

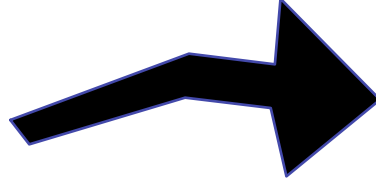
SPİNAL DEJENERASYONUN BİYOMEKANİĞİ VE SEGMENTAL İNSTABİLİTE

Dr.Hakan BOZKUŞ

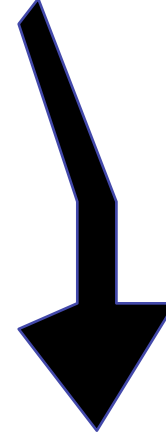


DEJENERASYON

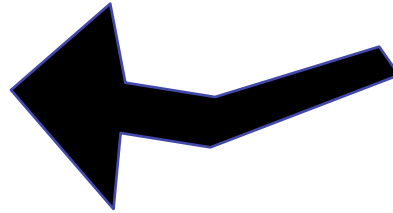
Doku
Adaptasyonu



Dejeneratif
Değişiklikler



Değişen Materyel
Özellikleri



Değişen
Mekanik
Çevre



Omurga Dejenerasyonu

- Biyomekanik Deęişiklikler
- Yapısal Deęişiklikler

Omurga Dejenerasyonu (Biyomekanik Deęişiklikler)

- Materyel özellikleri
- Hareket aralığı (Sınır Şartları)
- Rotasyonun anlık eksenini

Materiyel Özellikleri

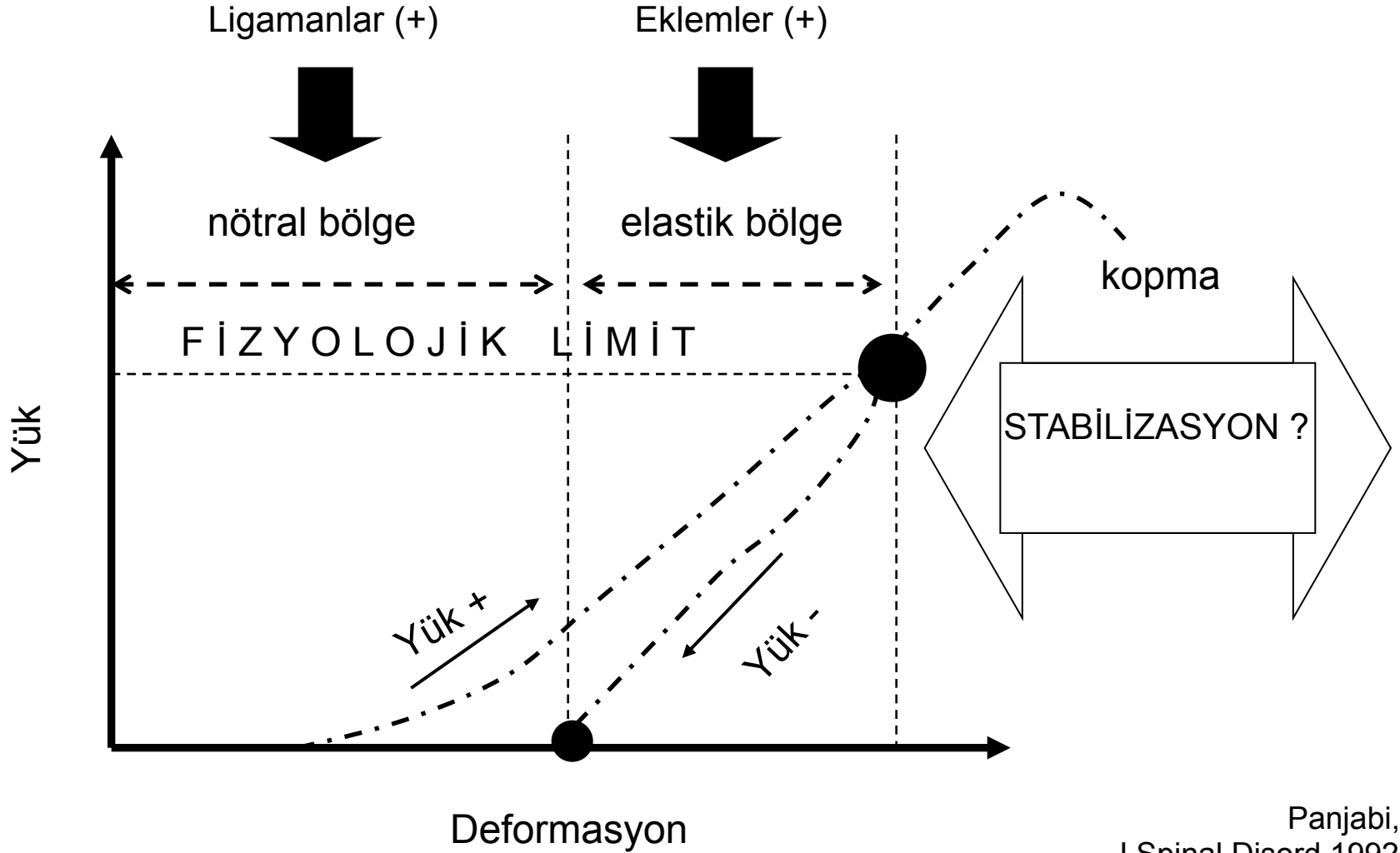
Elastisite Modülü: Gerilmenin birim şekil değişikliğine oranıdır.

Elastisite modülü yüksekse cisim daha fazla dayanımlıdır.

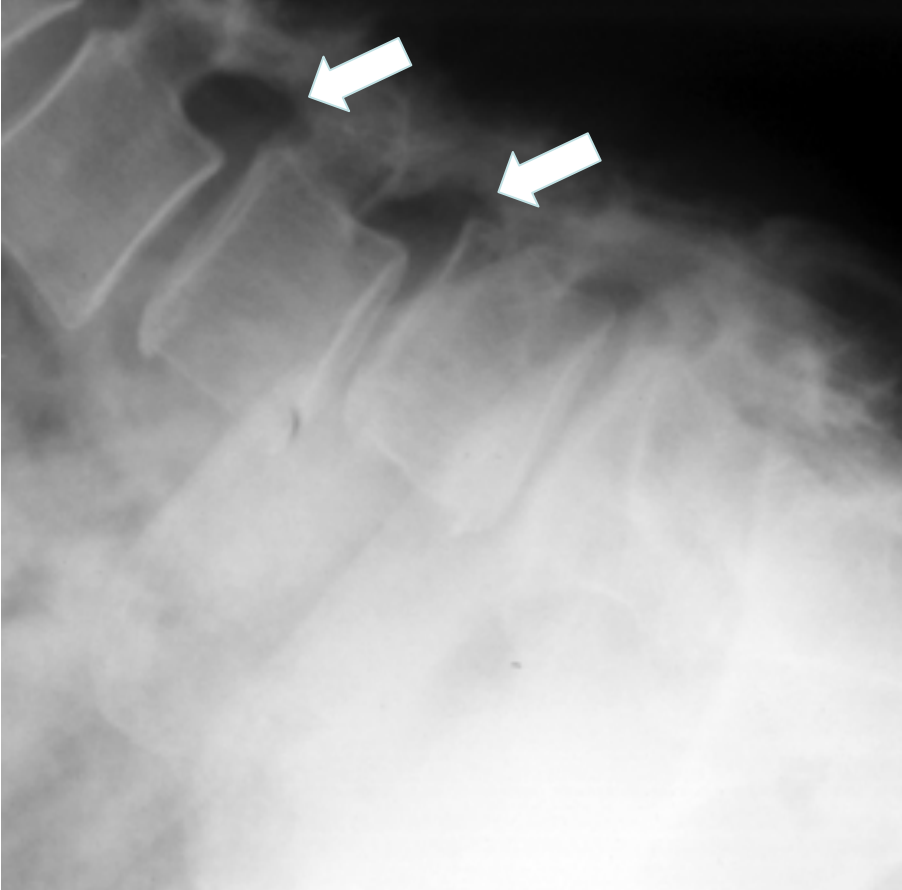
$$E = \sigma / \varepsilon$$

Kısım	Elastisite Modülü (MPa)
Spongioz kemik	100
Kortikal kemik	10000
Son-plak	50, 500, 1500
Nukleus	3.4

