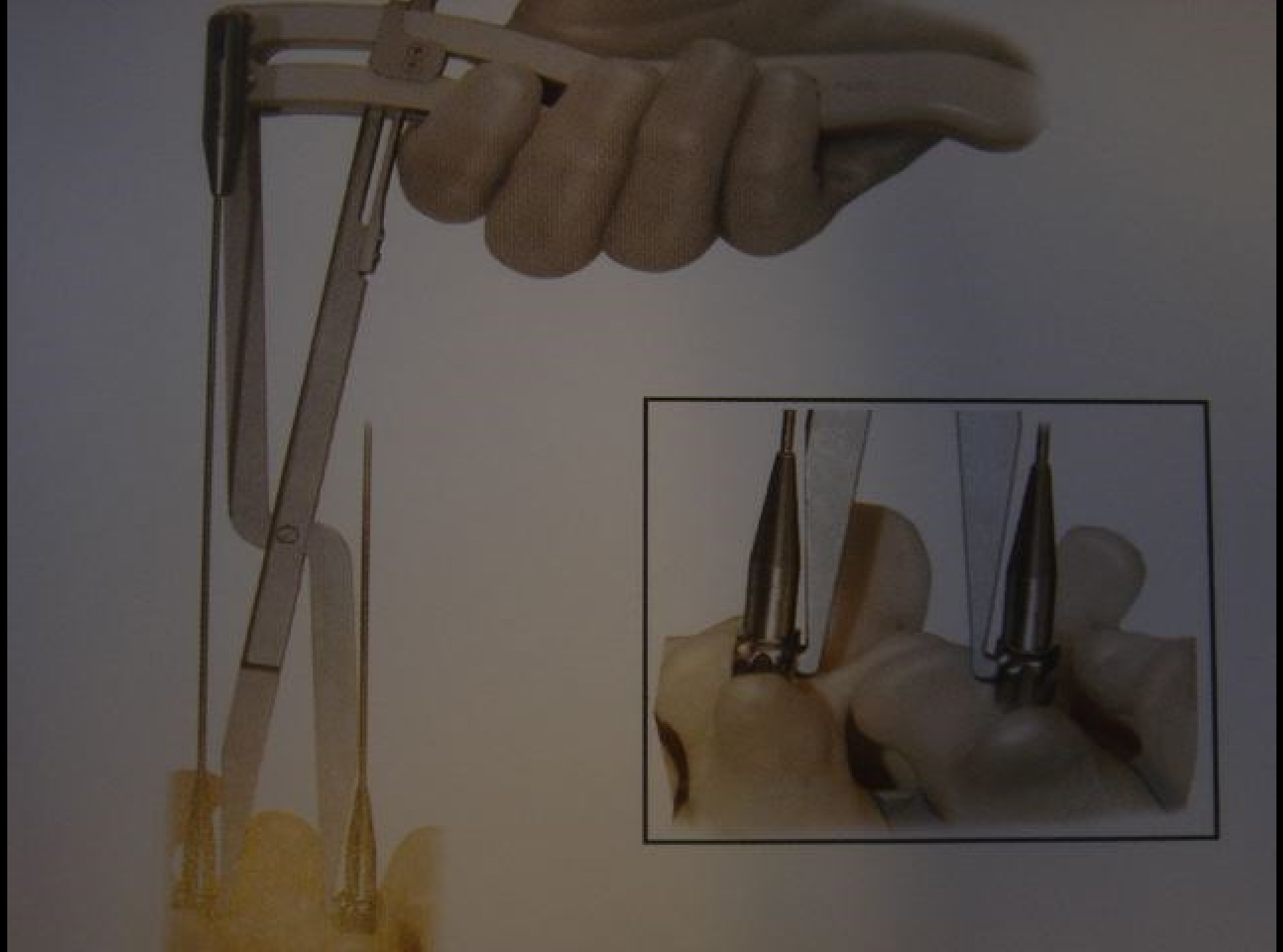
McNally et al, Spine 1996

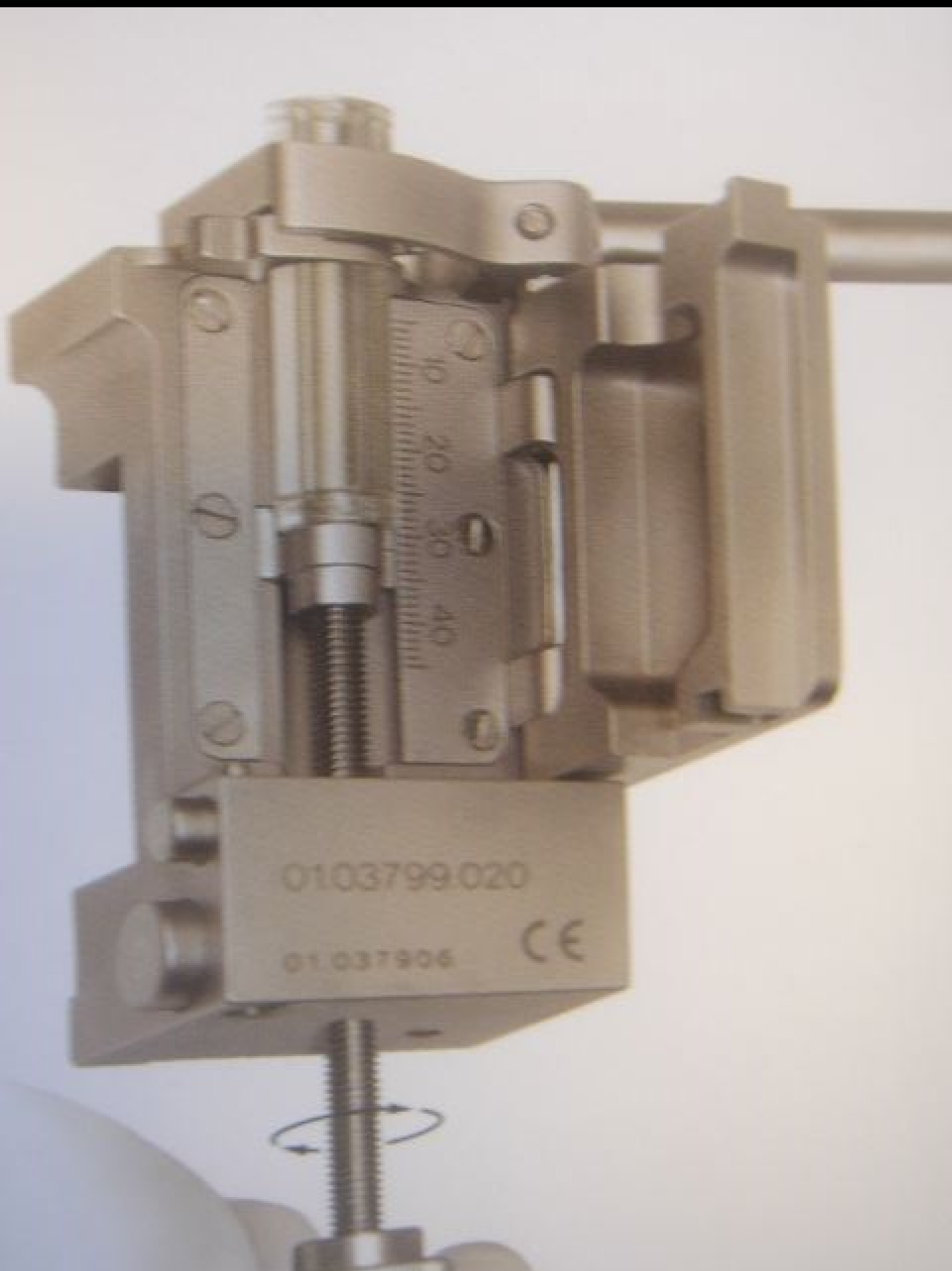








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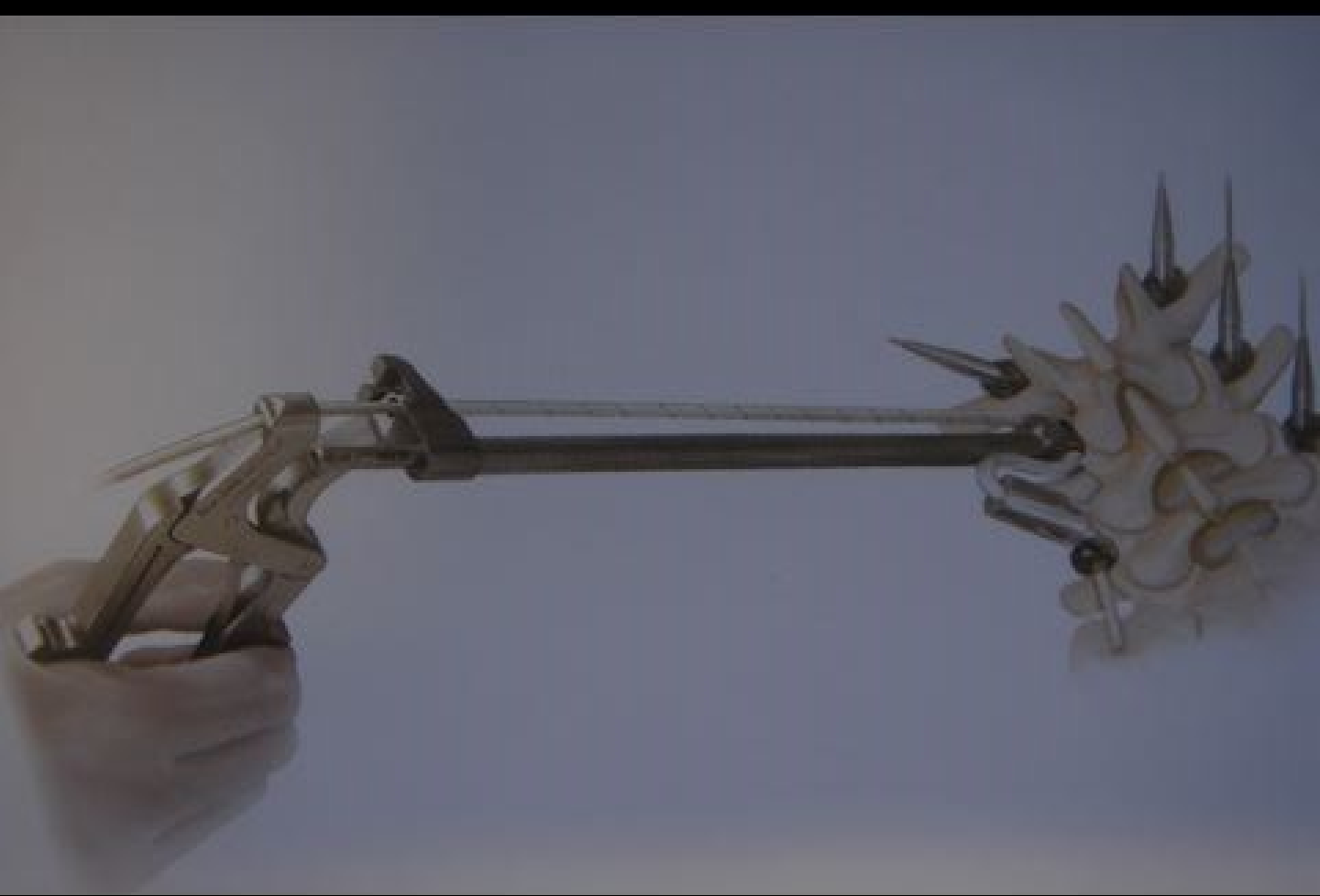
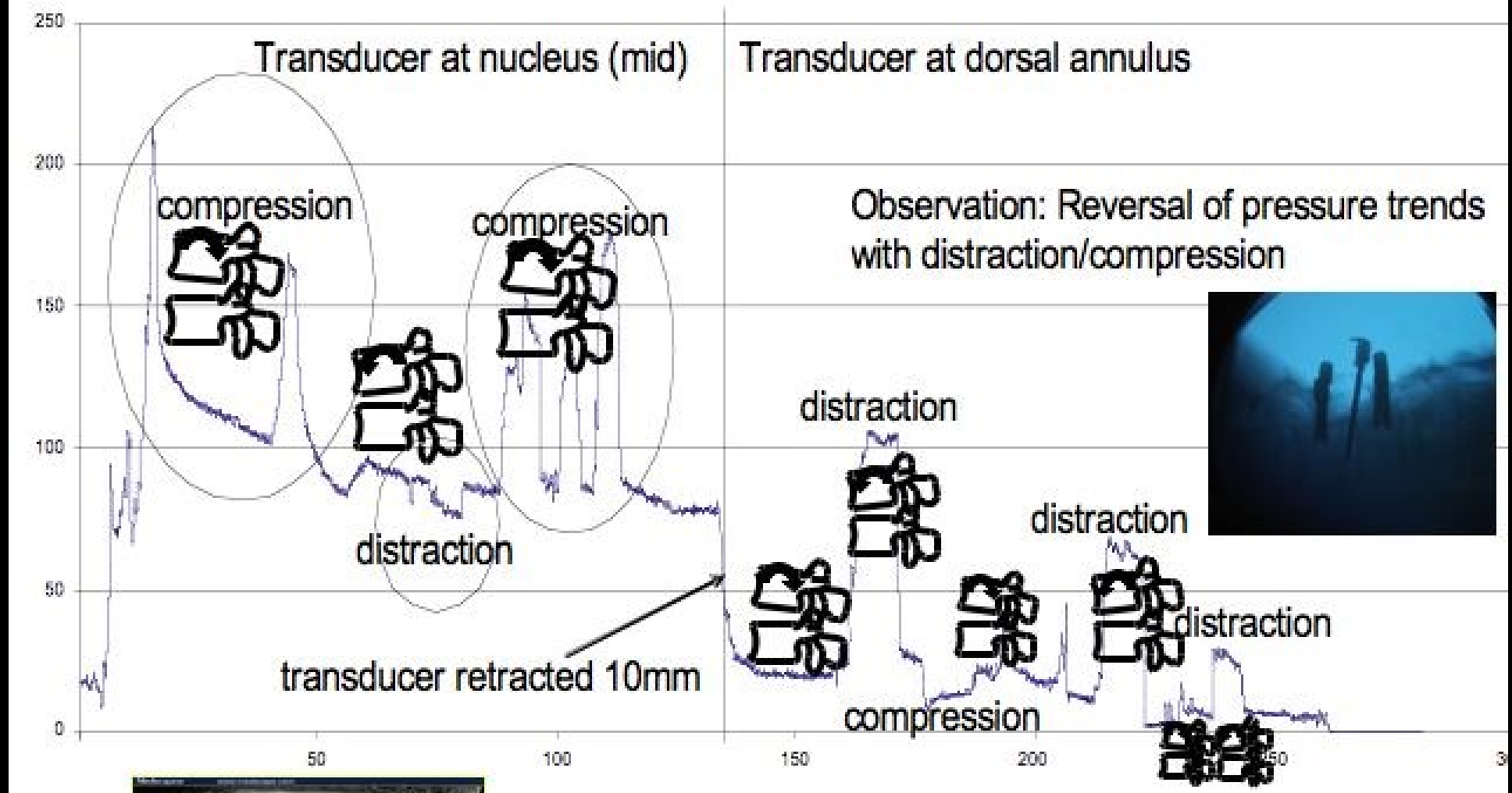
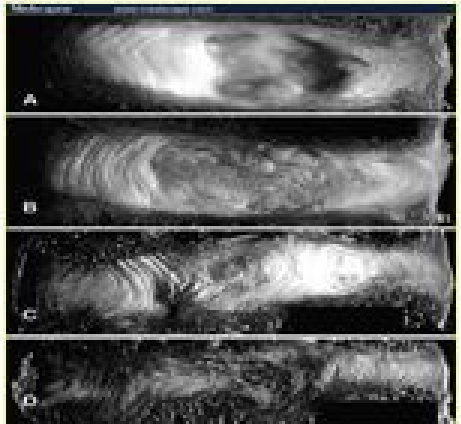
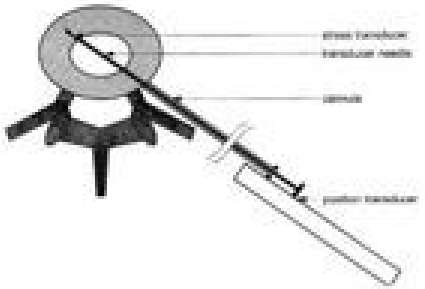
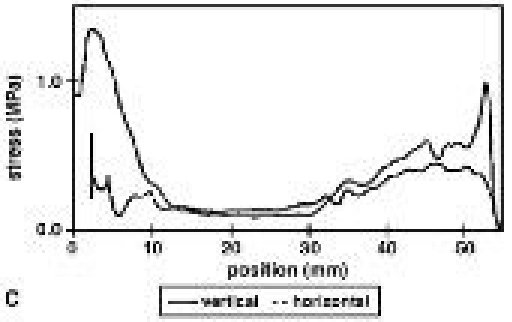
01.037906
CE




Transducer at nucleus (mid)
Transducer at dorsal annulus
compression
compression
distraction
transducer retracted 10mm
Observation: Reversal of pressure trends with distraction/compression
distraction
distraction
distraction
compression
250
200
150
100
50
0
50
100
150
200






stress (MPa)
1.0
0.0
0
10
20
30
40
50
position (mm)
vertical
horizontal

Clinical Experience With the Dynesys Semirigid Fixation System for the Lumbar Spine

Surgical and Patient-Oriented Outcome in 50 Cases After an Average of 2 Years

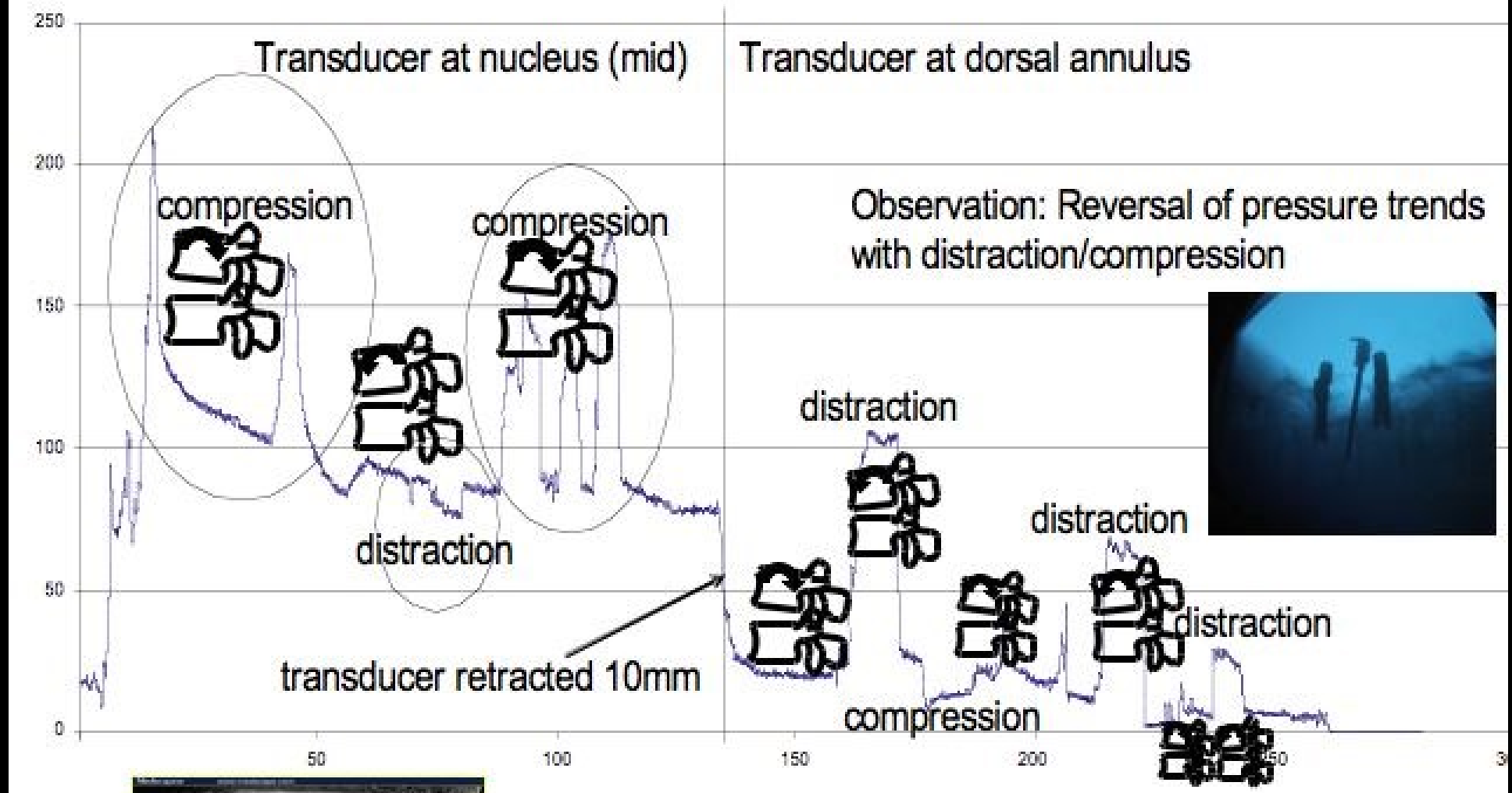
Dieter Grob, MD,* Arnoldo Benini, MD,* Astrid Junge, PhD,* and Anne F. Mannion, PhD*†

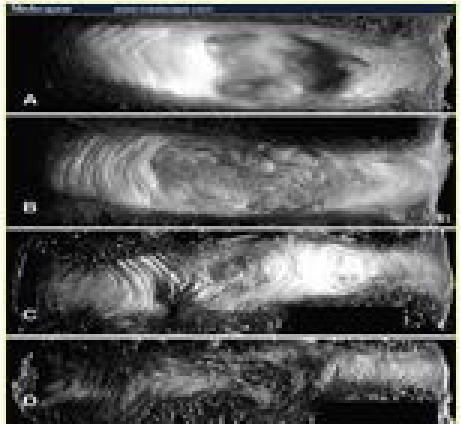
Conclusion. The results of the present study indicate that both back and leg pain are, on average, still moderately high 2 years after instrumentation with the Dynesys system. Only half of the patients declared that the operation had helped and had improved their overall quality

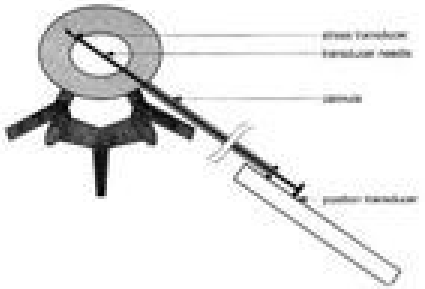
capacity. The reoperation rate after Dynesys was relatively high. The results provide no support for the notion that semirigid fixation of the lumbar spine results in better patient-oriented outcomes than those typical of fusion.

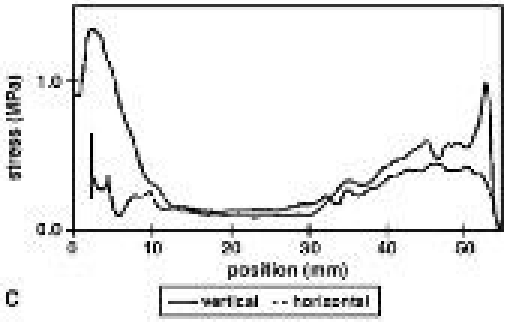
Key words: semirigid instrumention, Dynesys, fusion, patient-oriented outcome, degenerative disorders, back pain, leg pain. **Spine 2005;30:324–331**

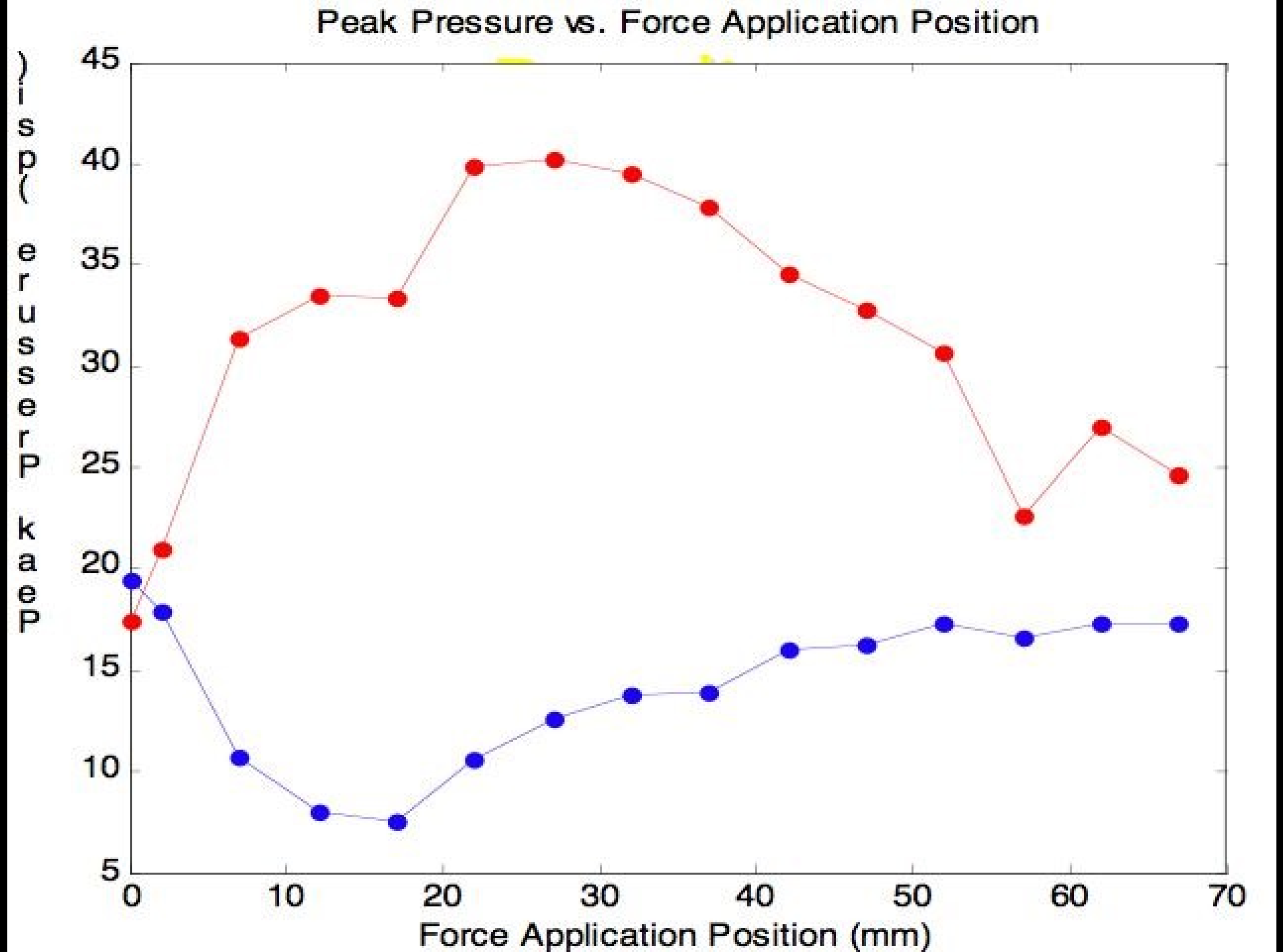
WHO?
and
HOW?


Transducer at nucleus (mid)
Transducer at dorsal annulus
compression
compression
distraction
transducer retracted 10mm
Observation: Reversal of pressure trends with distraction/compression
distraction
distraction
distraction
compression
250
200
150
100
50
0
50
100
150
200

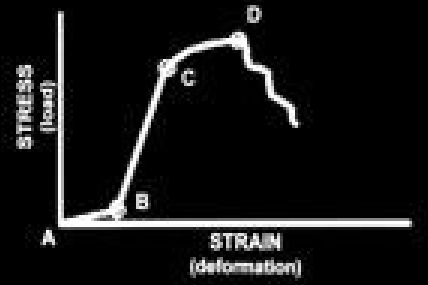





stress (MPa)
1.0
0.0
0
10
20
30
40
50
position (mm)
vertical
horizontal

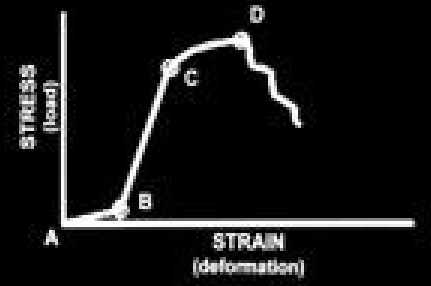

Peak Pressure vs. Force Application Position
)isp(erusserP kaeP
45
40
35
30
25
20
15
10
5
0
10
20
30
40
50
60
70
Force Application Position (mm)

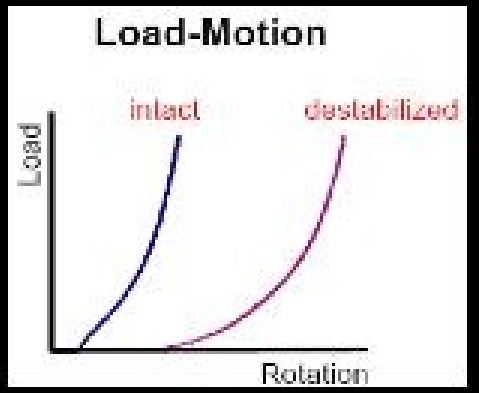
Fusion and TDA alter (improve?) Mechanics

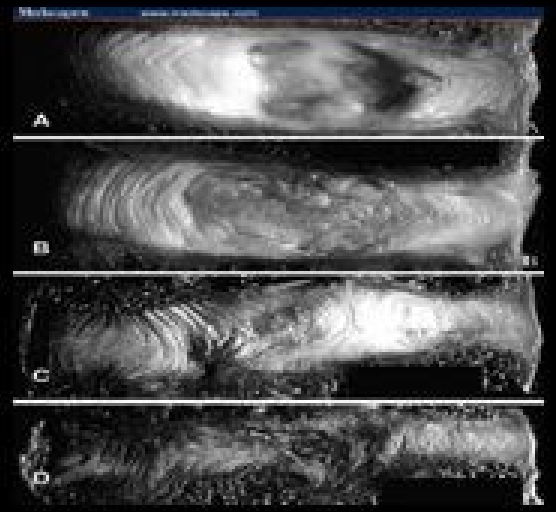


If Intrisic Mechanics not Altered,

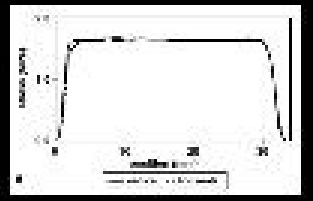
Does a Problem Exist?

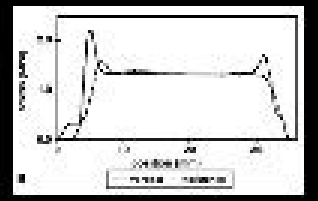


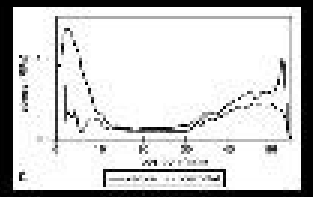


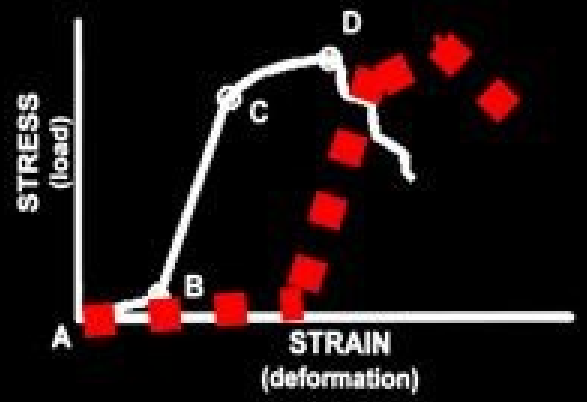


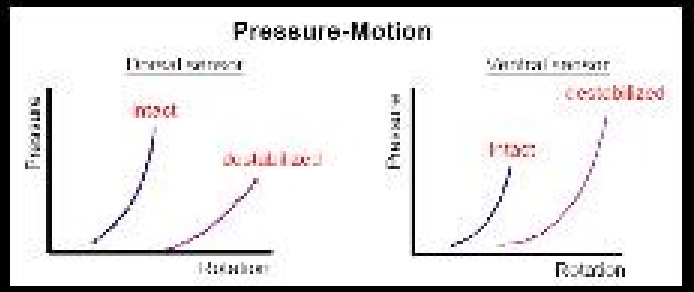
Discogenic Pain?