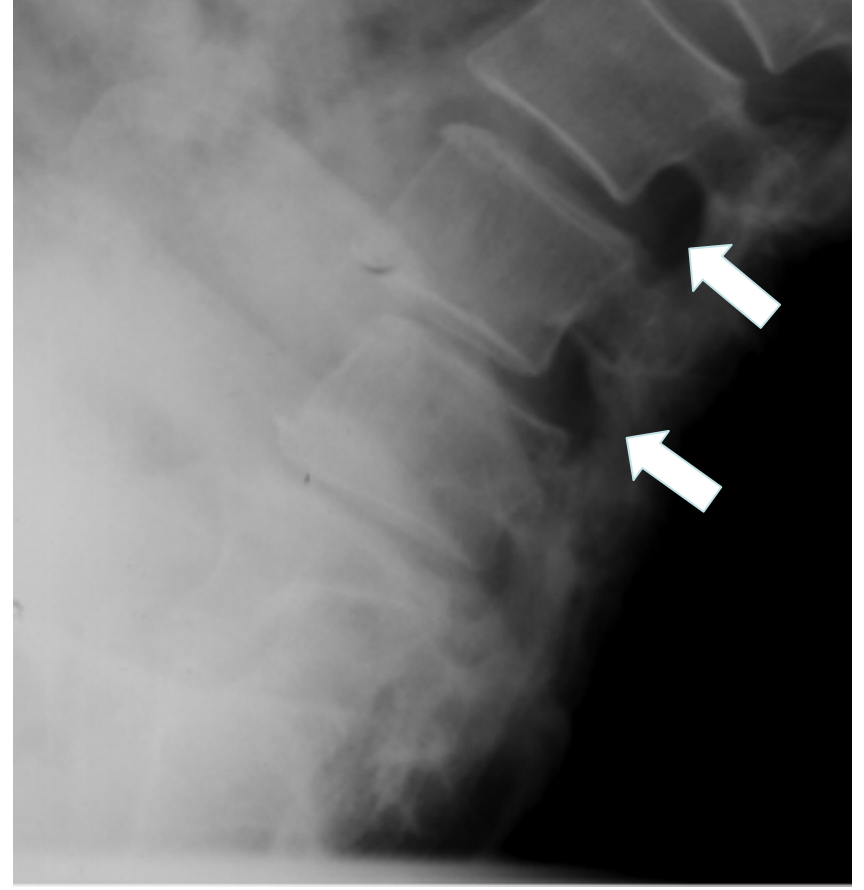
Hareket Aralığı (ROM)



Hareket Aralığı



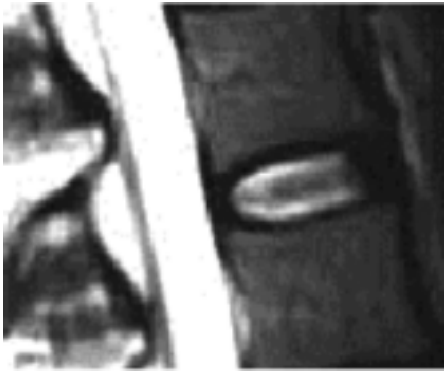
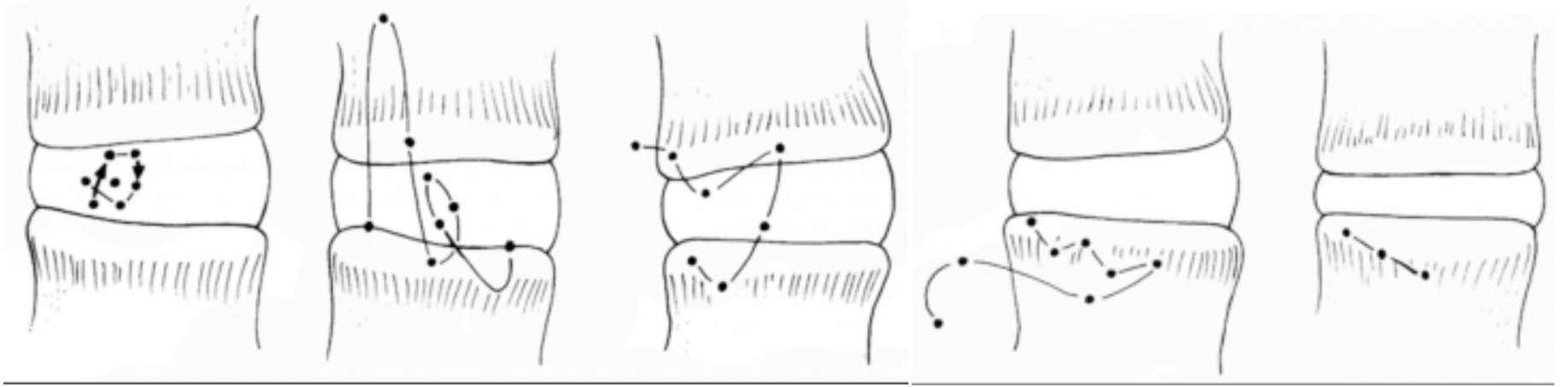
Hiperfleksiyon