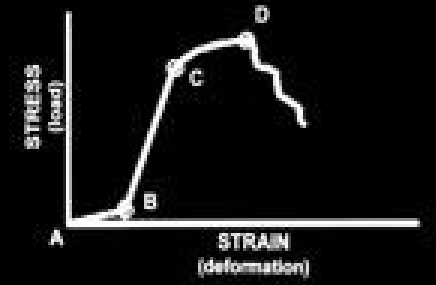




MECHANICAL PAIN

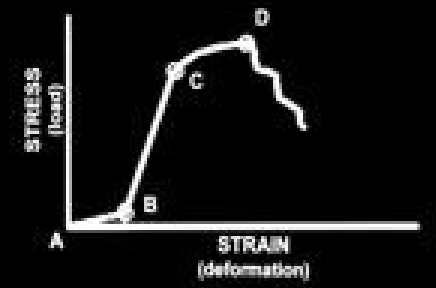
(not Discogenic Pain)

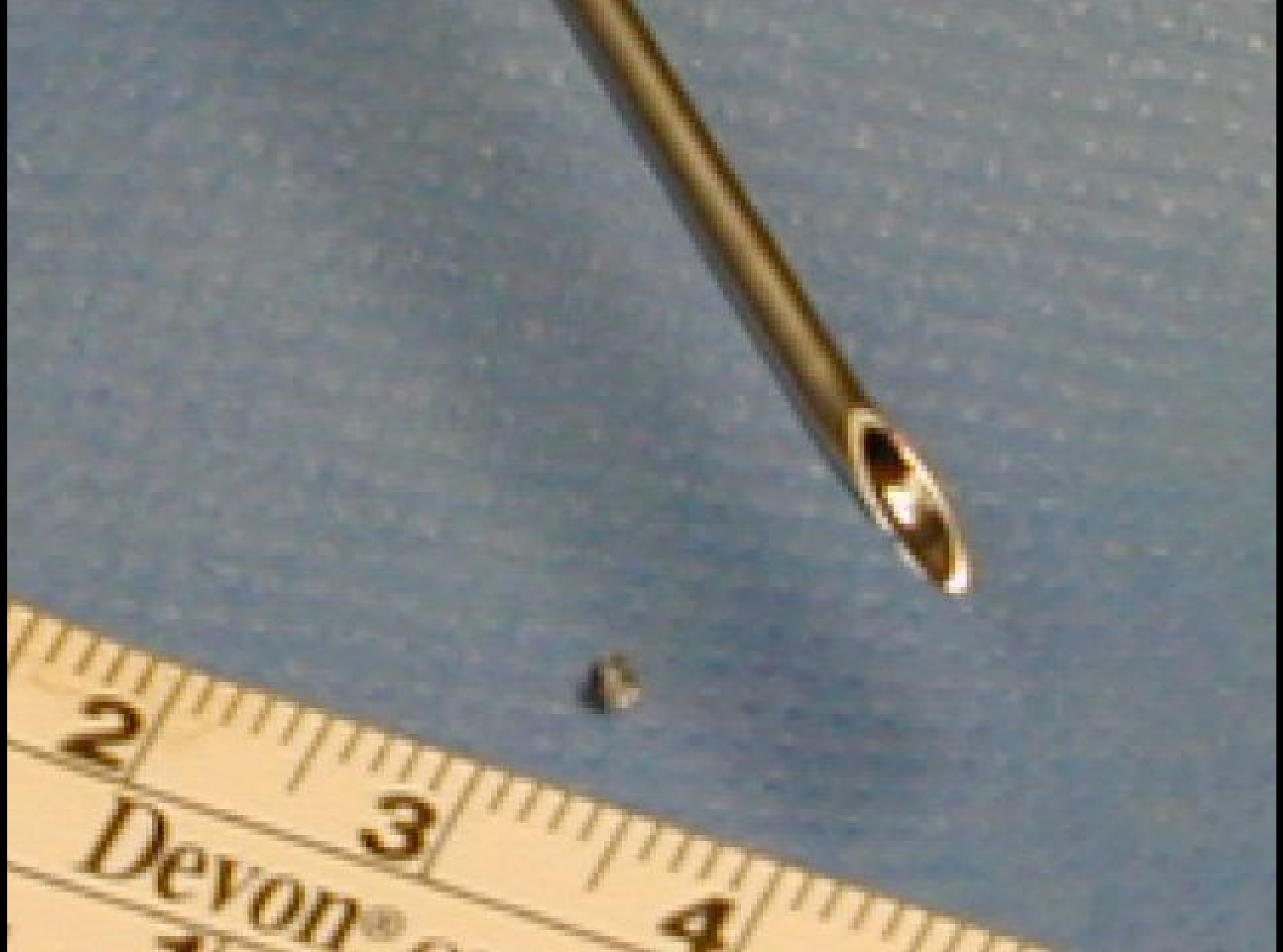
Deep and Agonizing
Worse with Loading
Improved by Unloading



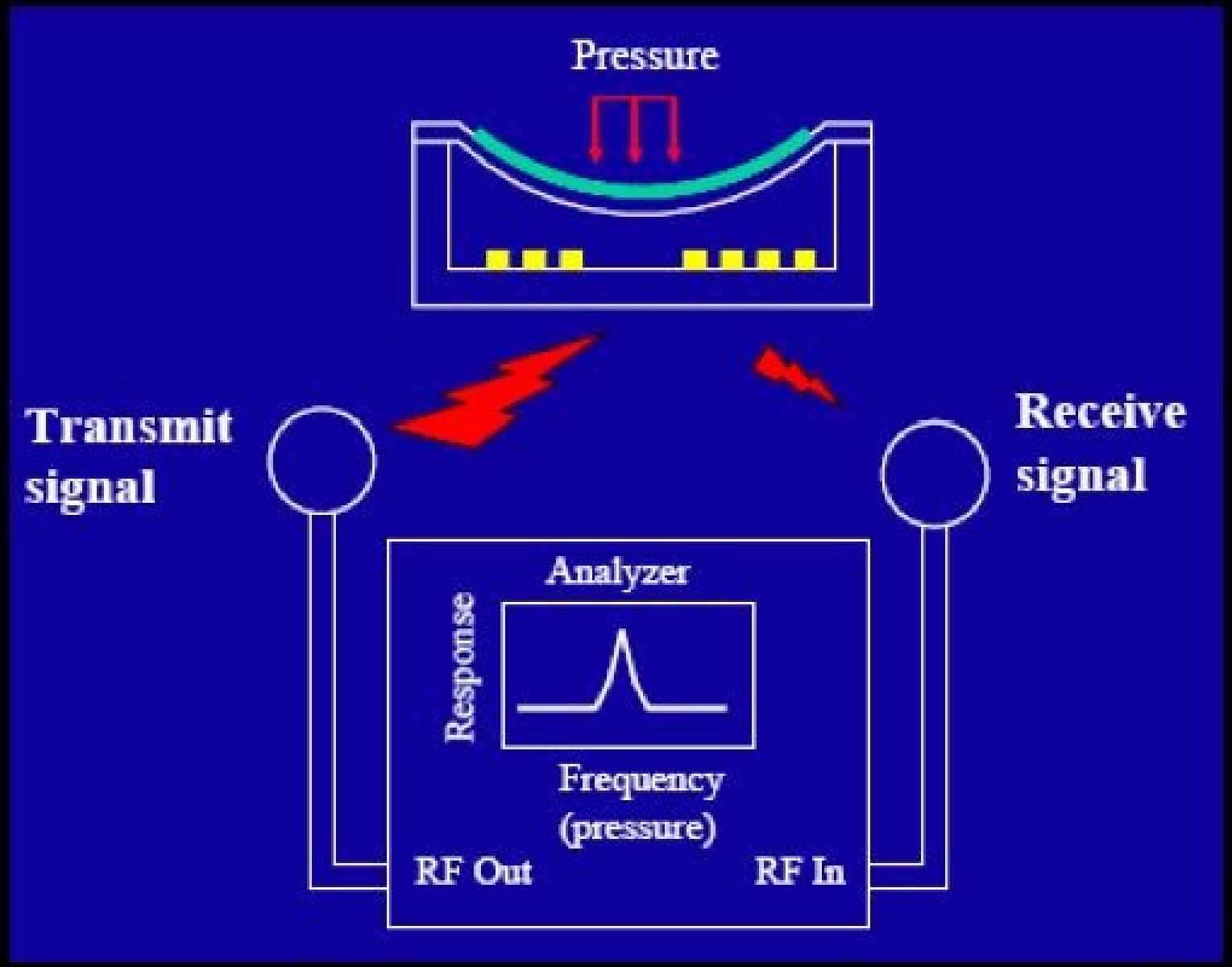
The Biomechanical Correlate of Mechanical Back Pain

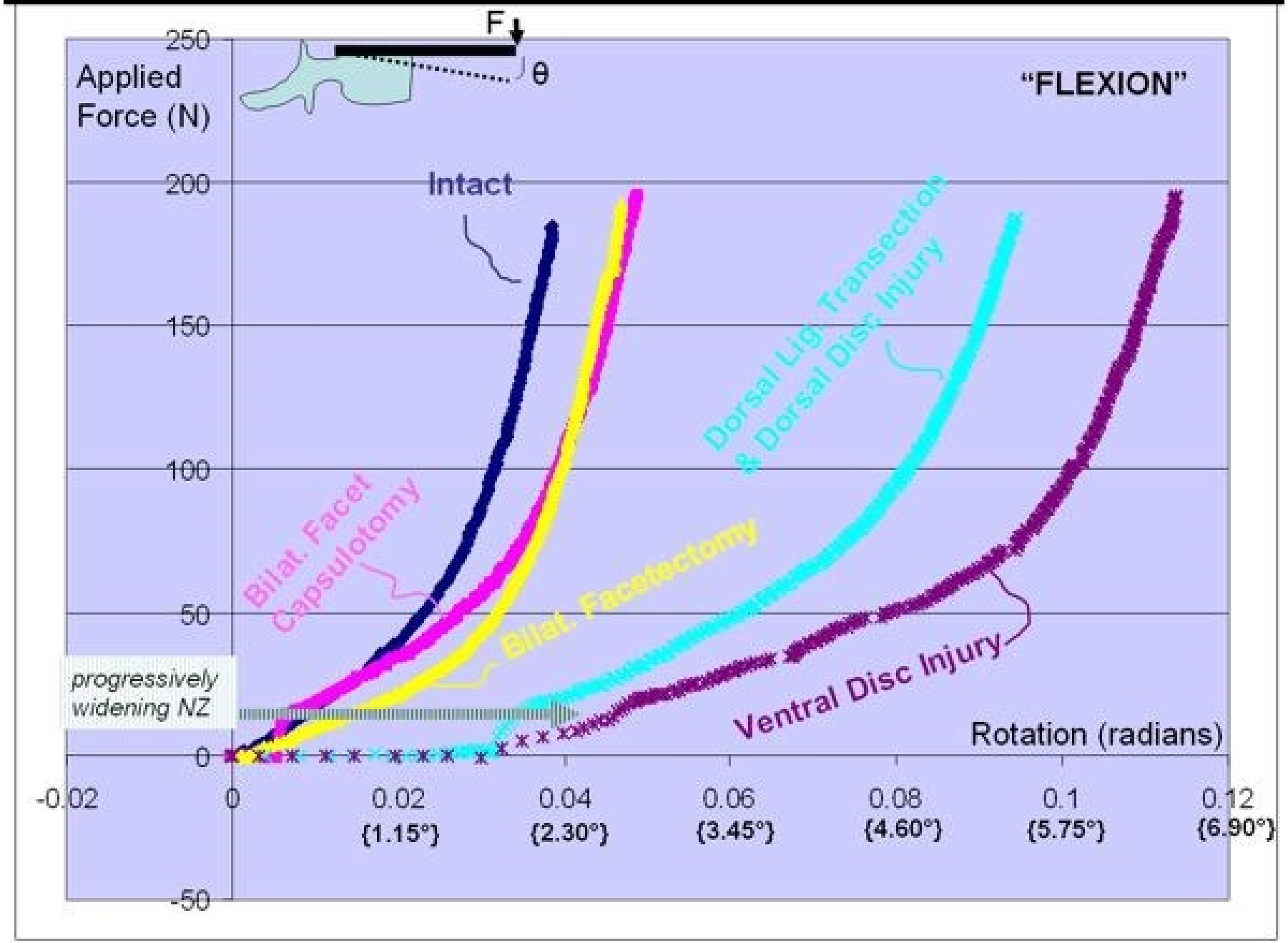
Widened Neutral Zone and Altered COR

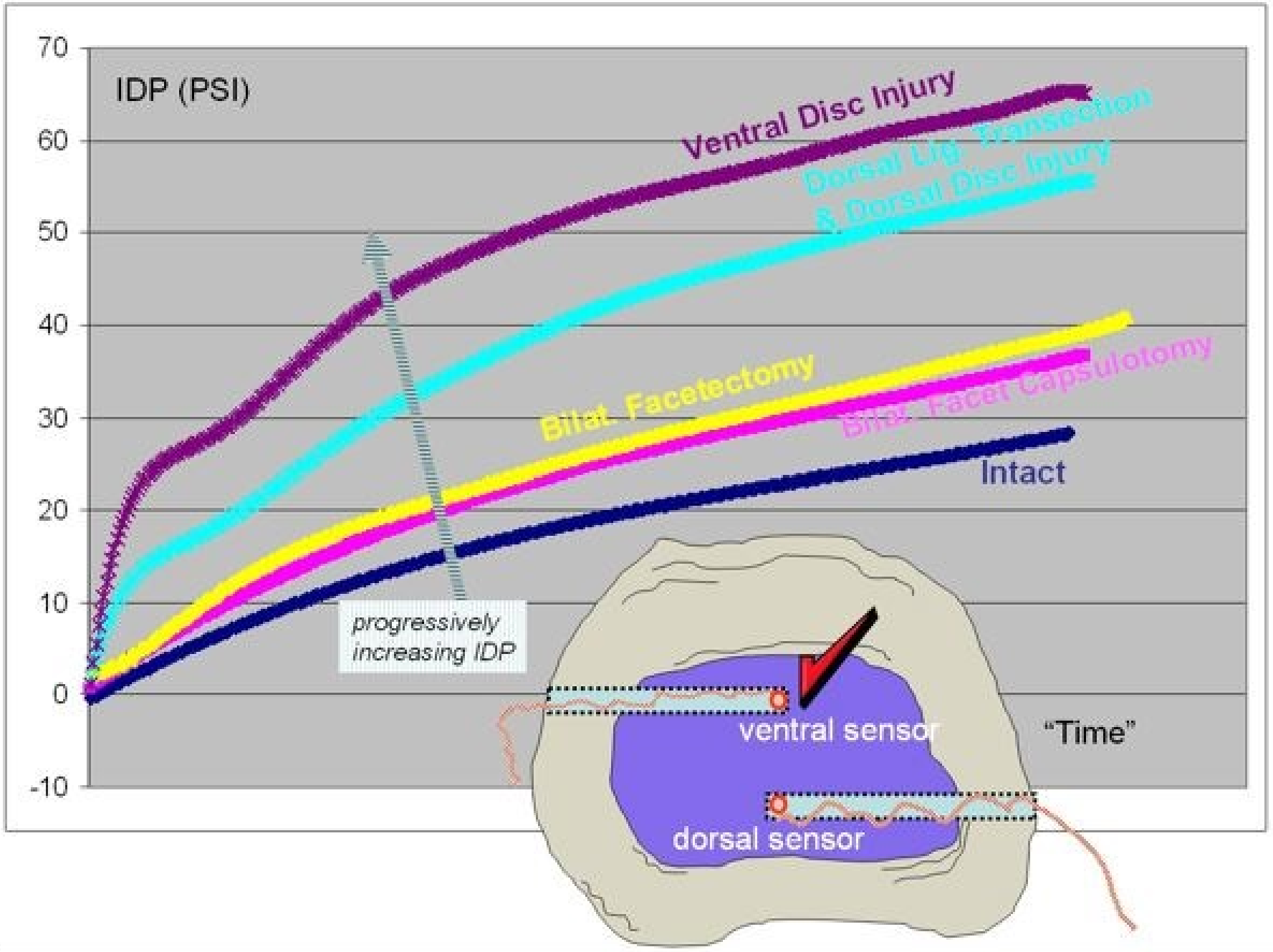



2
3
4
Devon

Wireless Telemetry Principle

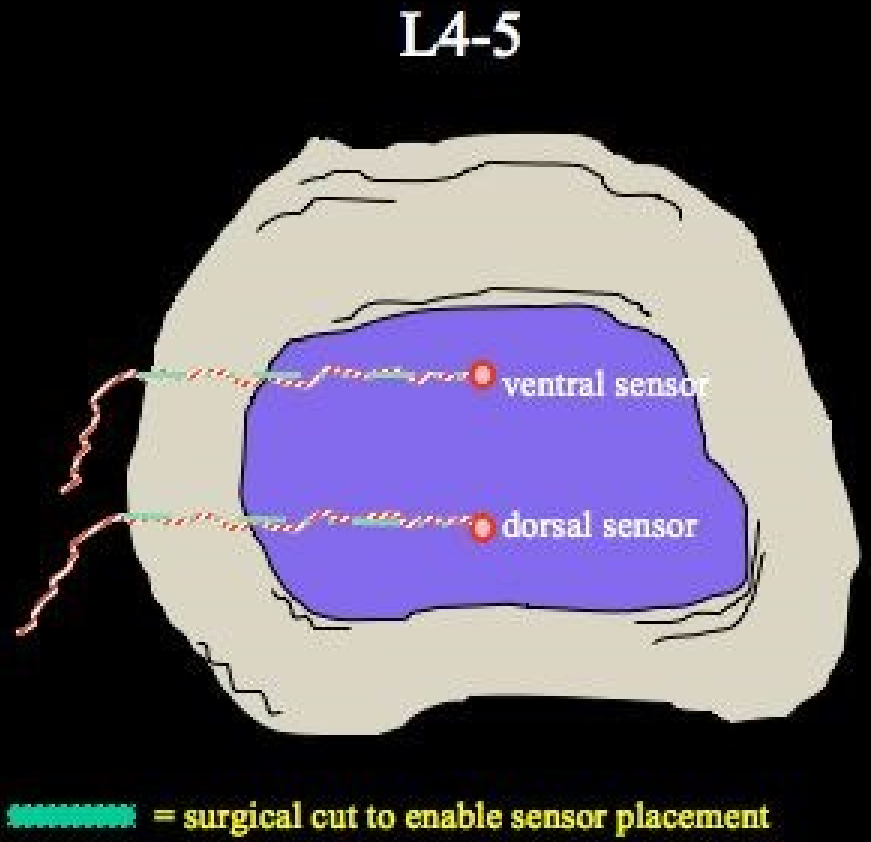


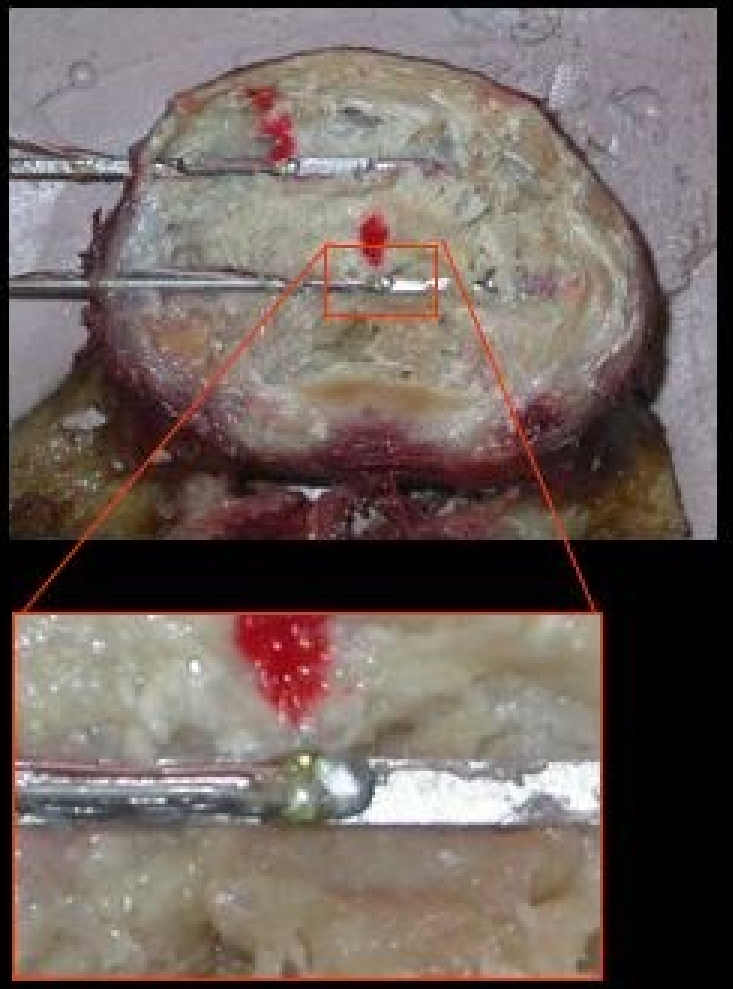

F
θ
250
200
150
100
50
0
-50
Applied Force (N)
"FLEXION"
Intact
Bilat. Facet Capsulotomy
Bilat. Facetectomy
Dorsal Lig. Transection & Dorsal Disc Injury
Ventral Disc Injury
progressively widening NZ
Rotation (radians)
-0.02
0
0.02 {1.15°}
0.04 {2.30°}
0.06 {3.45°}
0.08 {4.60°}
0.1 {5.75°}
0.12 {6.90°}


70
60
50
40
30
20
10
0
-10
IDP (PSI)
Ventral Disc Injury
Dorsal Lig. Transection & Dorsal Disc Injury
Bilat. Facetectomy
Bilat. Facet Capsulotomy
Intact
progressively increasing IDP
ventral sensor
dorsal sensor
"Time"

IDP Detection of Neutral Zone

(Cleveland Clinic - *In Vitro* Study at using Wired Sensors)

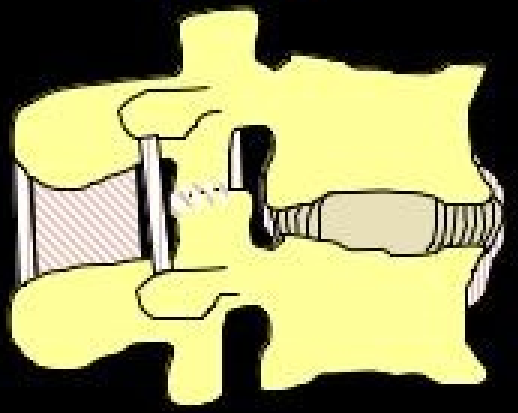




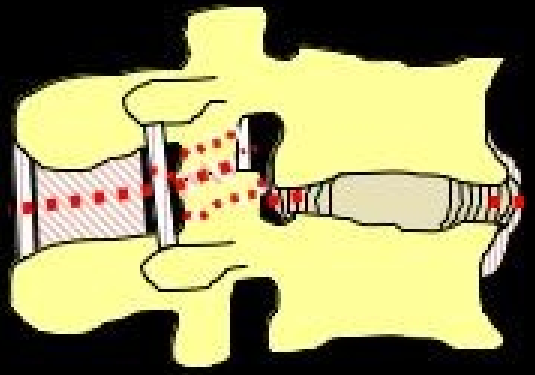
IDP Detection of Neutral Zone

(*In Vitro* Study – Instability Model)

"INTACT"



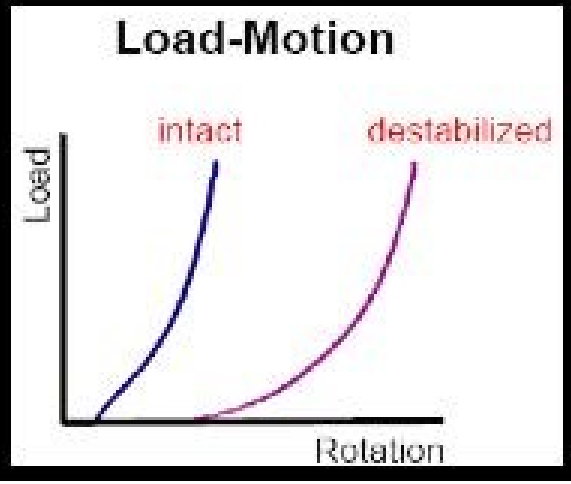
"DESTABILIZED"

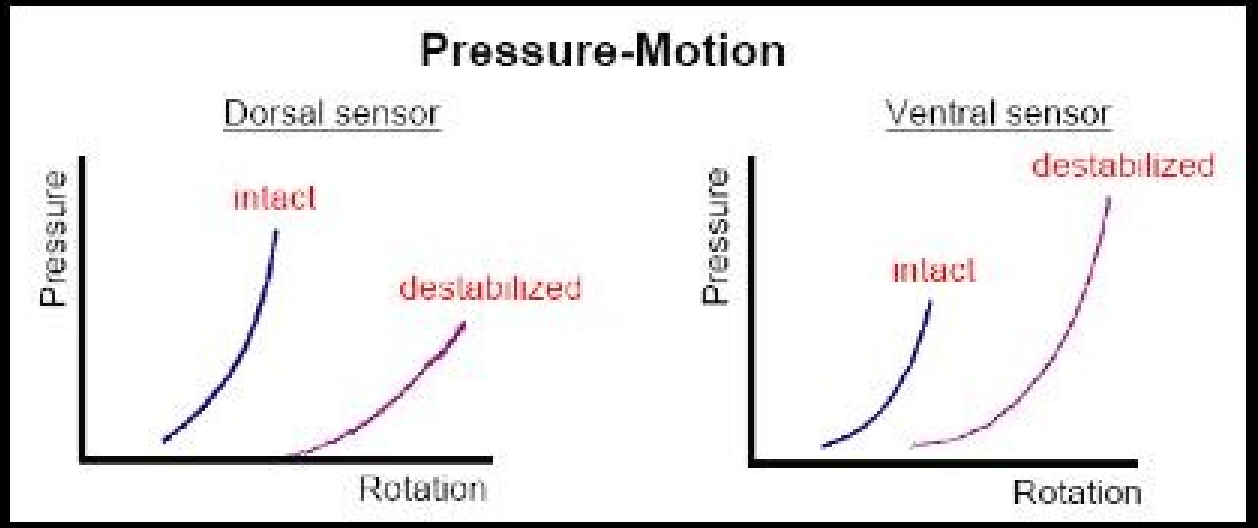


- Destabilized cases
  - Facet capsule
  - Bilateral facetectomy
  - Posterior ligament destabilization
  - Ventral disc destabilization
  - Dorsal disc destabilization
- Same loads for each injury
  - Cantilever Loading

IDP Detection of Neutral Zone

(Early Results – Flexion example)



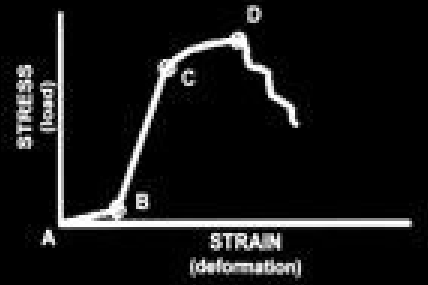


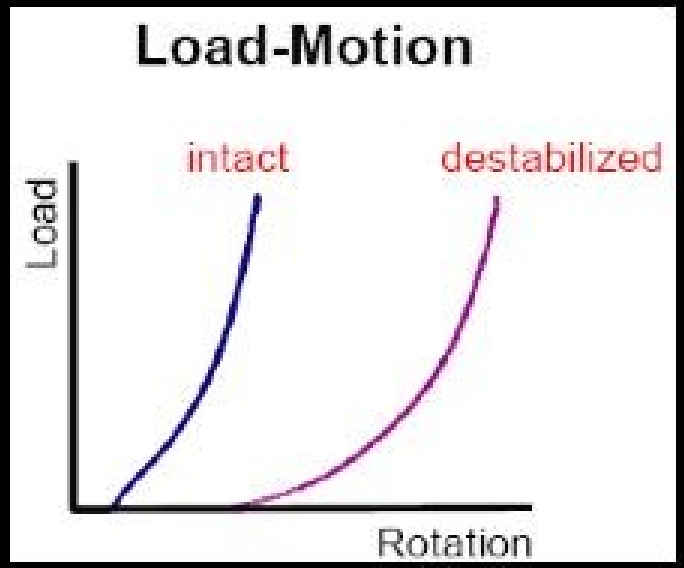
Binary

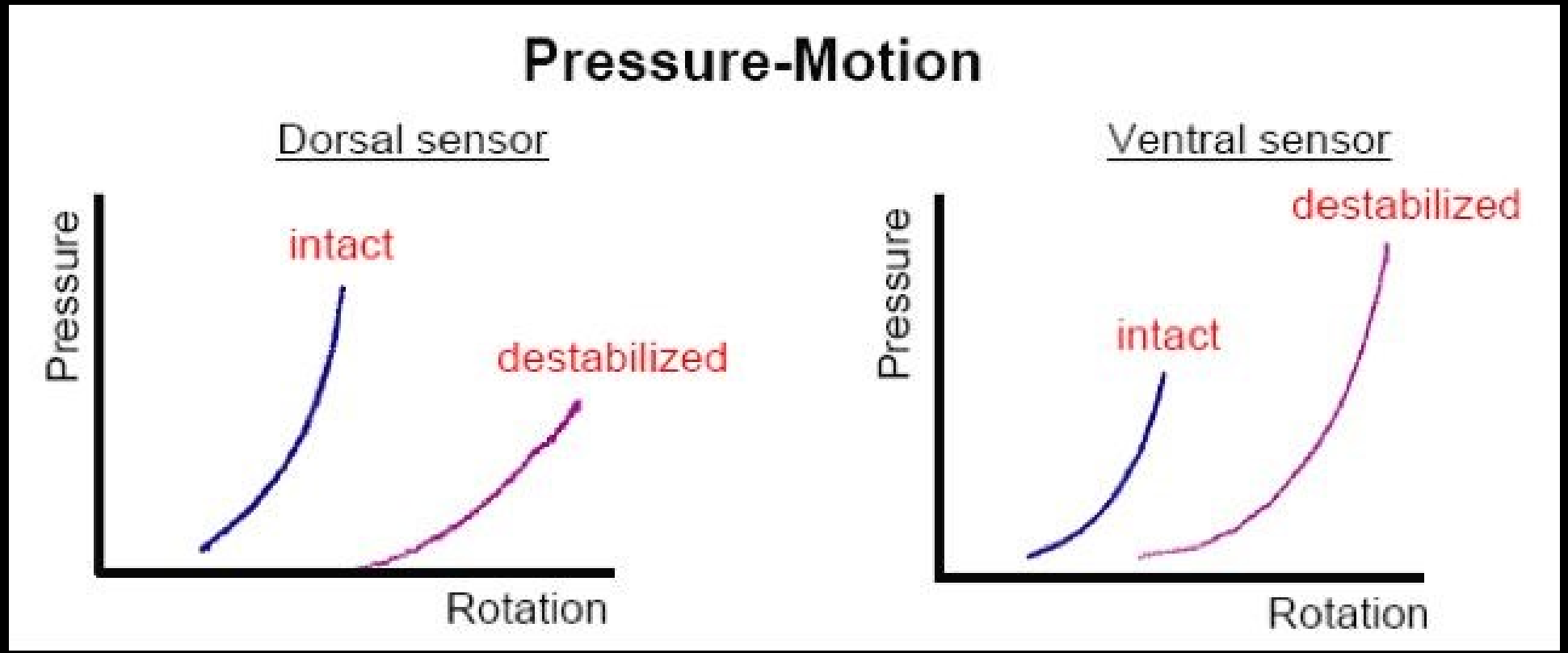
Normal Neutral Zone
(no Fusion or TDA)

versus

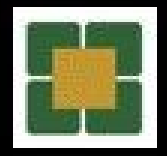
Widened Neutral Zone
(possible Fusion or TDA)

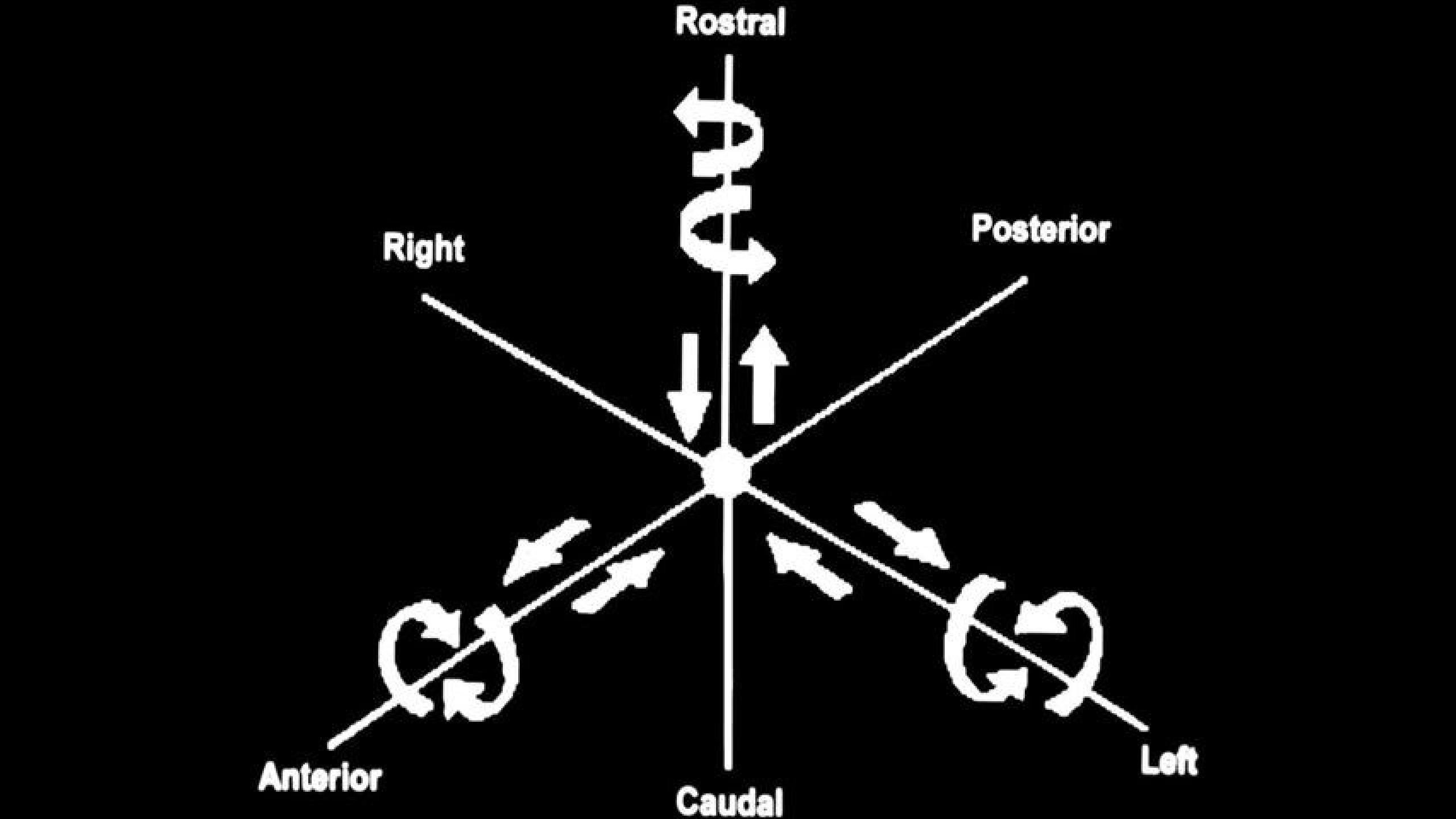



Load-Motion
intact
destabilized
Load
Rotation

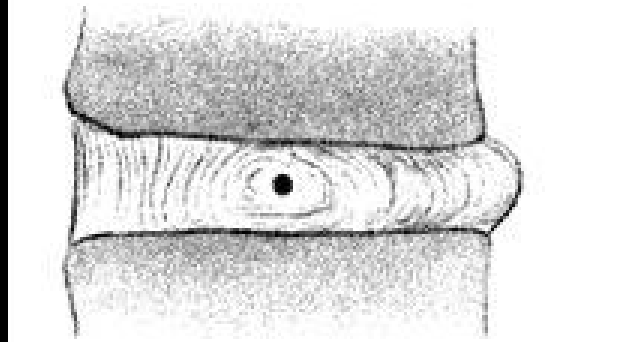

Pressure-Motion
Dorsal sensor
intact
destabilized
Pressure
Rotation
Ventral sensor
destabilized
intact
Pressure
Rotation