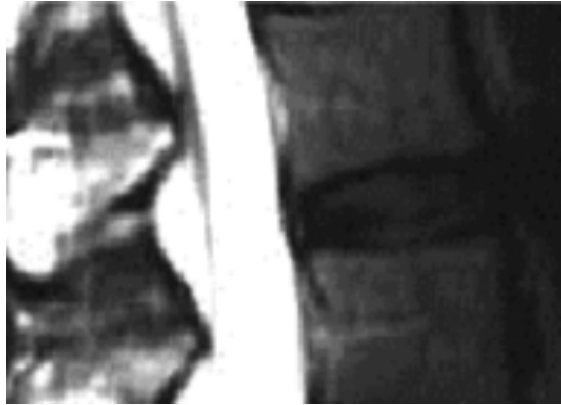
Hiperekstansiyon

Sagittal Planda Rotasyonun Anlık Ekseni

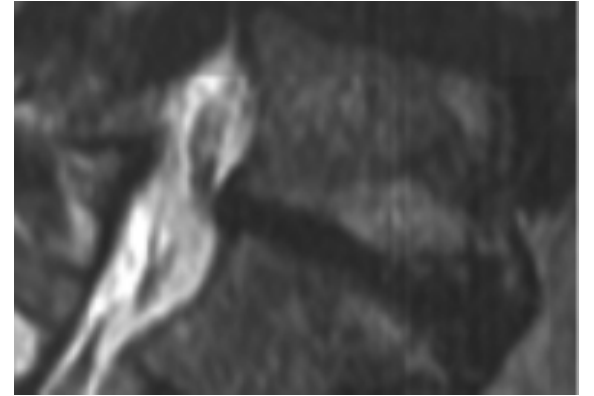
Lomber Bölge



Normal

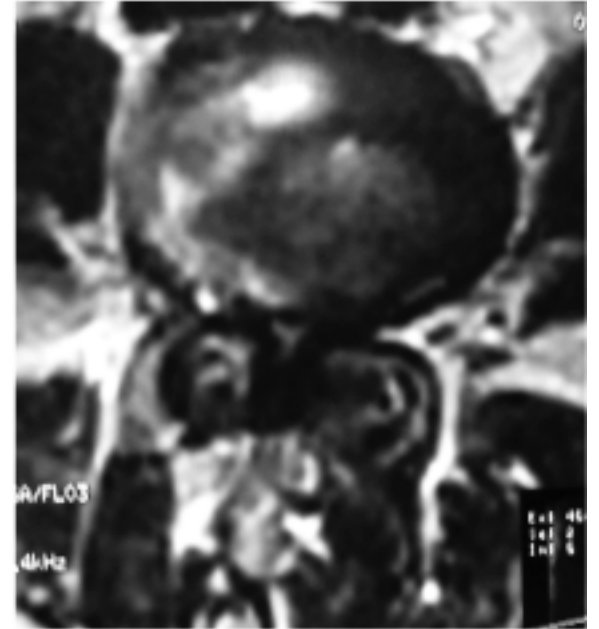
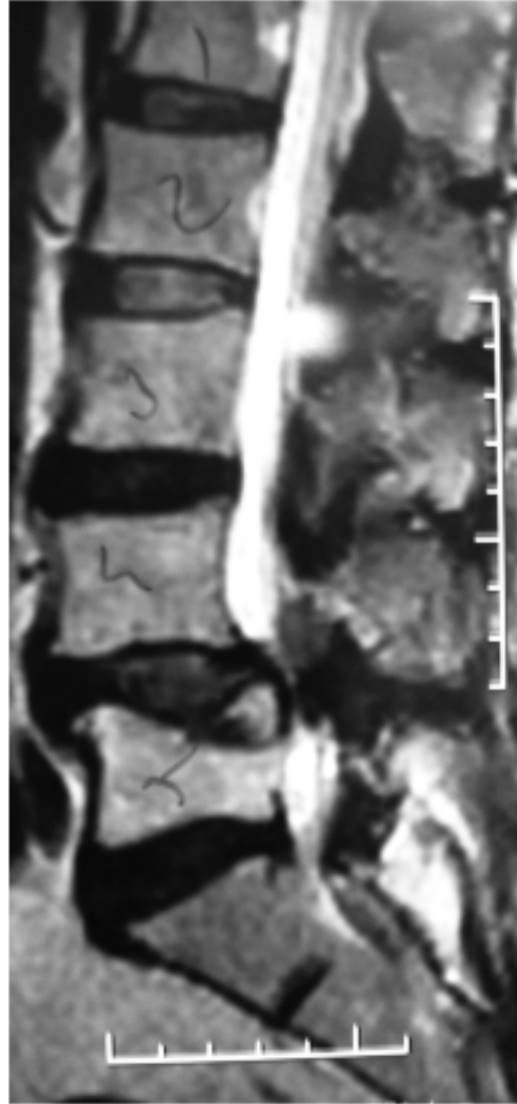
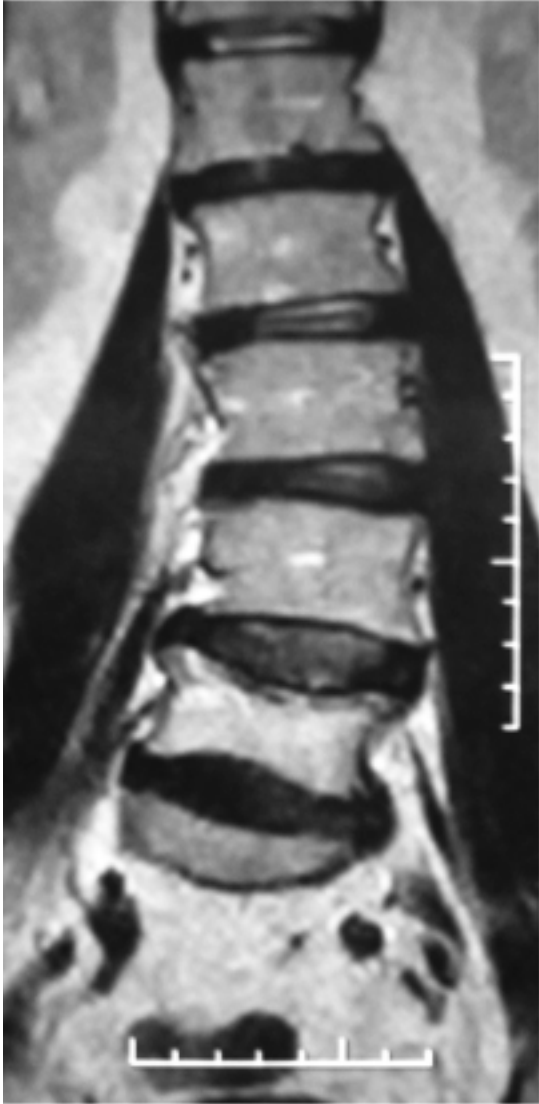


Dejenere



İleri Dejenere

3 Planda Dejenerasyon 3 Planda RAE Deęiřimi



Omurga Dejenerasyonu (Yapısal Değişiklikler)

- Omur cismi
 - Korteks
 - Trabeküller
 - Endplate
- Faset eklemleri
- İntervertebral disk
- Ligamanlar
- Paravertebral adale

Korteksten Yük Geçiři

Rockoff (1969)

%45-75

McBroom (1985)

%10

Yoganandan (1988)

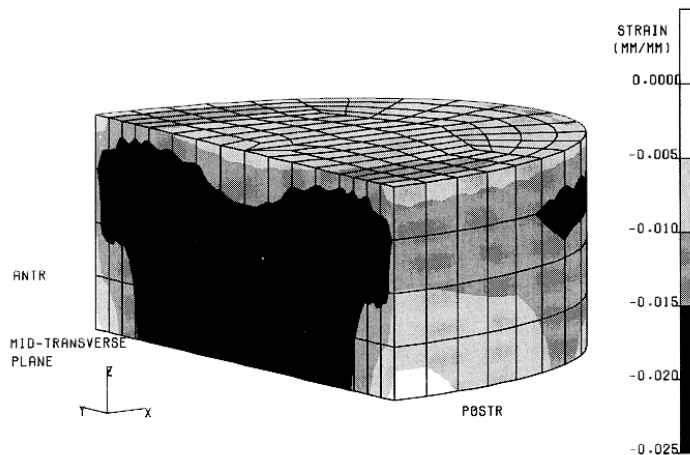
%40

Faulkner (1991)

%12 (osteoporozda %56)

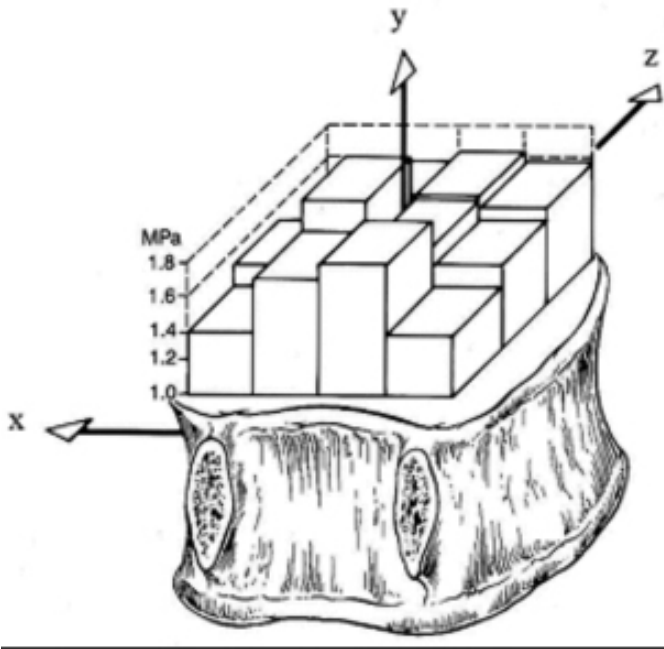
Burr (1994)

%50 (osteoporozda %90)