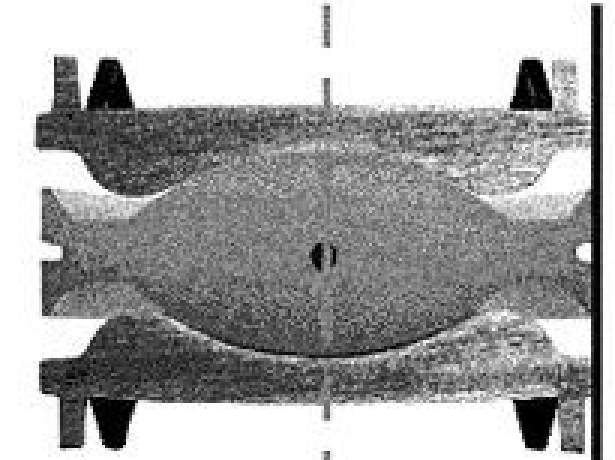
IAR

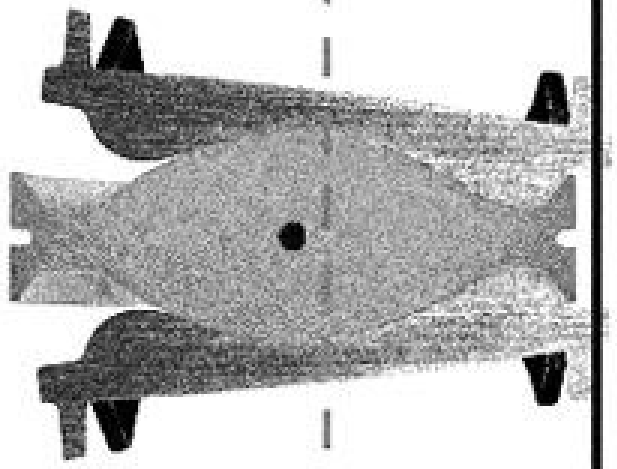



Rostral
Right
Posterior
Anterior
Left
Caudal

1.







Appropriate Loading

Bone
Supporting Soft Tissues

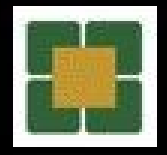
MINIMAL COMPLICATIONS

Short Term

Vascular
Neurological
Expulsion

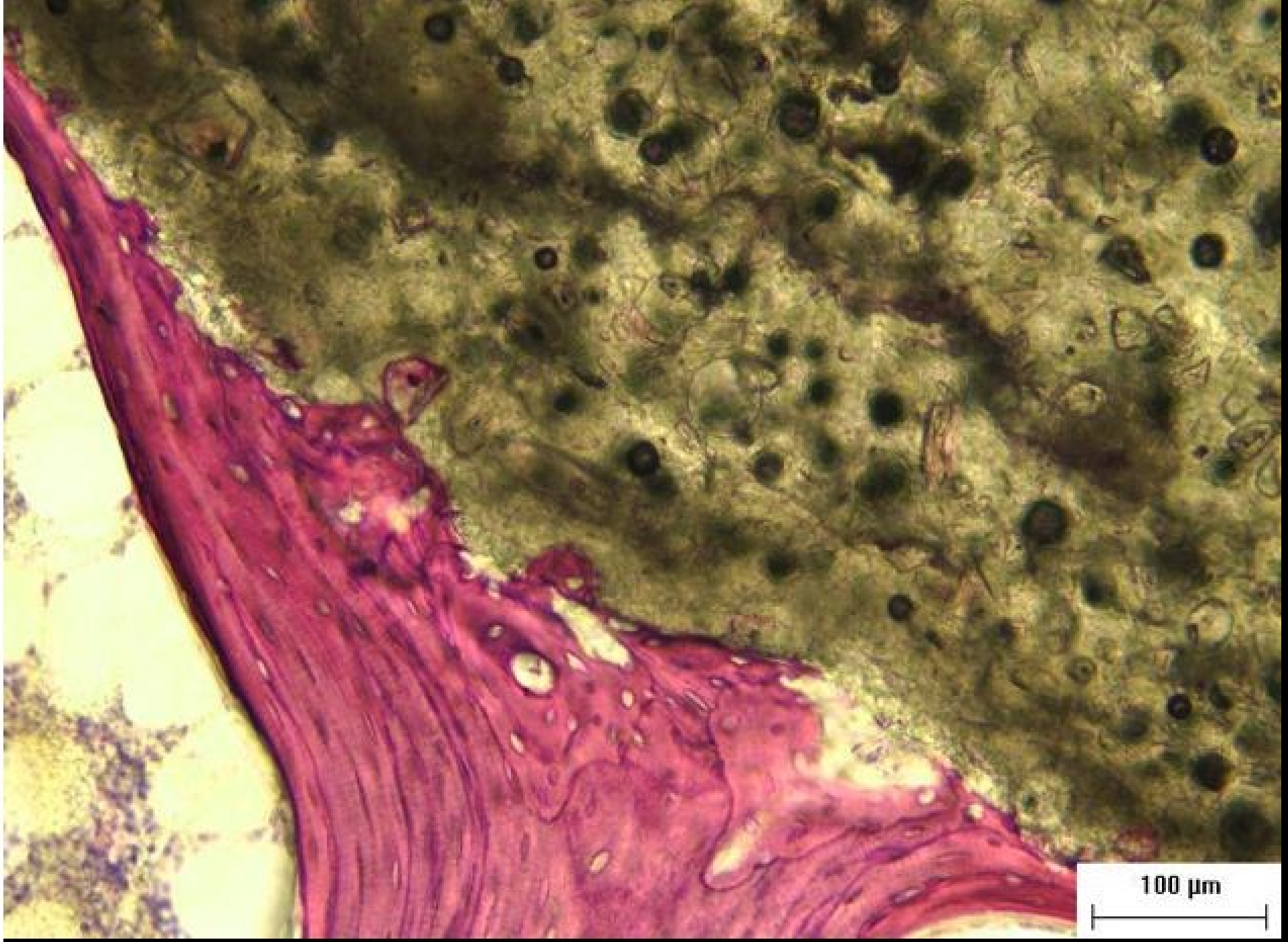
Long Term

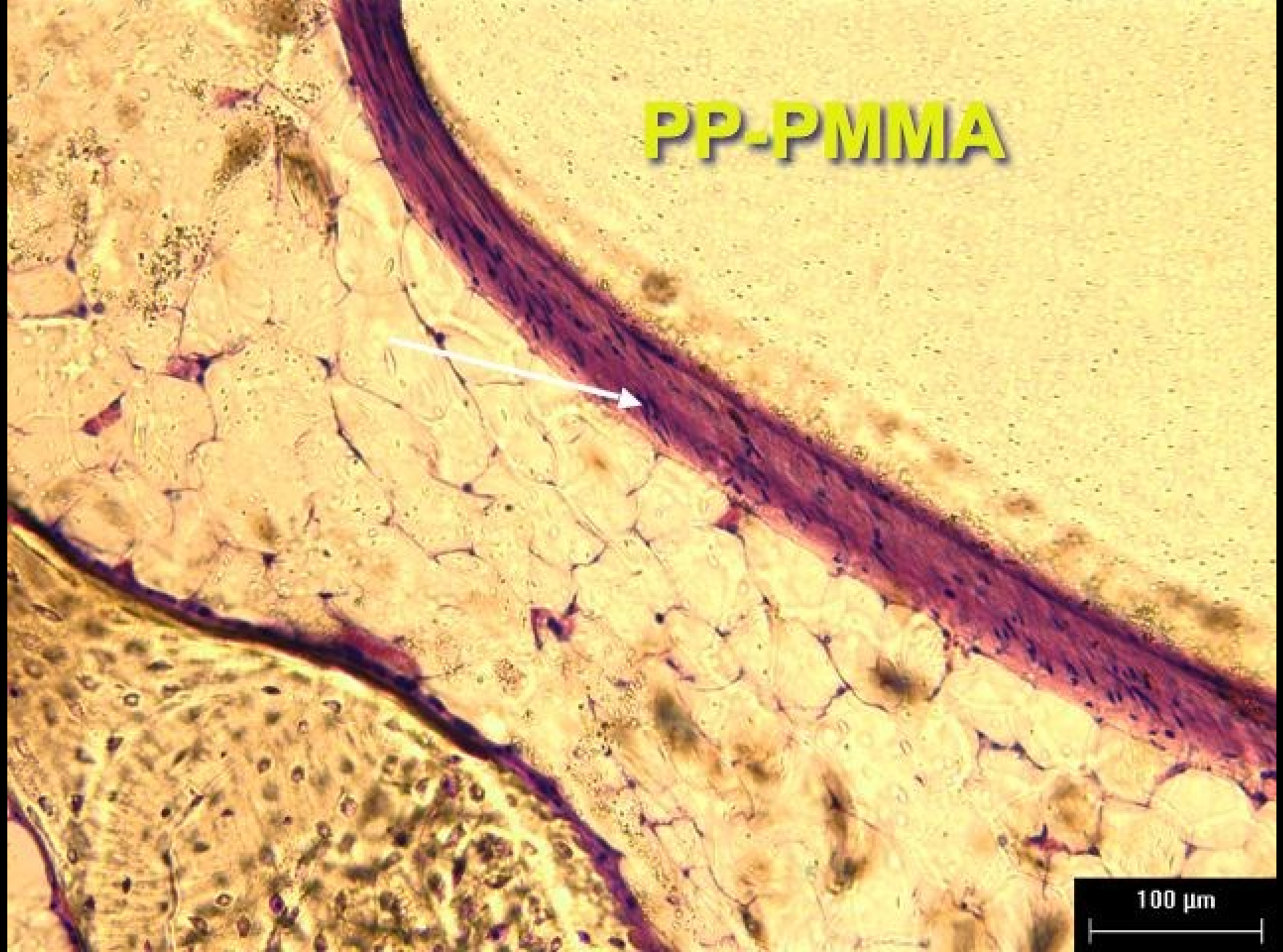
Expulsion
Subsidence
Failure of Ingrowth
Osteophyte Formation

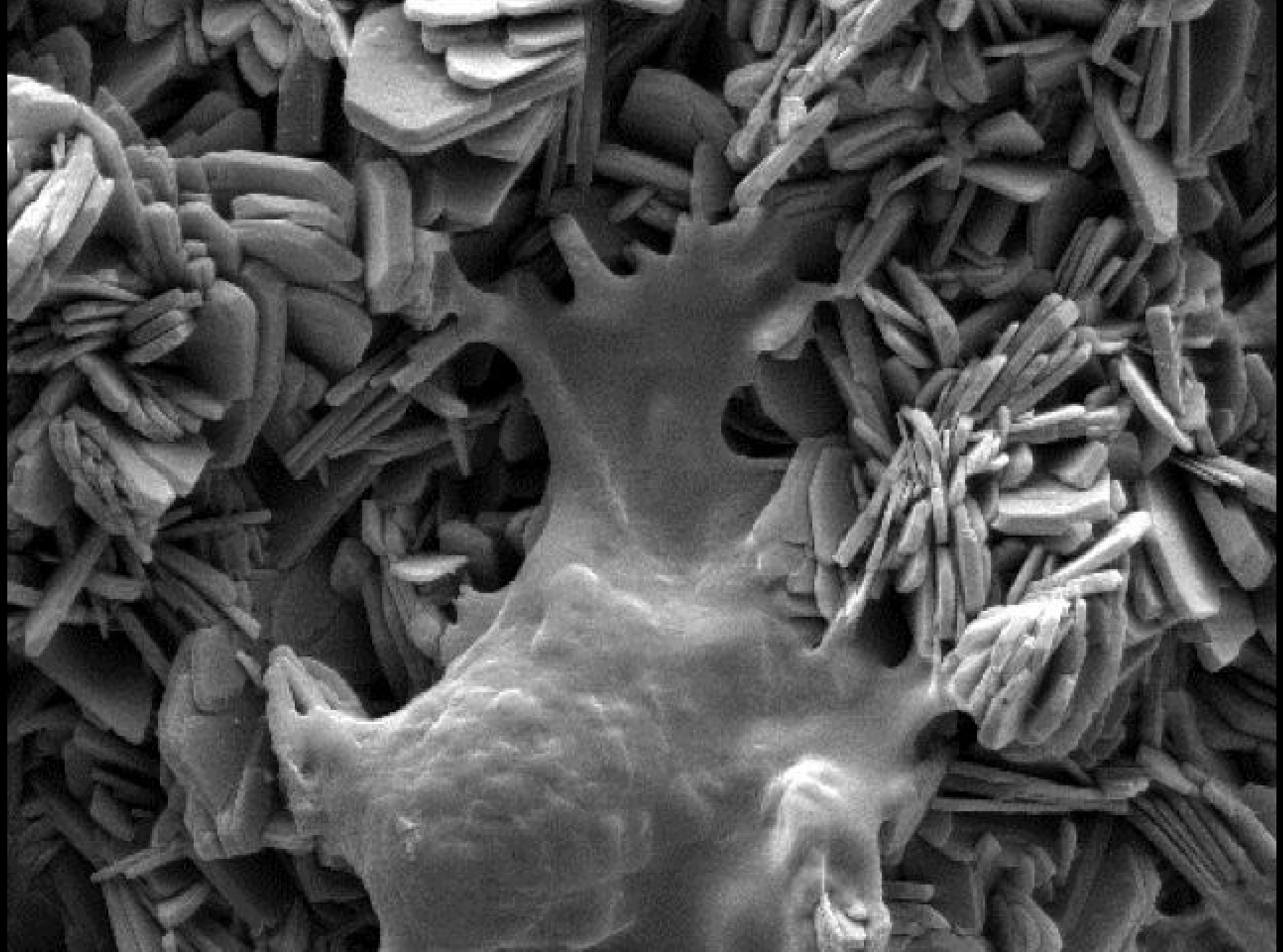


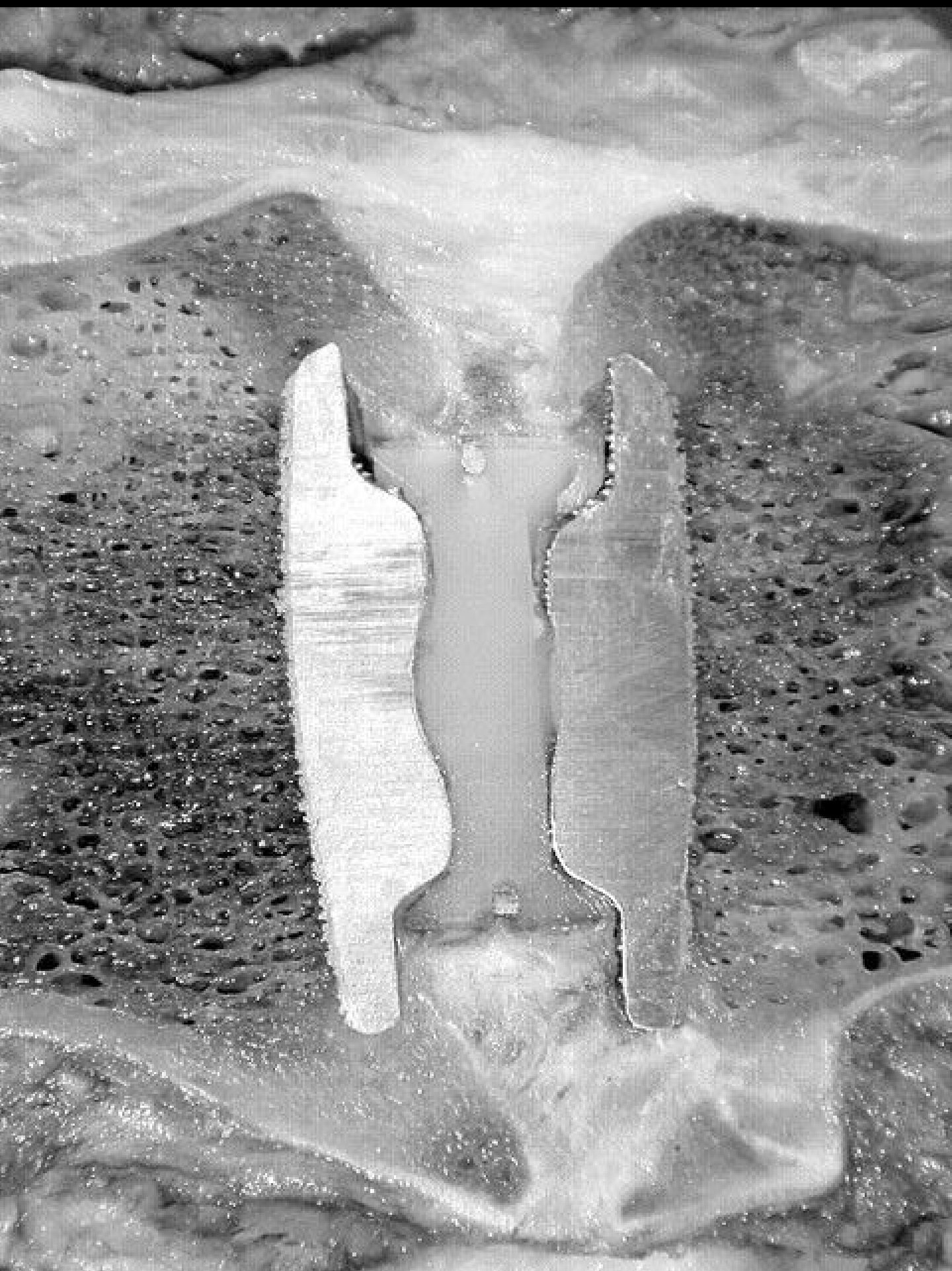
Osteointegration

Bony Ingrowth


100 µm


PP-PMMA
100 µm





Large vs Small Pore Size

Short - Long Term Fixation

Short Term Fixation

Intermediate Term Fixation

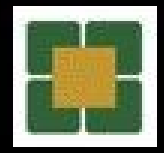
Long Term Fixation

ACCEPTABLE REVISION STRATEGIES

Dorsal Fusion and Instrumentation Removal?