Trabeküler Kemik Dayanımı

Basma yüklemesi



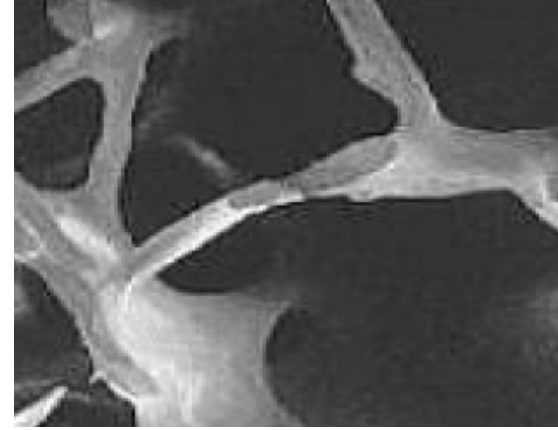
Basma yüklemesine dayanım;

En fazla → ORTA

En az → ARKA YAN

1 MPa= 10 kg/cm²

Omur Cismi Dayanımı



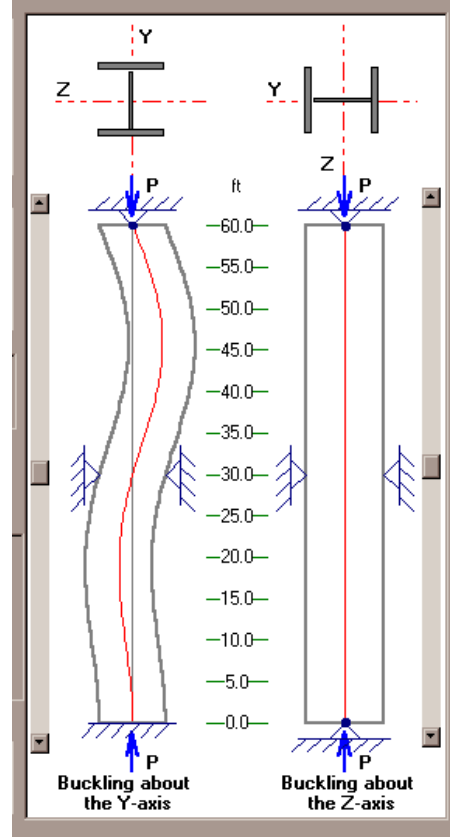
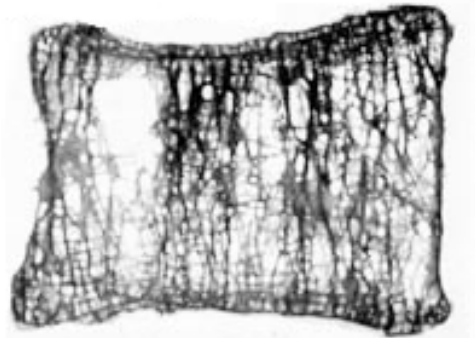
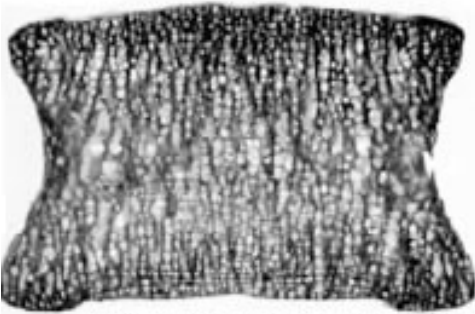
- Kemik mineral dansitesi ile vertebranın aksiyal basma kuvvetine dayanımı direk ilişkili

- 1 MPa - 5 MPa vertebranın kırıldığı aksiyal yük



Euler Eğilme Teoremi

- Bir silindirin eğilmeye dayanımı;
 - Silindirin çapı, uzunluğu, ara bağlantıları, elastik modülü ile doğru orantılıdır.



Crisco JJ, Panjabi MM, Clin Biomech 1992
Bozkuş H ve ark., Turkish Neurosurg 2003

Son-plak (end-plate)



- En sağlam yer posterolateral son-plak
- En zayıf yer ortası
- Üst son-plak, alt alt son-plaktan daha zayıf

Son-plak (end-plate)

- Tekrarlayan ykleme ile yorulma testi
- İlk kırılan yer endplate ve komşu trabekler yapı
- Disk dejenerasyonu ile direk korelasyonu yok



Schmorl' s Nod

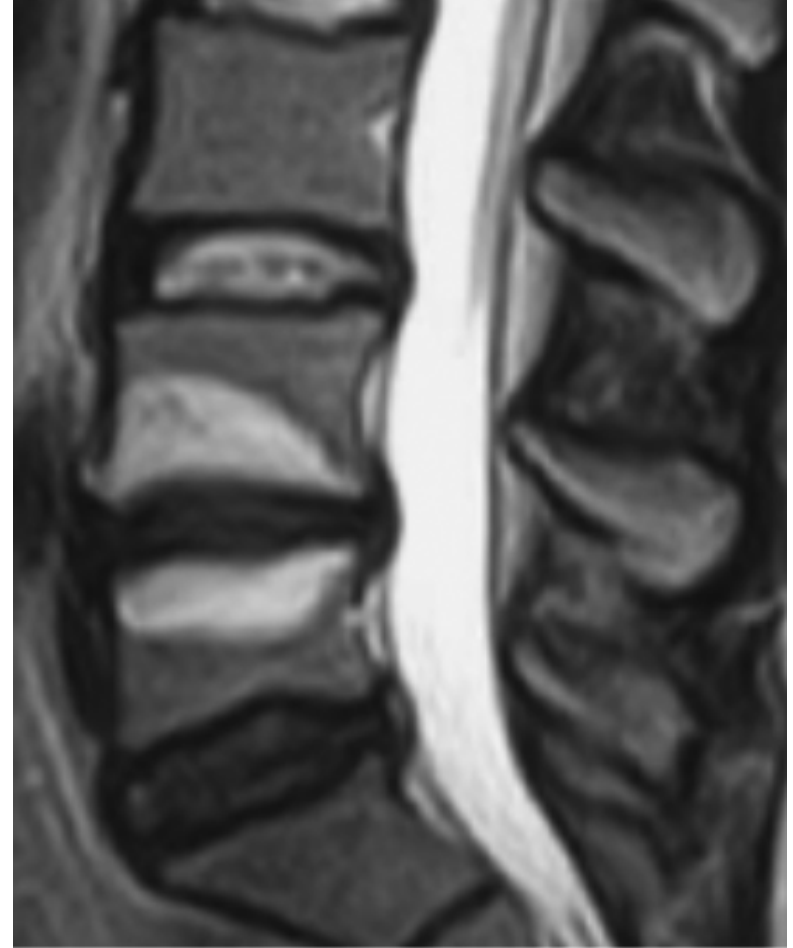
Degenerative Disk Disease: Assessment of Changes in Vertebral Body Marrow with MR Imaging¹

- 474 dejenere disk olgusunun MR deęerlendirmesi

	<u>T1</u>	<u>T2</u>
• Tip 1:	hipo	hiper
• Tip 2:	hiper	hiper
• Tip 3:	hipo	hipo

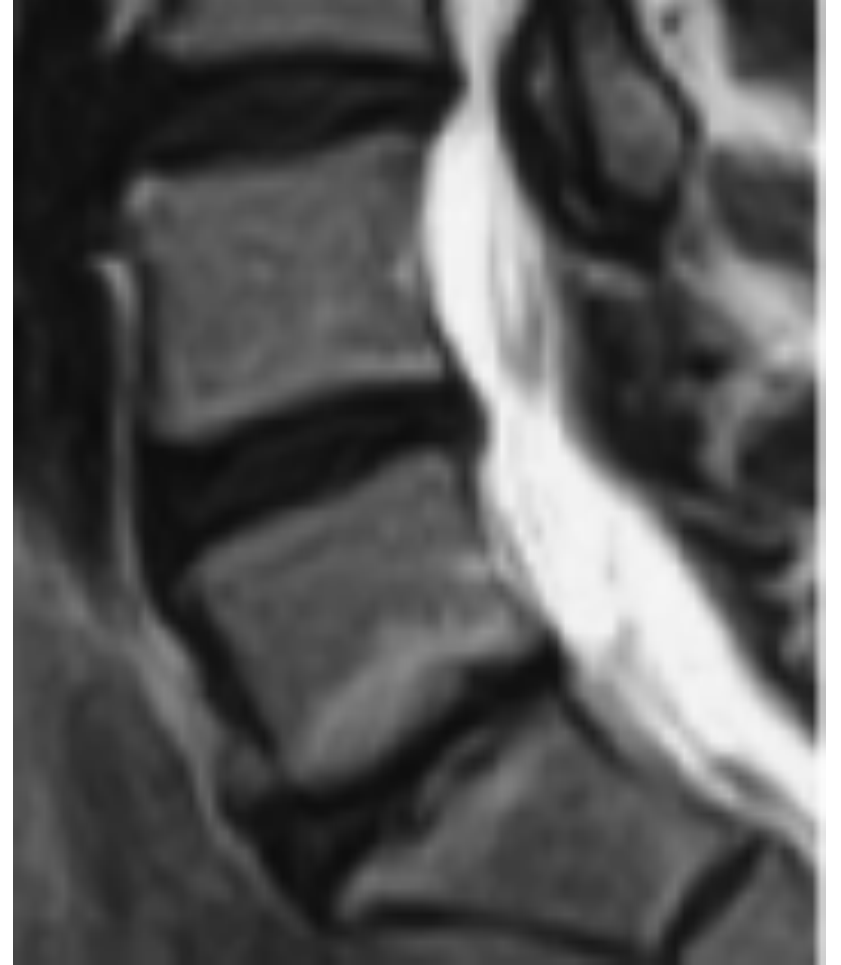
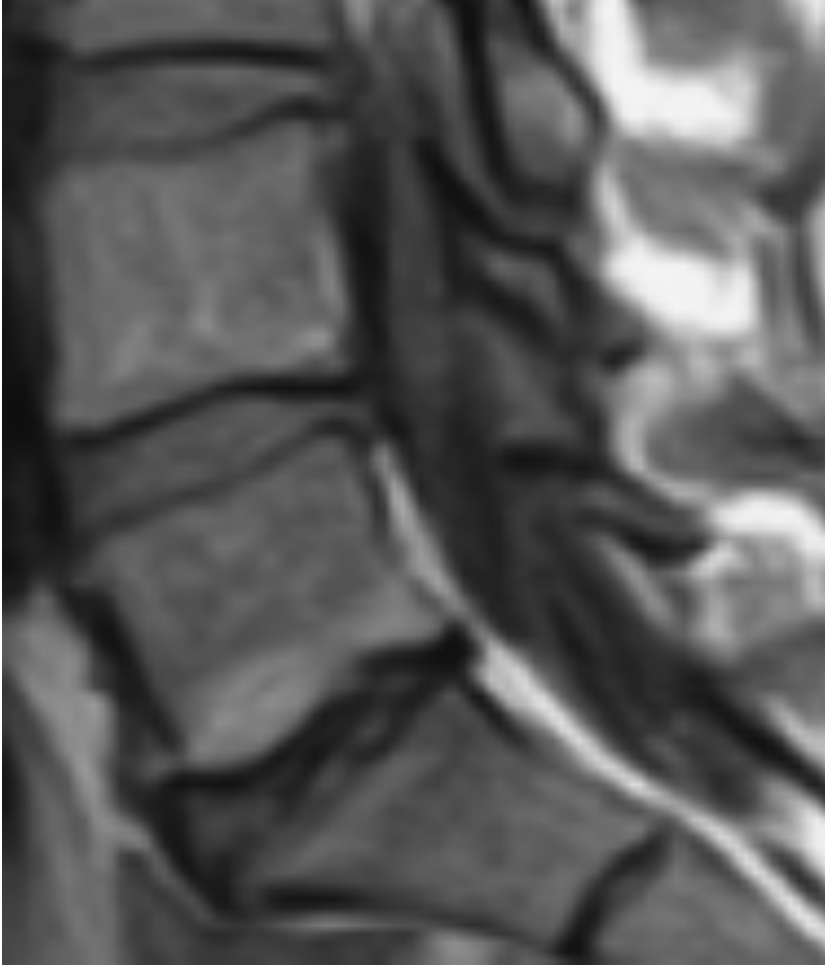
- Tip 1 Tip 2' ye dönebiliyor (14 ay-3 yıl)
- Tip 2 aynı kalabiliyor (2-3 yıl)

Modic 1



Subkondral kemik iliğinde artmış vaskularite

Modic 2



Subkondral kemik iliğinde yağ dejenerasyonu

Modic 3

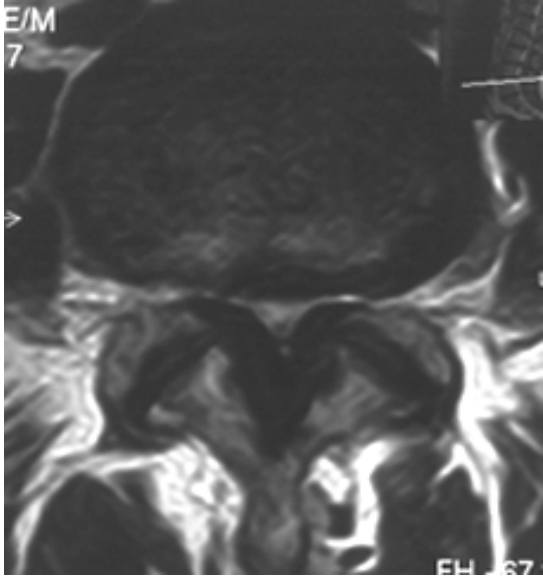


Subkondral kemik iliğinde skleroz

Hangi Yapı Önce Dejenere Oluyor ?

Disk dejenerasyonu genellikle faset eklem osteoartritinden önce oluşmaktadır.

FASET EKLEMİ ve PEDİKÜL



Lumbar Spondylolysis: Reactive Marrow Changes Seen in Adjacent Pedicles on MR Images

AJR 1995;164:429-433

John L. Ulmer¹
Allen D. Elster¹
Vincent P. Mathews¹
Anton M. Allen^{1,2}

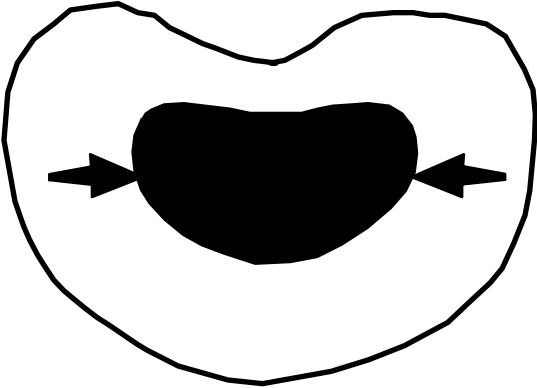
OBJECTIVE. In a search for ancillary MR findings for the diagnosis of spondylolysis, we performed a retrospective study to characterize changes in MR signal intensity of marrow within lumbar pedicles at the level of a spondylolytic defect. These reactive marrow changes were classified according to the anatomic-pathologic scheme developed for degenerative disk disease by Modic et al.