LONGEVITY

?



RETARDATION OF DEGENERATIVE CHANGES

?

Degeneration

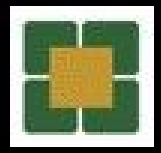
Rostral

Caudal

Facets

Osteophytes

Stressed Ligaments and Tendons



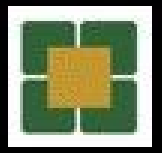
SYMPTOM RELIEF

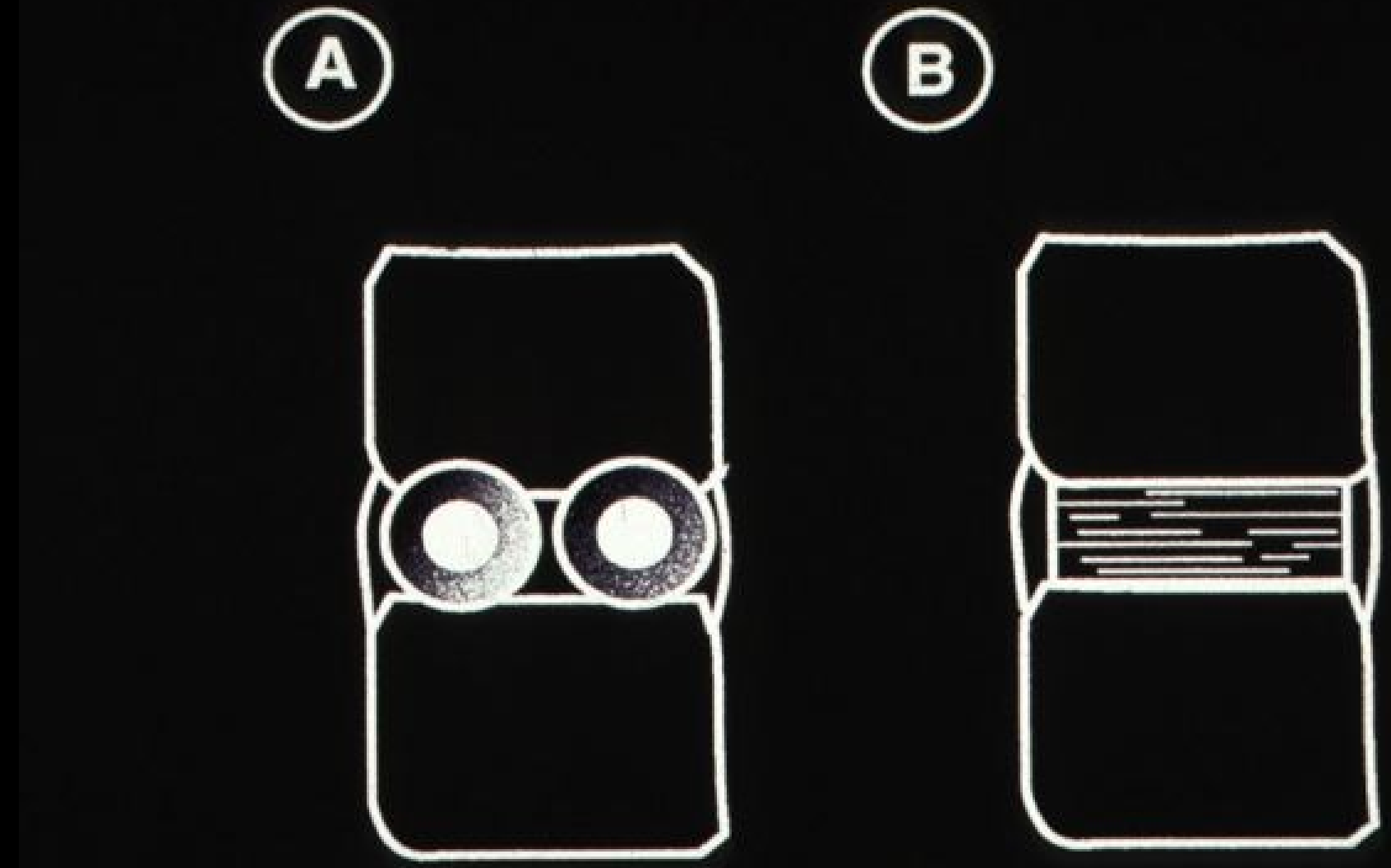
Anecdotal Information
Non-Inferiority ~ Inferior Device
Bias

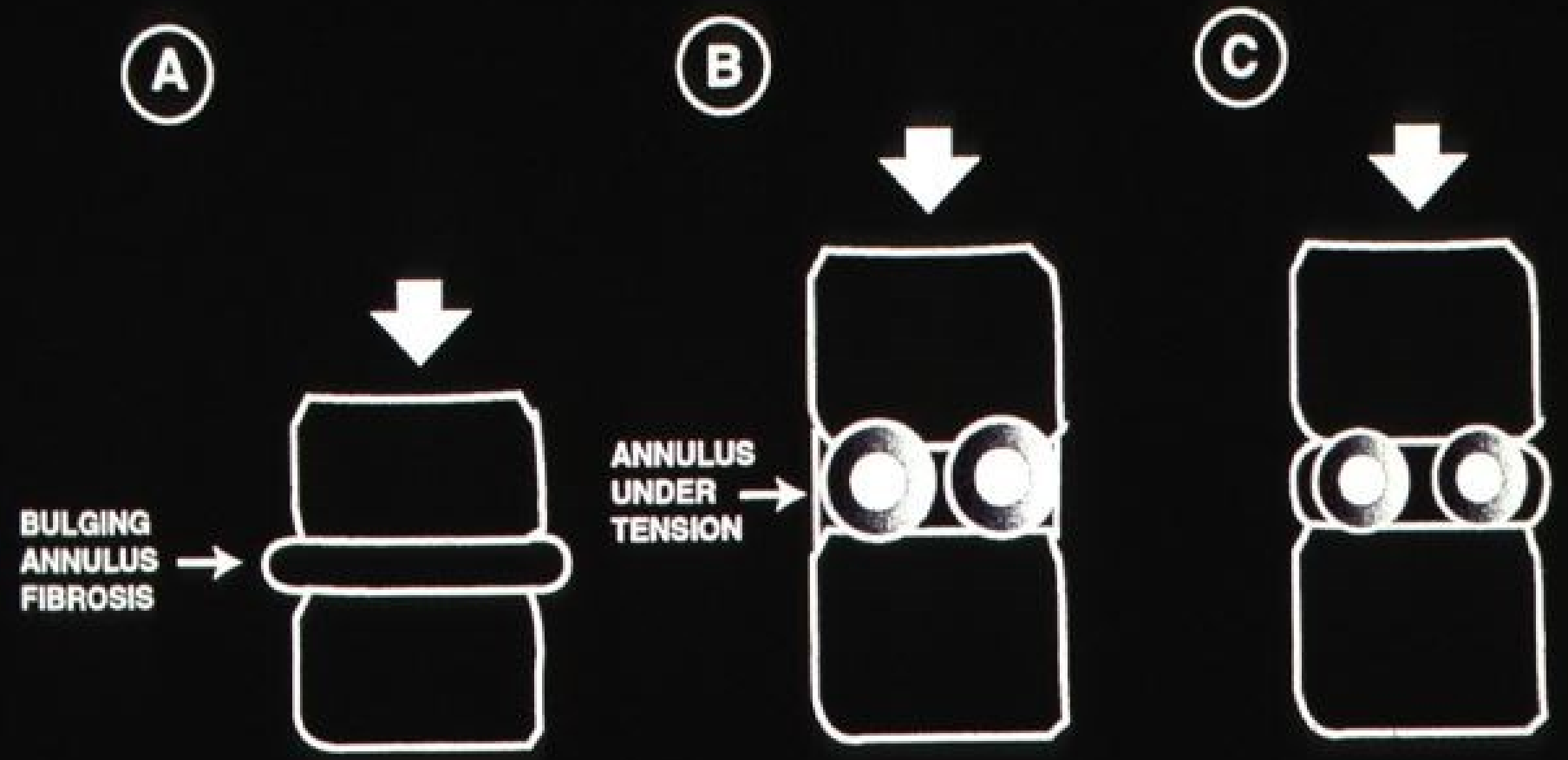
SYMPTOM RELIEF

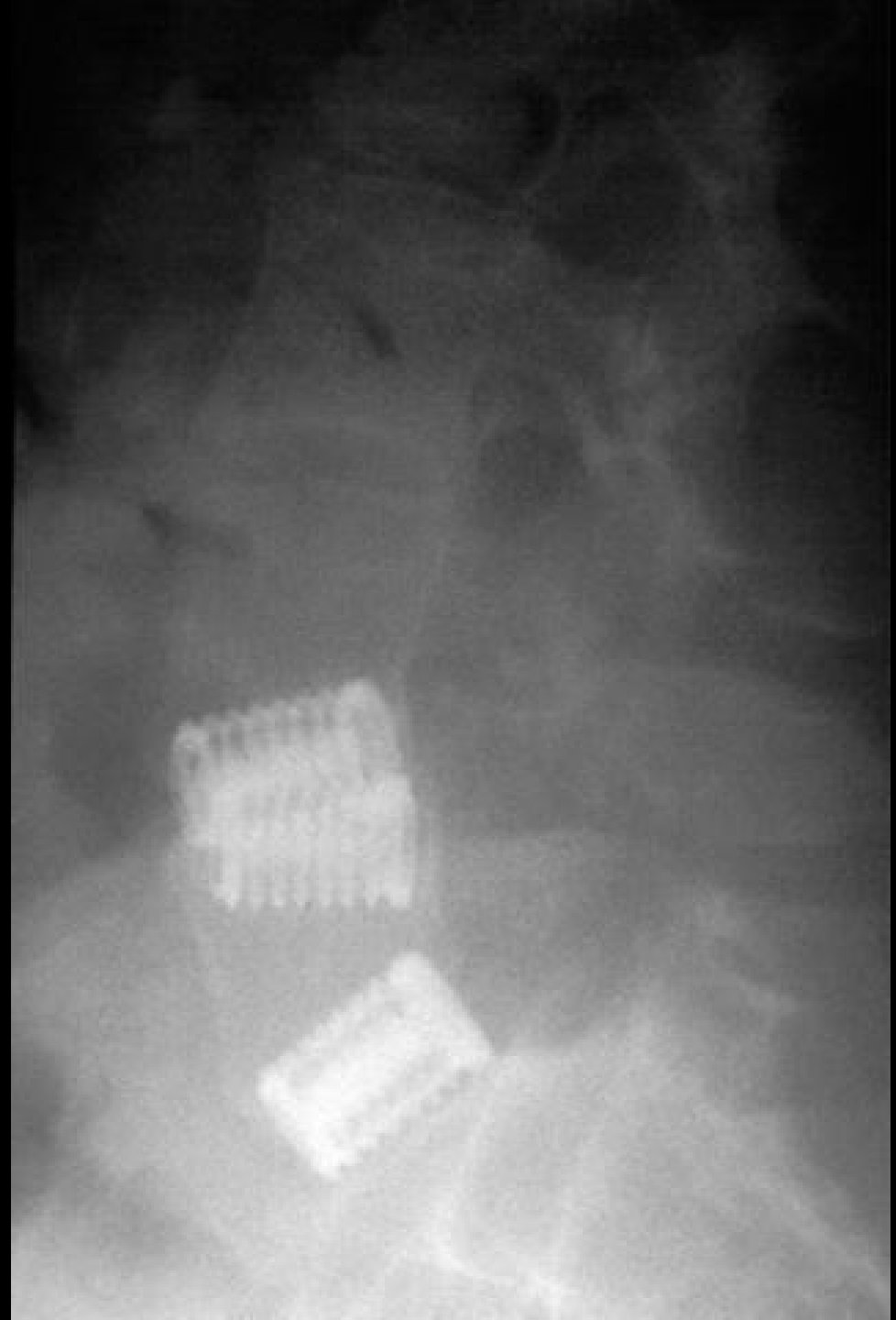
Anecdotal Information
Non-Inferiority ~ Inferior Device
Bias

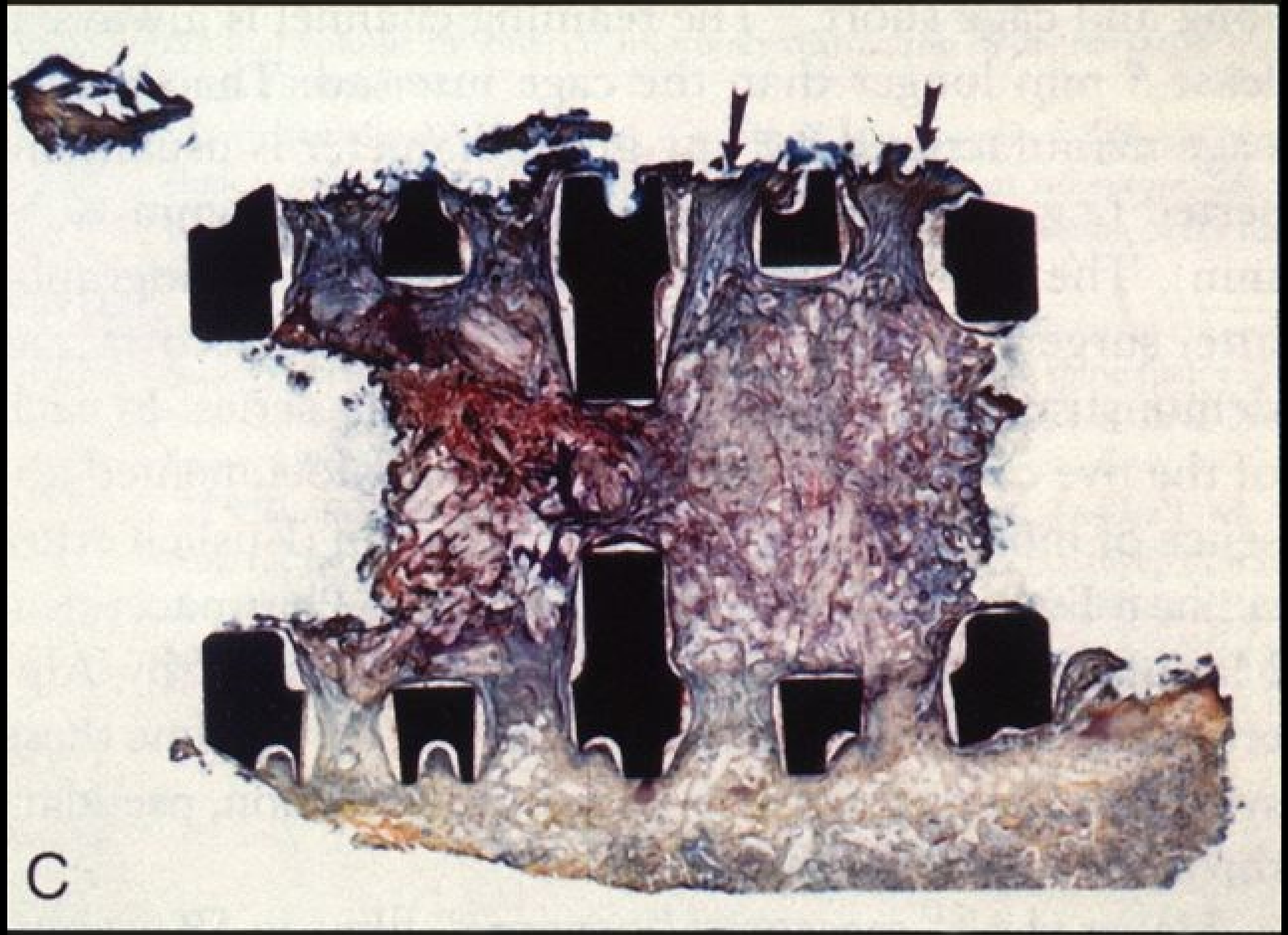
Investigator Bias
Patient Selection Bias
Winner-Loser Bias