Lomber spondilozda pedikül Modic deęişiklikleri %40 hastada görölüyor

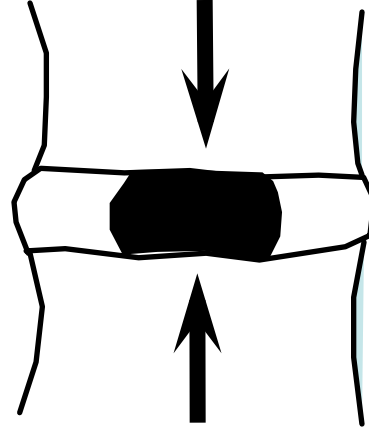


Nukleusda Sıvının Yönü

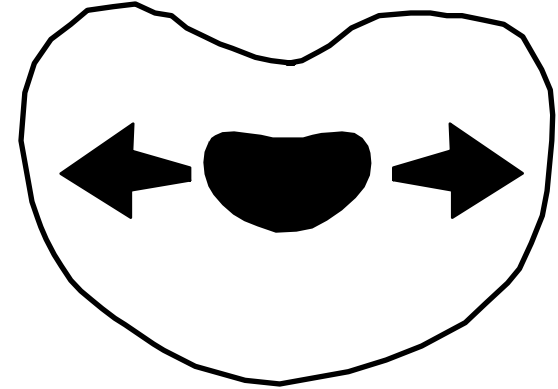
Normal
Yüksek PG içeriği



Sıvı Disk İÇİNE

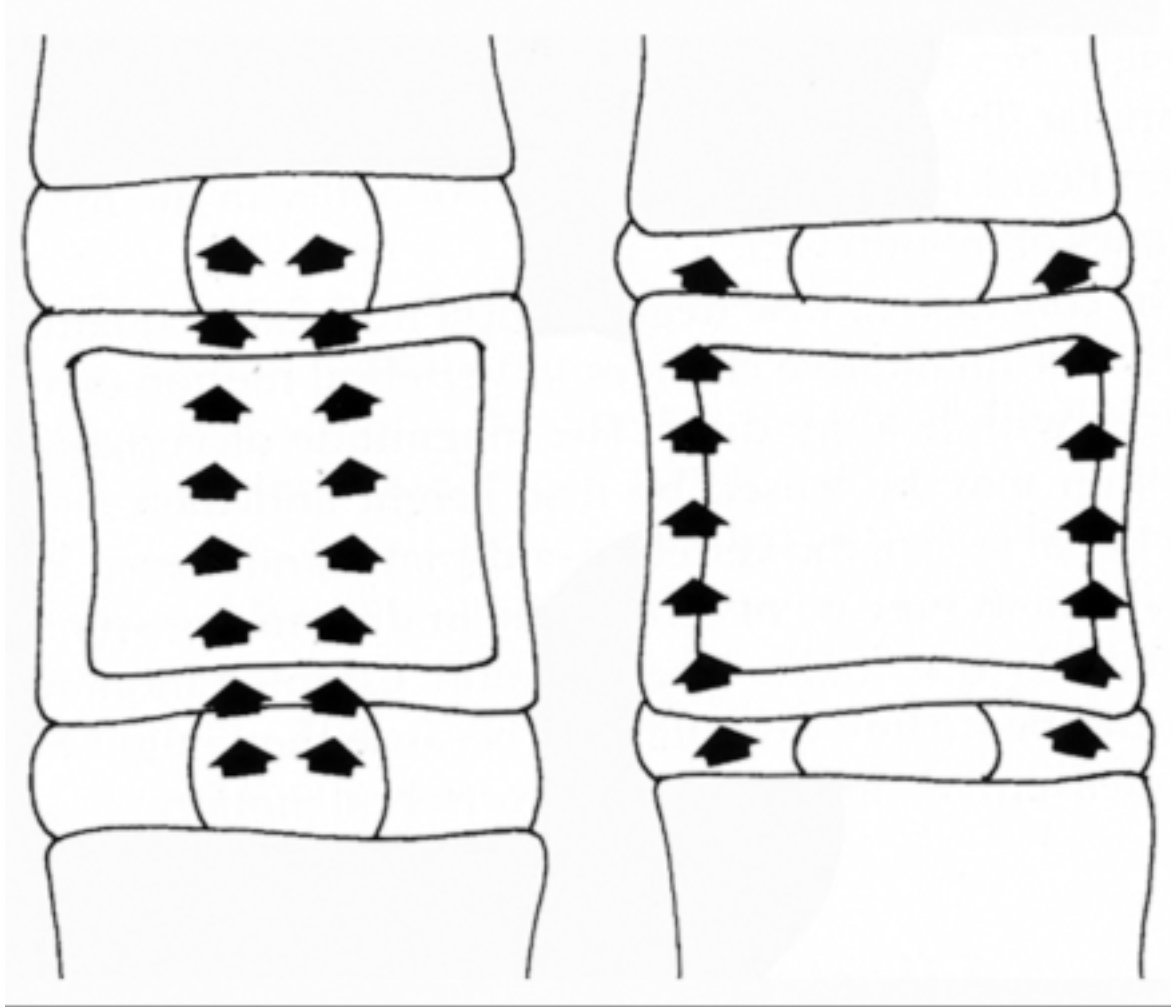


Dejenerasyon
Düşük PG içeriği



Sıvı Disk DIŞINA

Nukleus Yük Geçişi



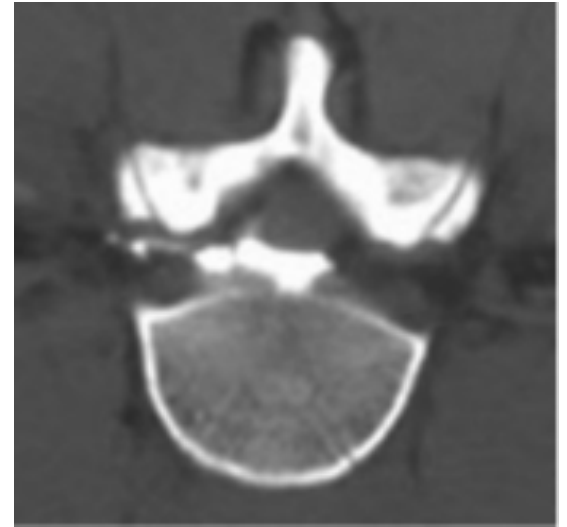
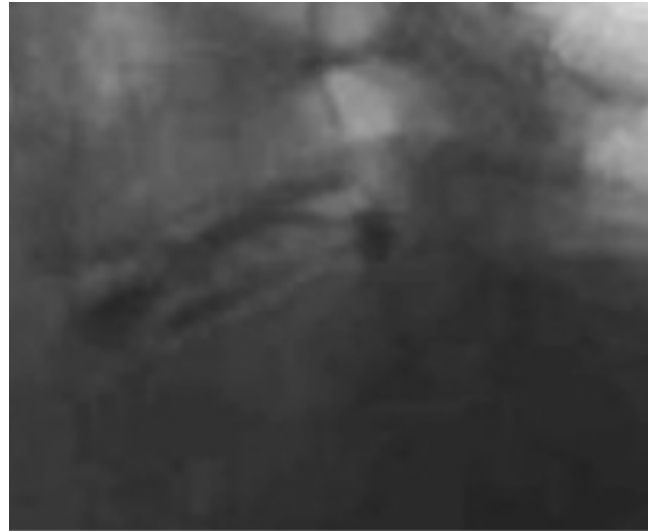
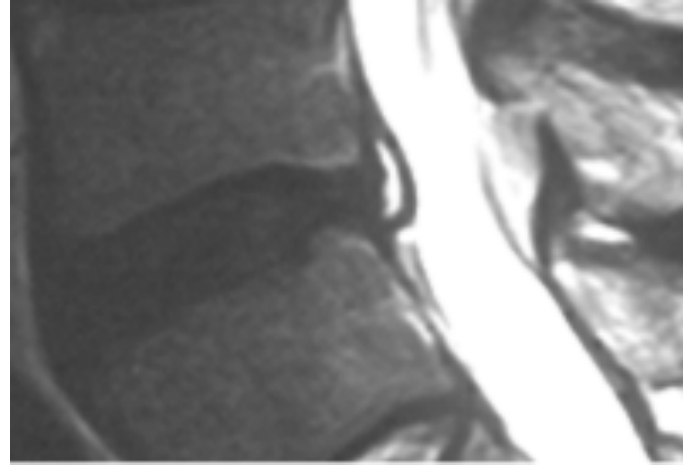
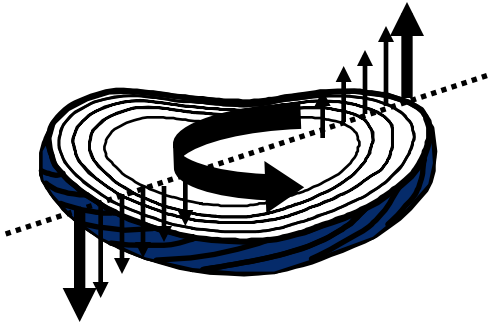
Normal

Dejenere

Anuler yırtık

Düşük Çekme
Gerilmesi Dayanımı

Yüksek Kayma
Gerilmesi



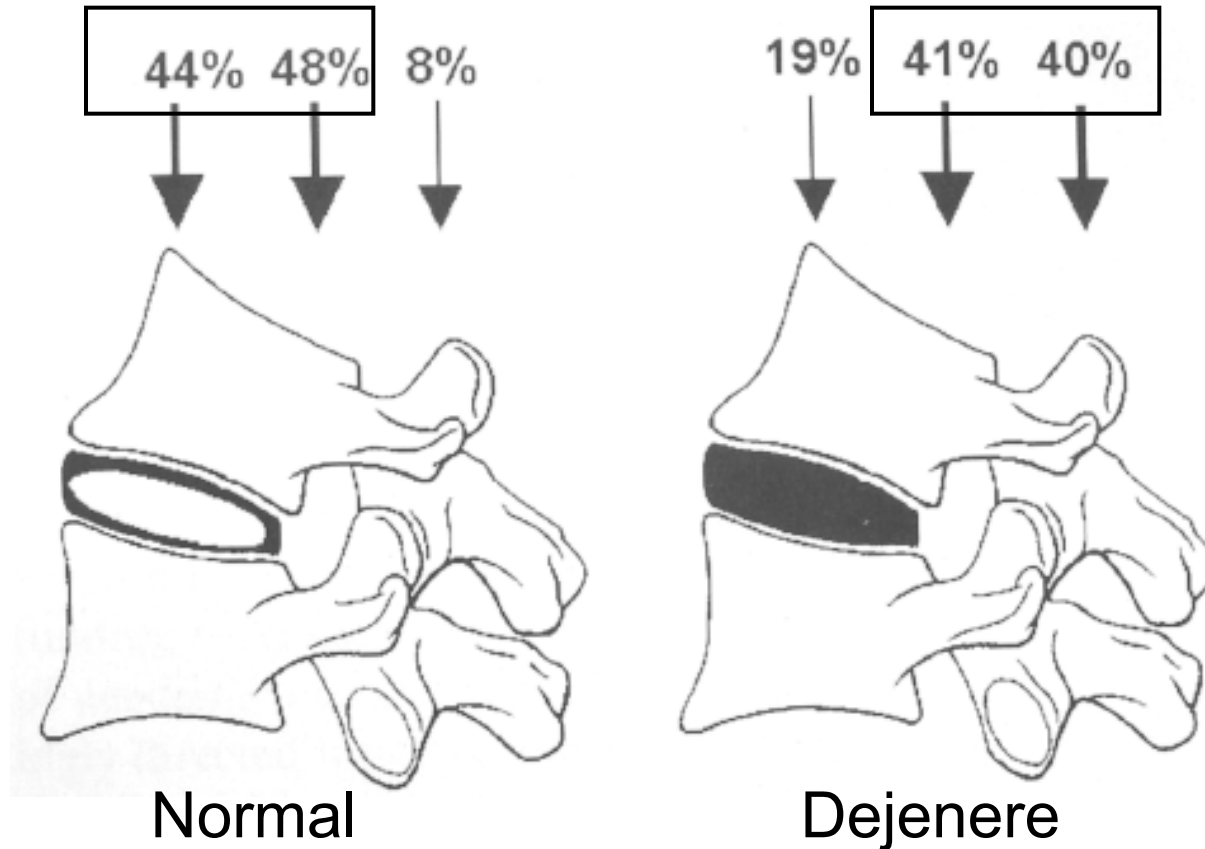
Yük Dağılımı

Journal of Biomechanics 38 (2005) 1972–1983

Perspective

Spine biomechanics ☆

Michael A. Adams*, Patricia Dolan

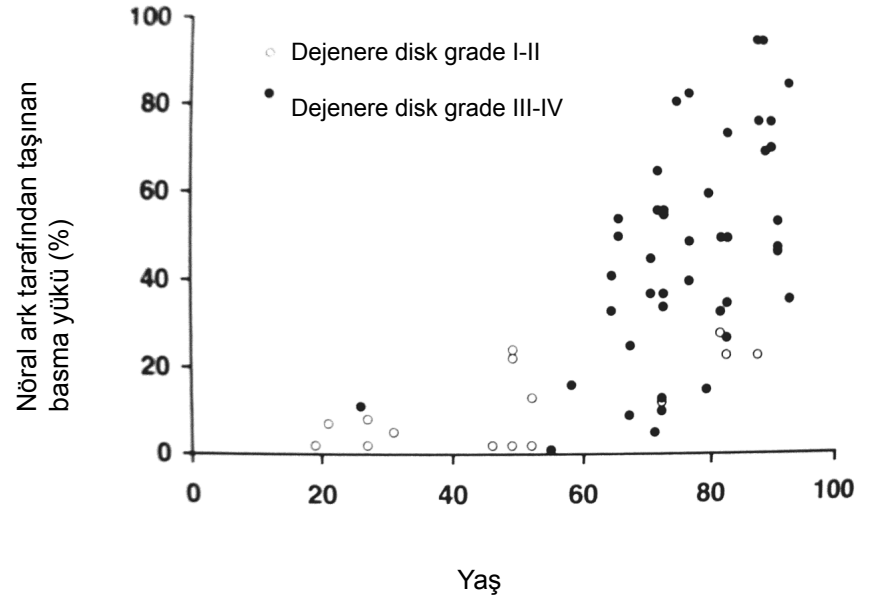
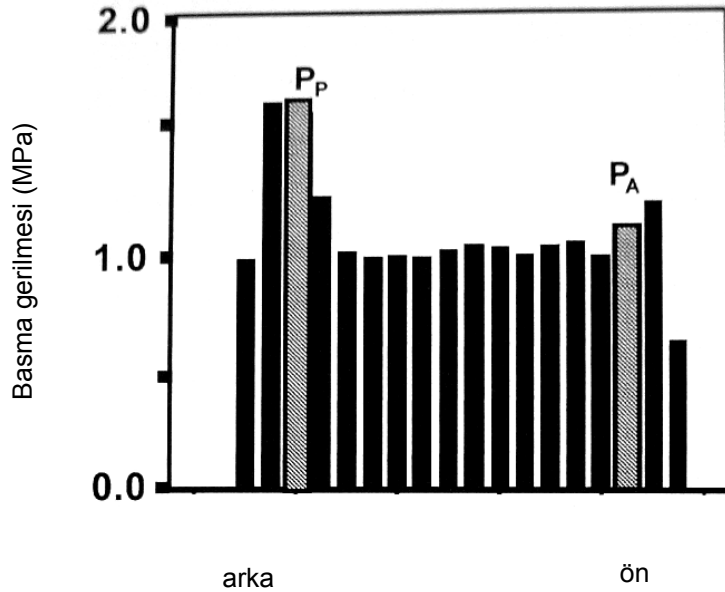
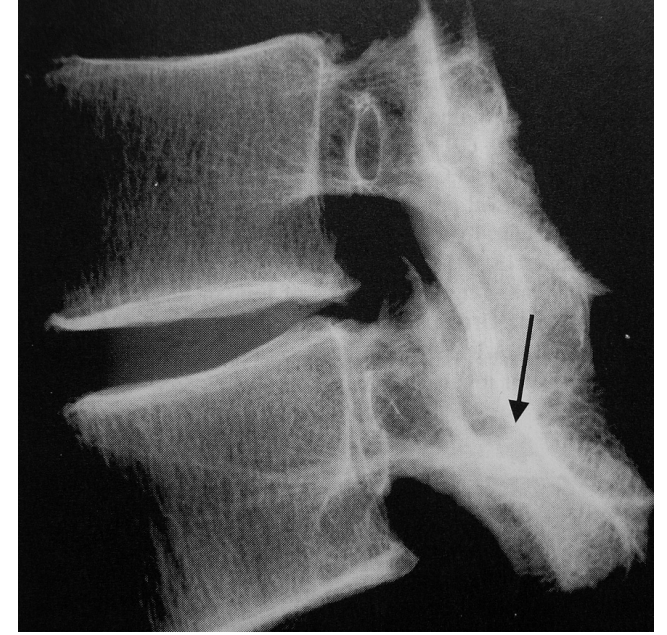