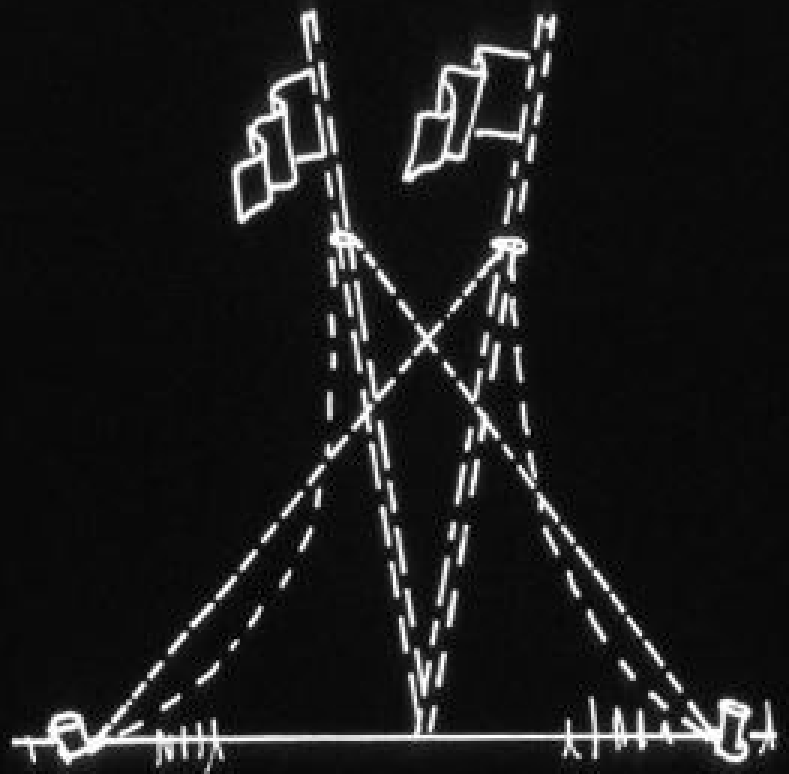

A
B

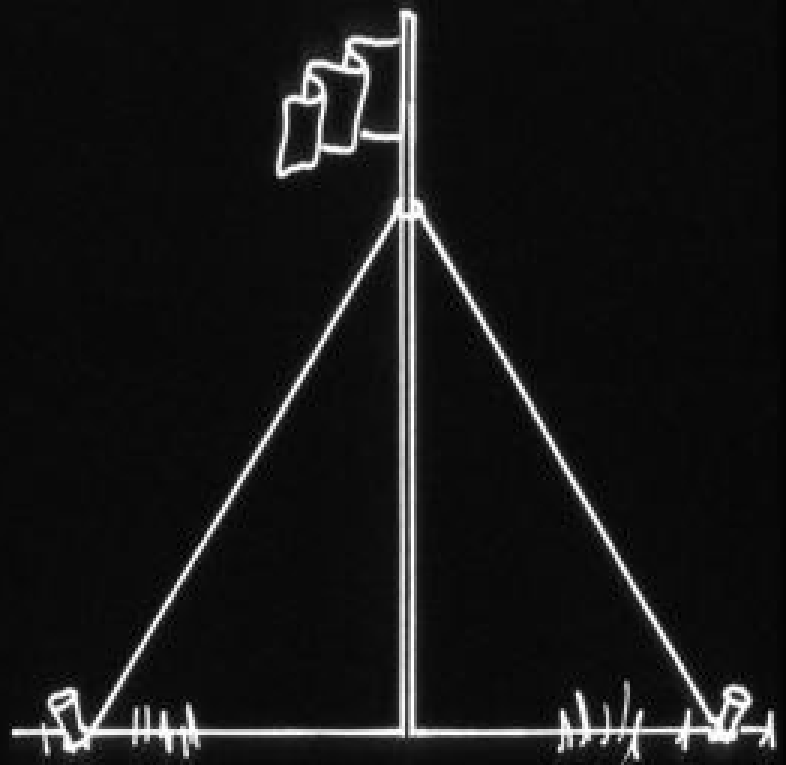

A
B
C
BULGING
ANNULUS
FIBROSIS
ANNULUS
UNDER
TENSION



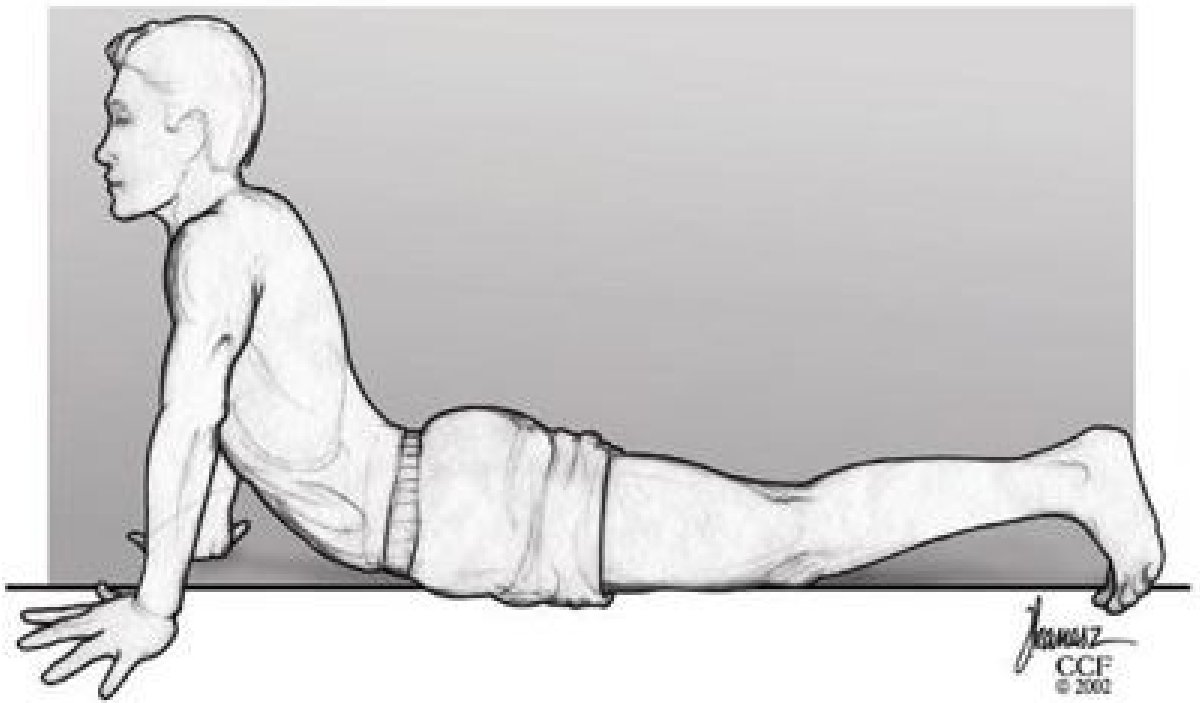

C

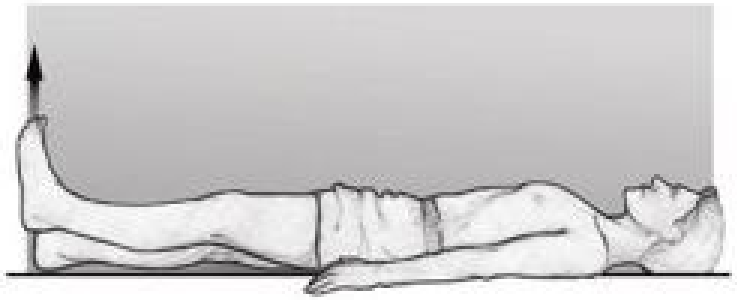
SMOKING

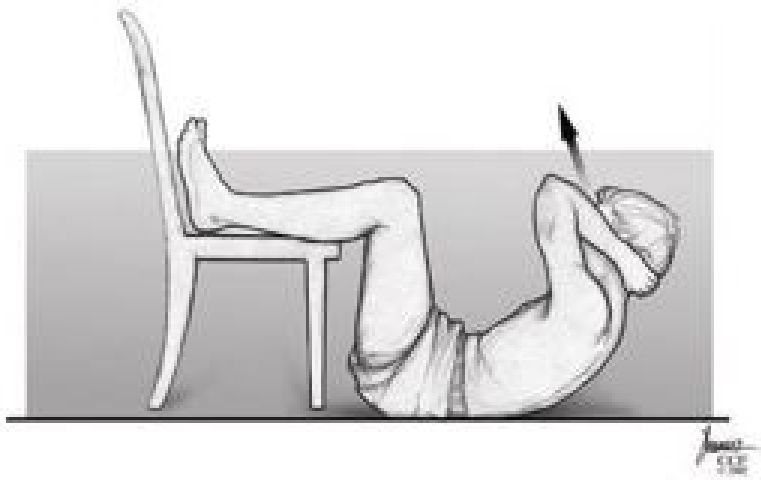


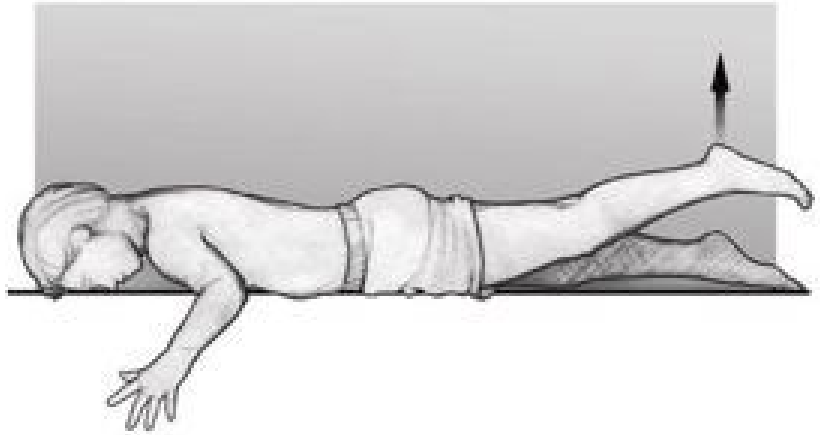


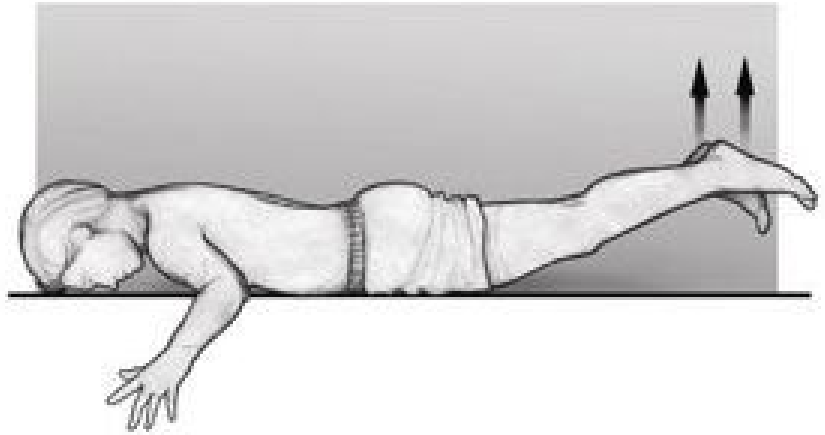

CCF
© 2002

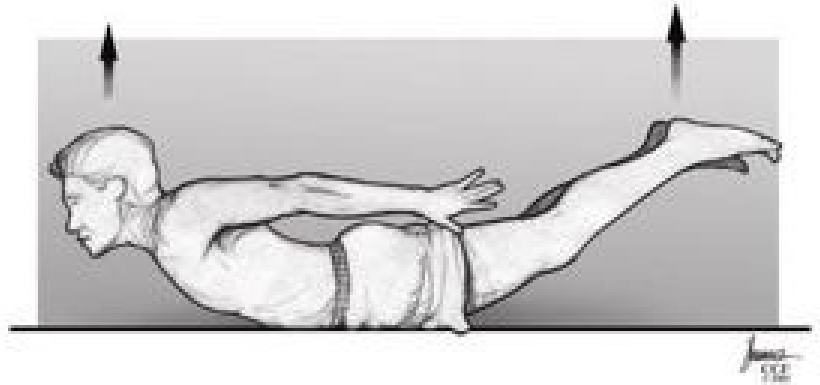

CCF
© 2002

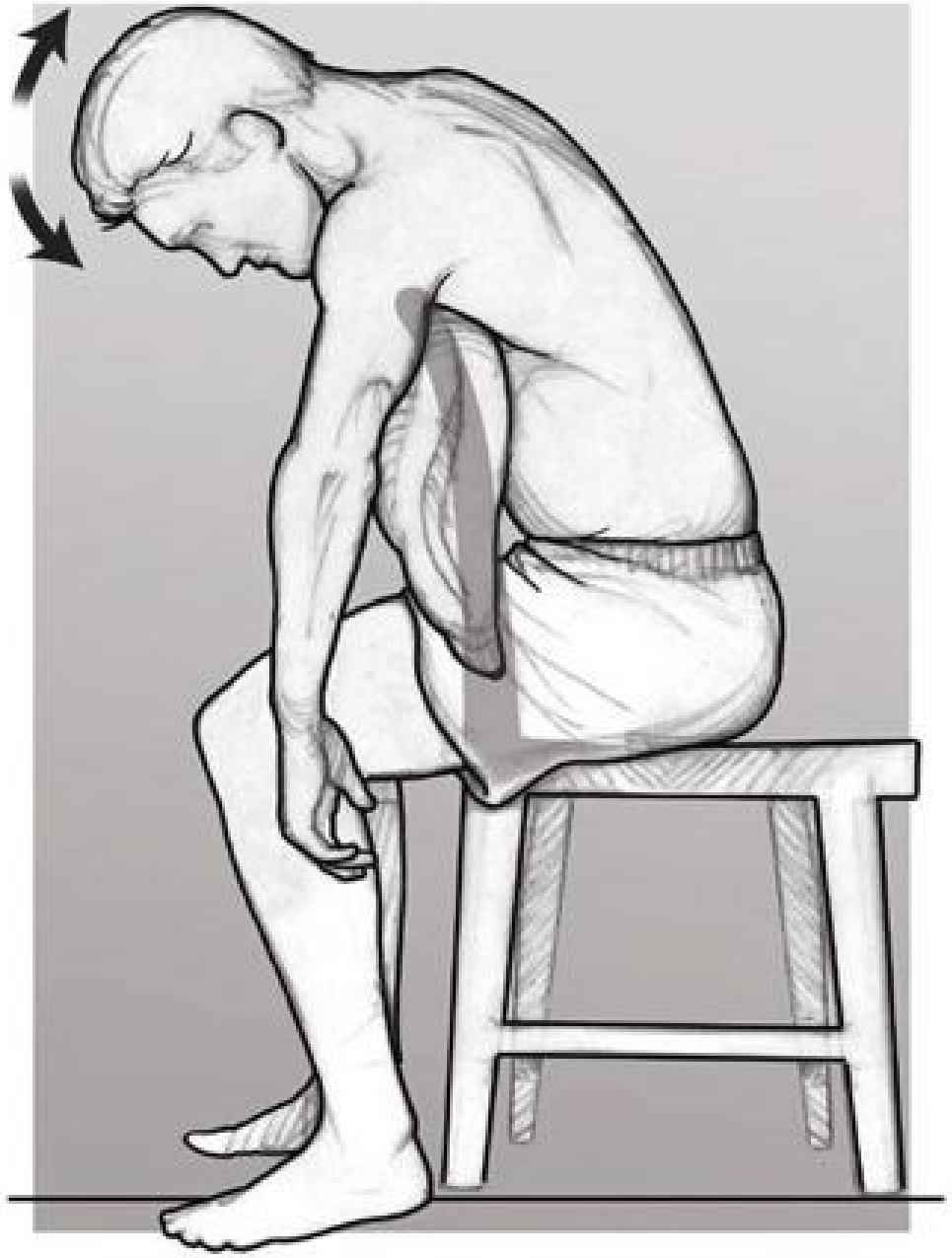


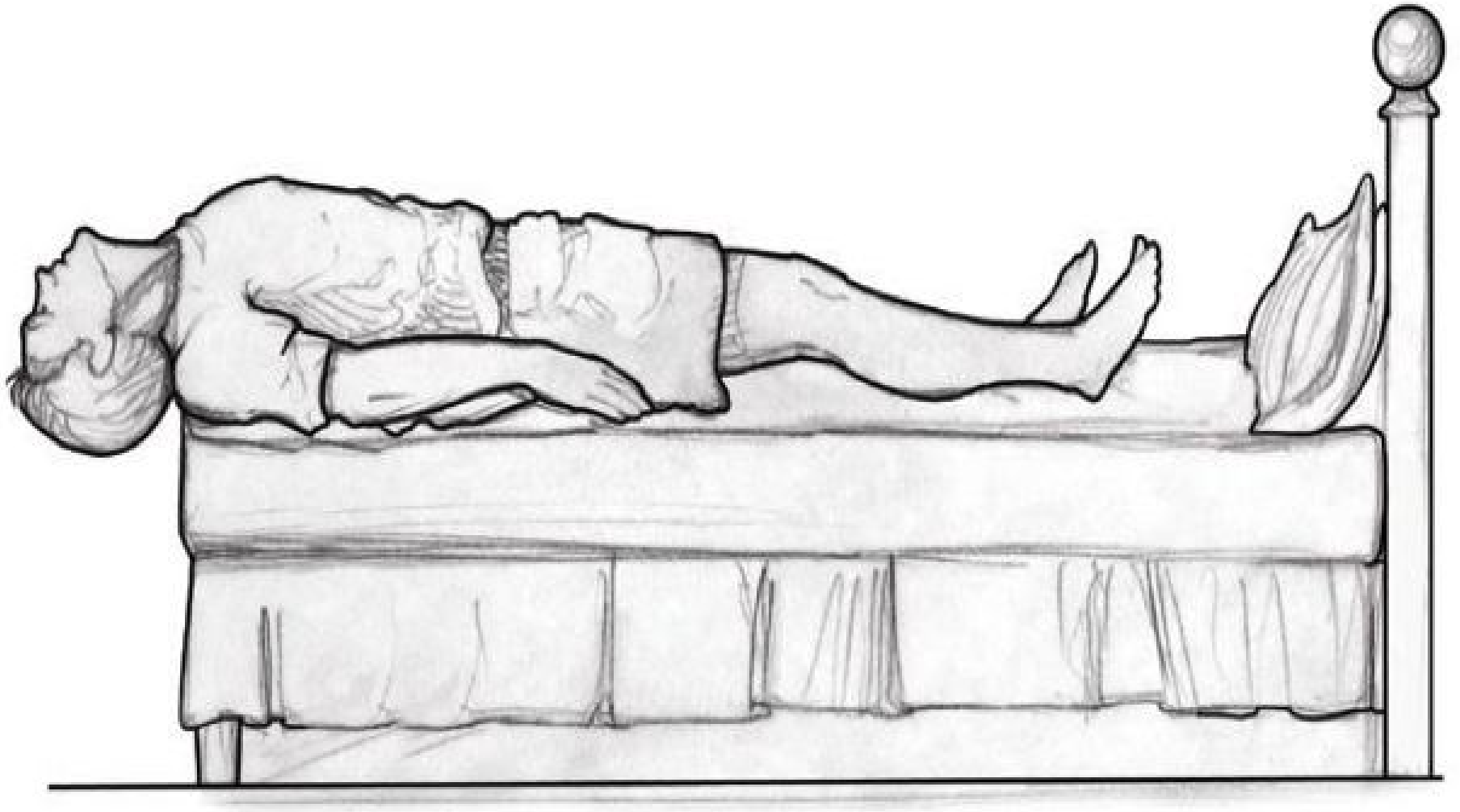


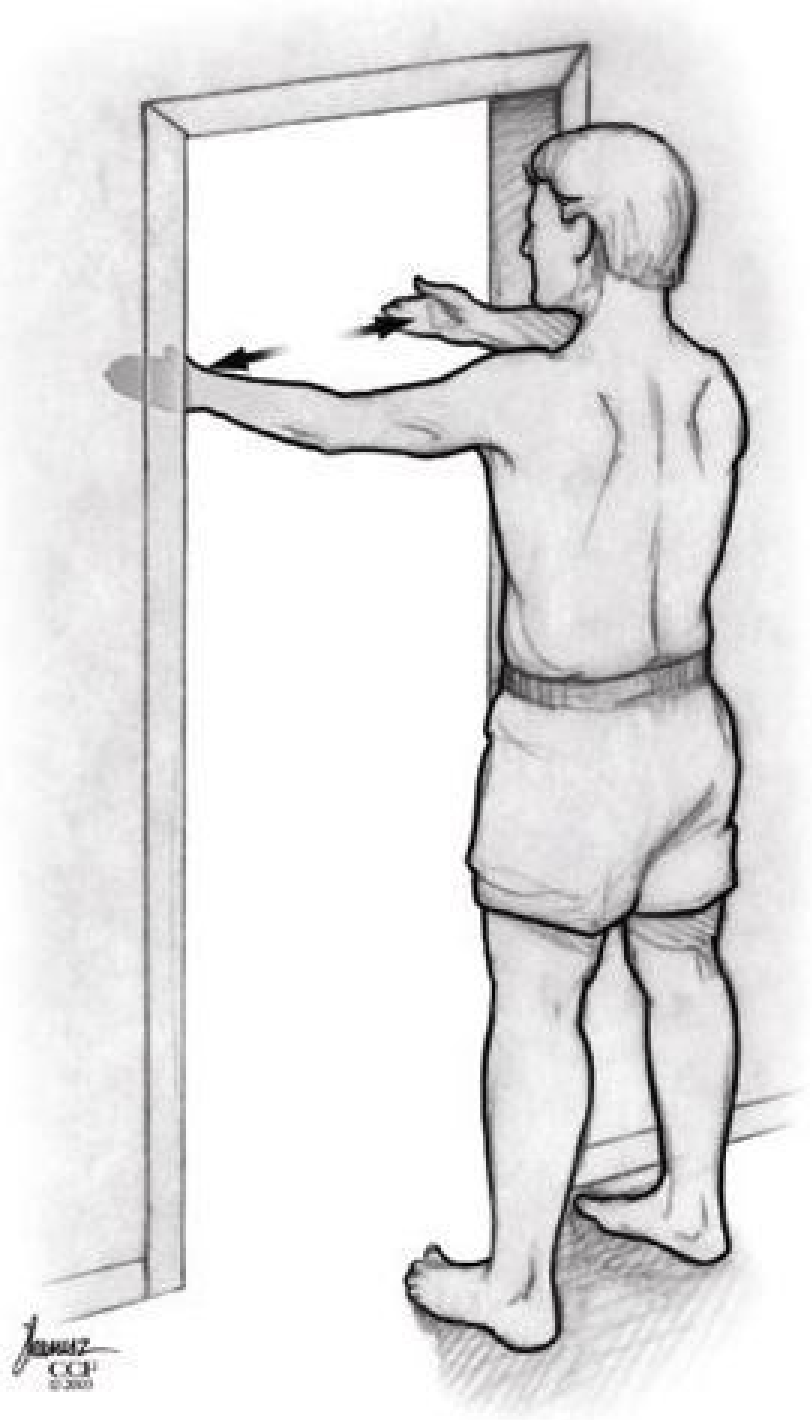


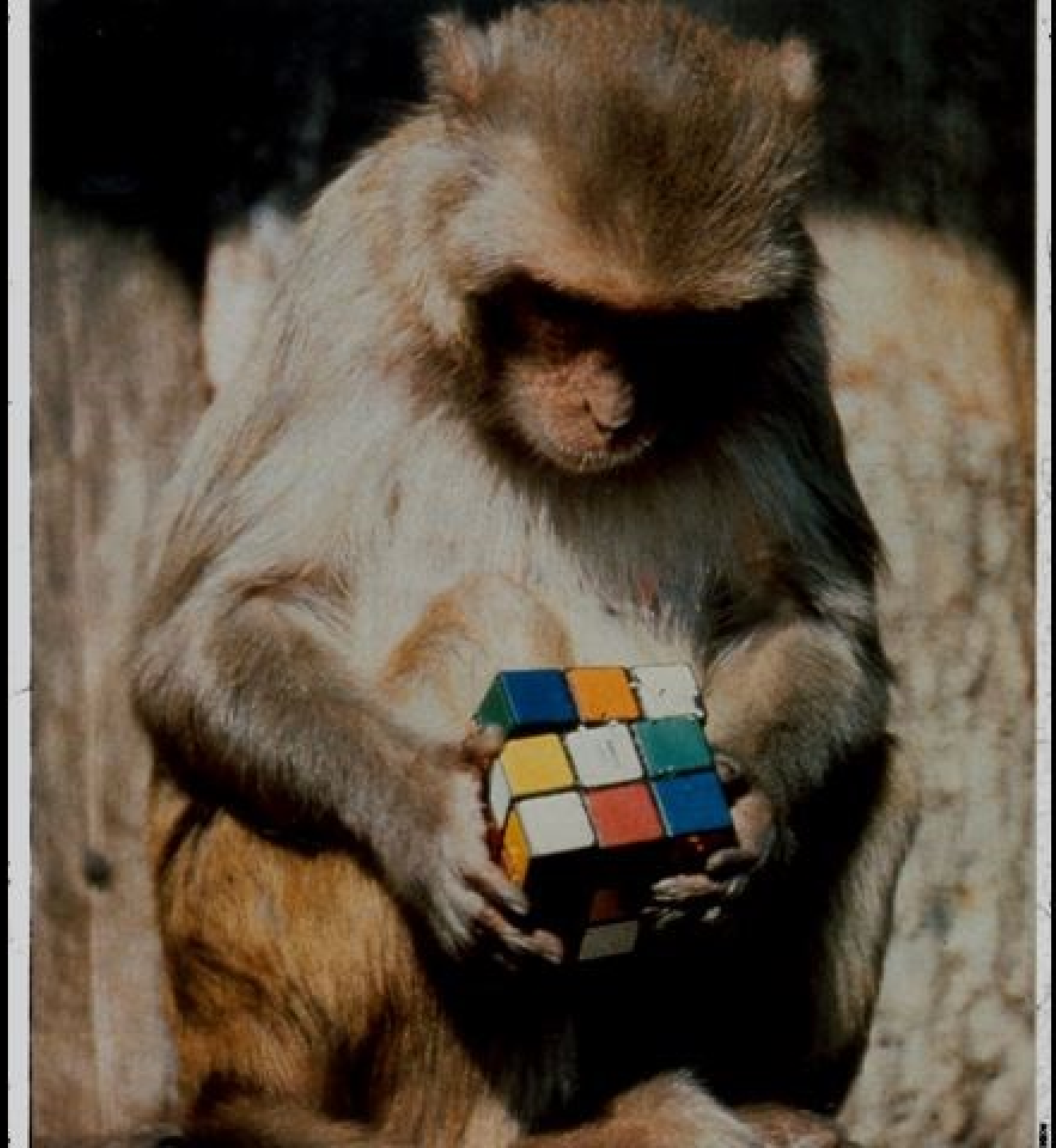












Surgeons

Impulsive

4 Docs go Duck Hunting

Family Practitioner
Gynecologist
Spine Surgeon
Pathologist

4 Docs go Duck Hunting

Duck Flies Over

4 Docs go Duck Hunting

Duck Flies Over

Family Practitioner – Is it a DucK?

4 Docs go Duck Hunting

Duck Flies Over

Family Practitioner – Is it a DucK?

Gynecologist – Is it a Male or Female Duck?

4 Docs go Duck Hunting

Duck Flies Over

Family Practitioner – Is it a DucK?

Gynecologist – Is it a Male or Female Duck?

Spine Surgeon – Shoots the Bird

4 Docs go Duck Hunting

Duck Flies Over

Family Practitioner – Is it a DucK?

Gynecologist – Is it a Male or Female Duck?

Spine Surgeon – Shoots the Bird

Turns to Pathologist

4 Docs go Duck Hunting

Duck Flies Over

Family Practitioner – Is it a DucK?

Gynecologist – Is it a Male or Female Duck?

Spine Surgeon – Shoots the Bird

Turns to Pathologist

GO SEE IF THAT BIRD WAS A DUCK!!!

NASS Survey

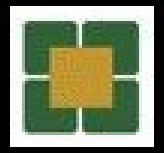
80+% - Recommend Surgery Refractory MLBP

NASS Survey

80+% - No Surgery for Self

Two Recommendations

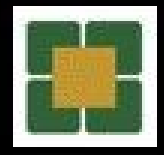
#1
Act Like You
Are
The
Patient



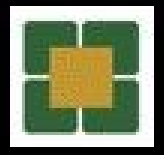
#2
Act Like Paying for the Surgery

Decrease

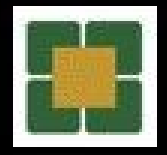
Rate of Surgery
Cost of Surgery



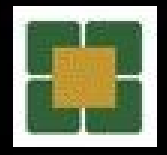
"Technology" is a Tool



A fool with a tool.....



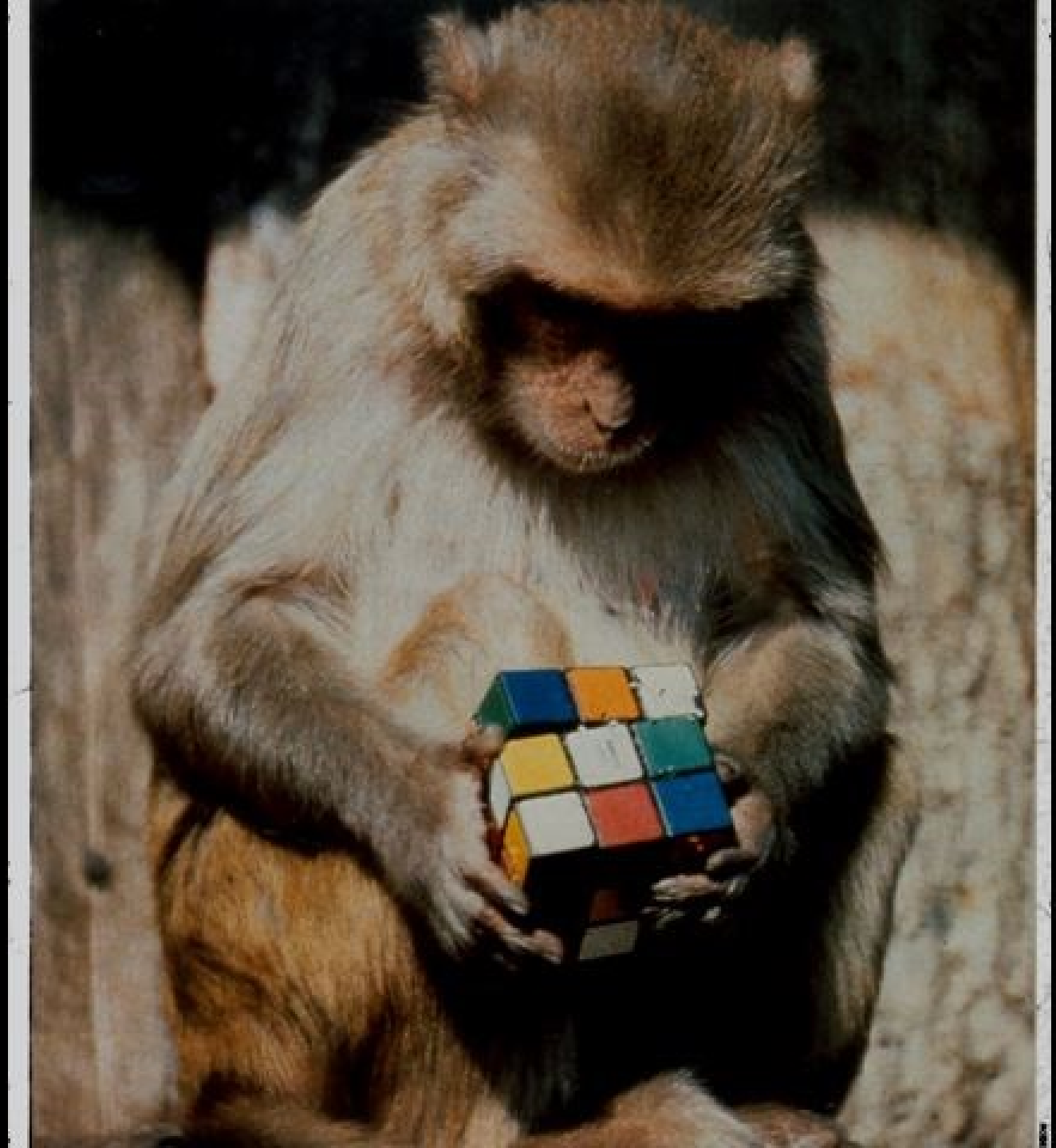
.....is still a fool!!!!



What Happens in 10, 15, 20 ..... Years?

The art of medicine is amusing the patient until nature cures the disease.

Voltaire




CLEVELAND SPINE REVIEW

Hands-On Education

Hands-On Fun

Cleveland Indians Baseball

The Hike

Crawfish Boil

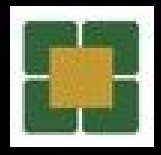
Rock Hall Reception

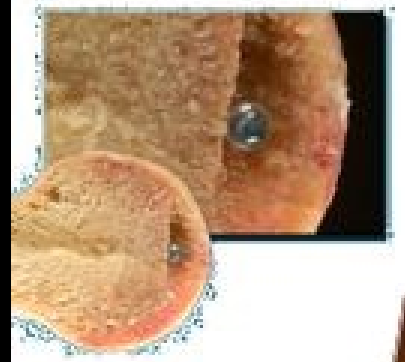
2008 Course Dates: July 16 - 22

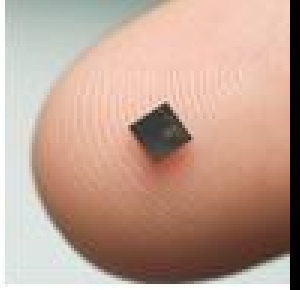
For More Information

tobinm@ccf.org

"A failure of non-operative management should not be construed as implying that surgery will work."







THANK YOU!!!