Neural arch load-bearing in old and degenerated spines

P. Pollintine, A.S. Przybyla, P. Dolan, M.A. Adams*

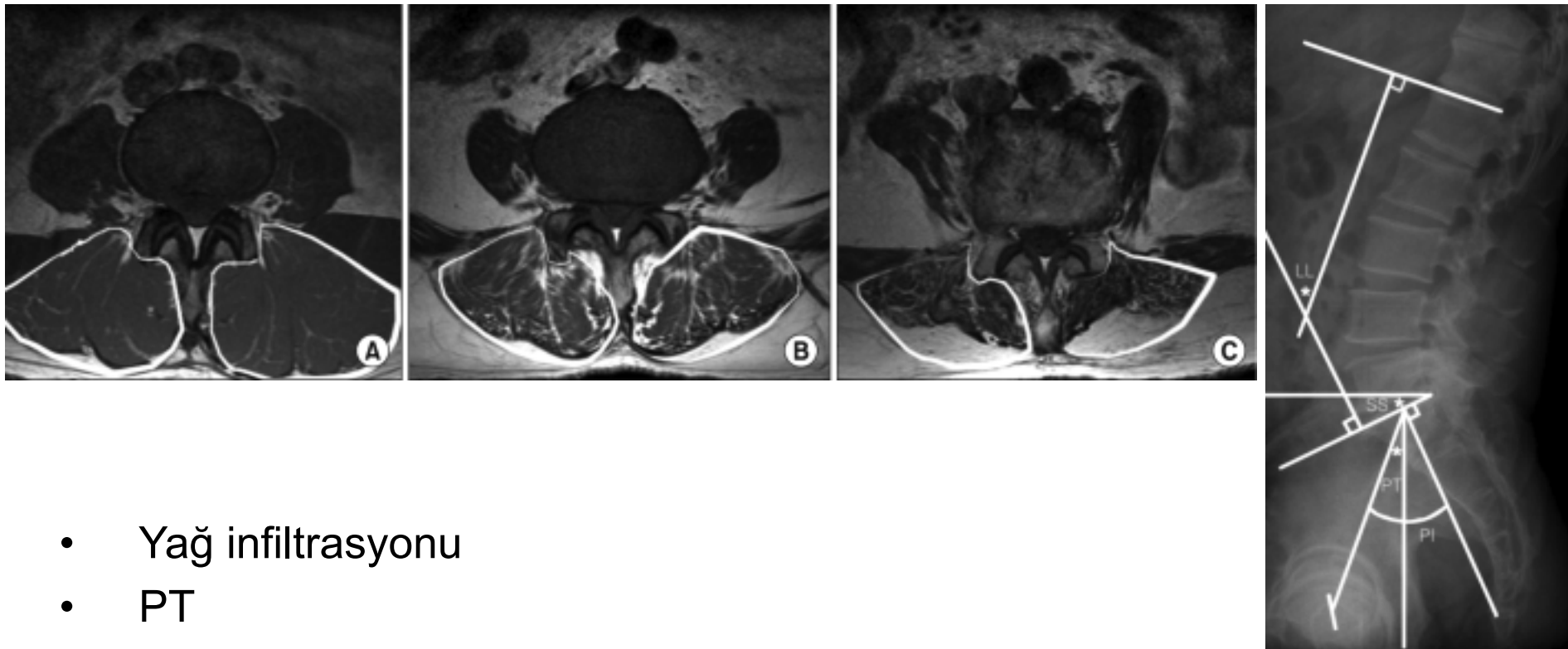
Comparative Orthopaedic Res Unit, Department of Anatomy, University of Bristol, Bristol BS2 8EJ, UK

70 yaş sonrası nöral ark %50 yük taşıyor



Clinical and Radiological Predictive Factors to be Related with the Degree of Lumbar Back Muscle Degeneration: Difference by Gender

Woo Dong Nam, MD, Bong-Soon Chang, MD*, Choon-Ki Lee, MD*, Jae Hwan Cho, MD

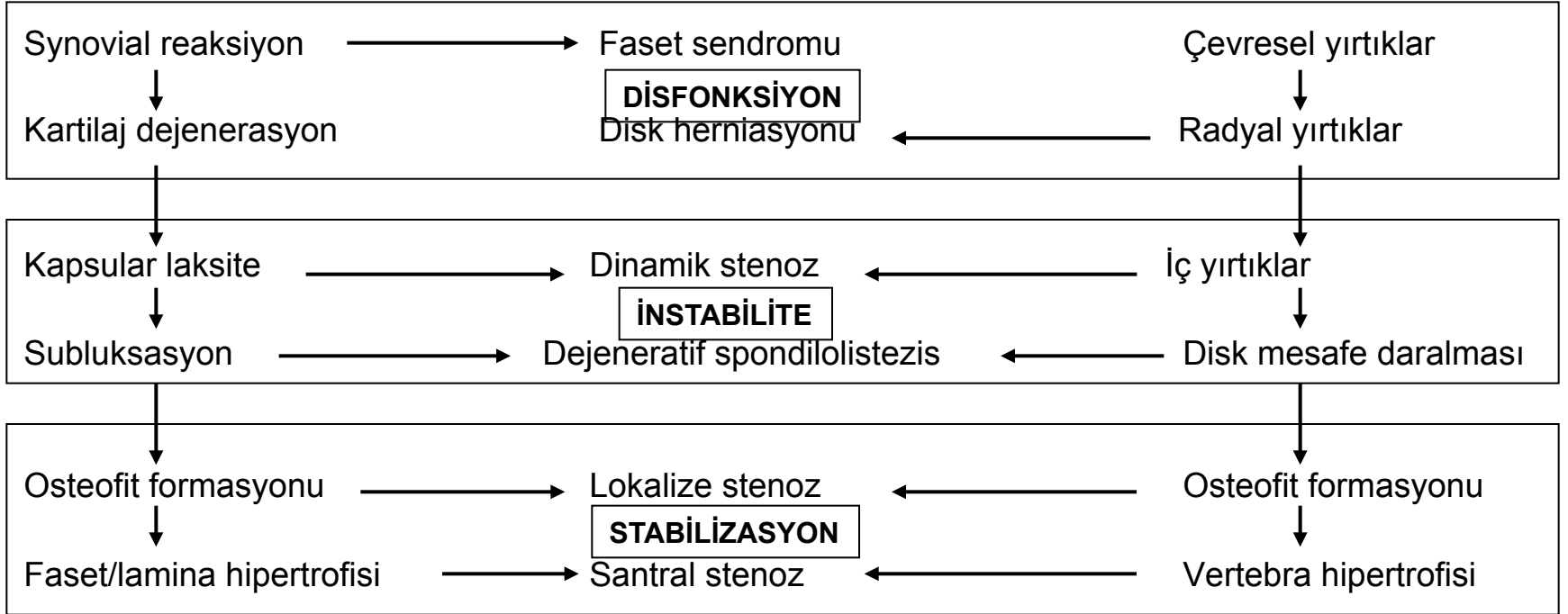


- Yağ infiltrasyonu
- PT

Dejeneratif Kaskad

Faset

Disk/Annulus



SPONDİLOZİS

Konuřmanın slaytları

www.hakanbozkus.com

Teřekkür ederim