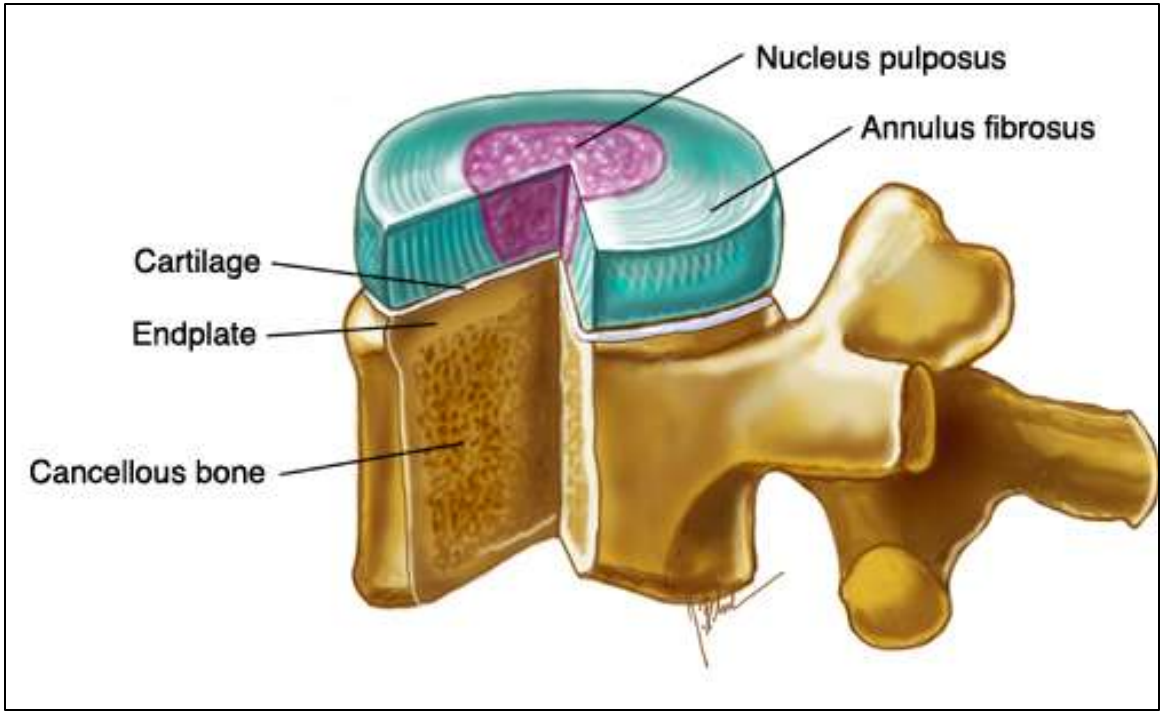
Total disc replacement

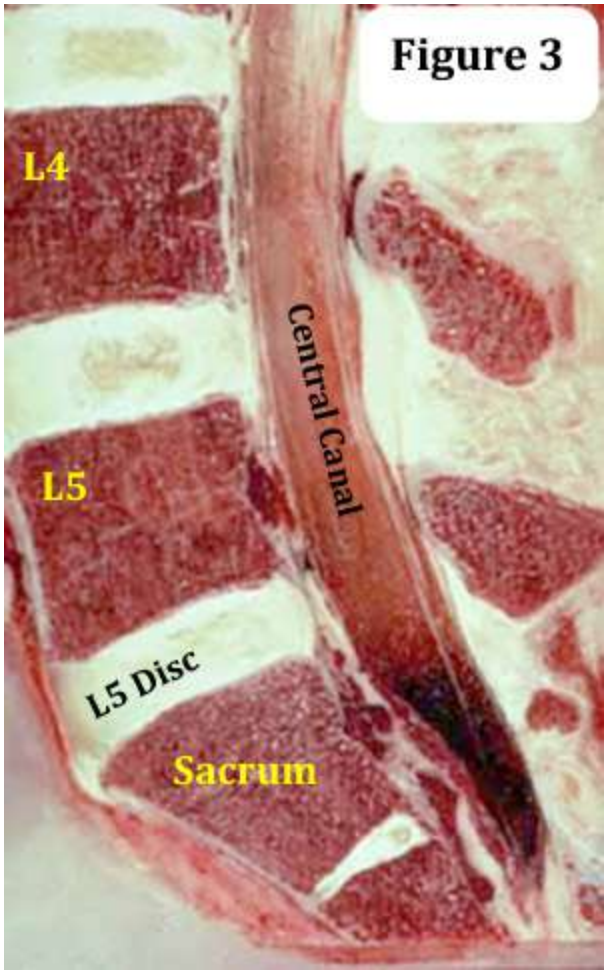
Dr. VishnuPrasath

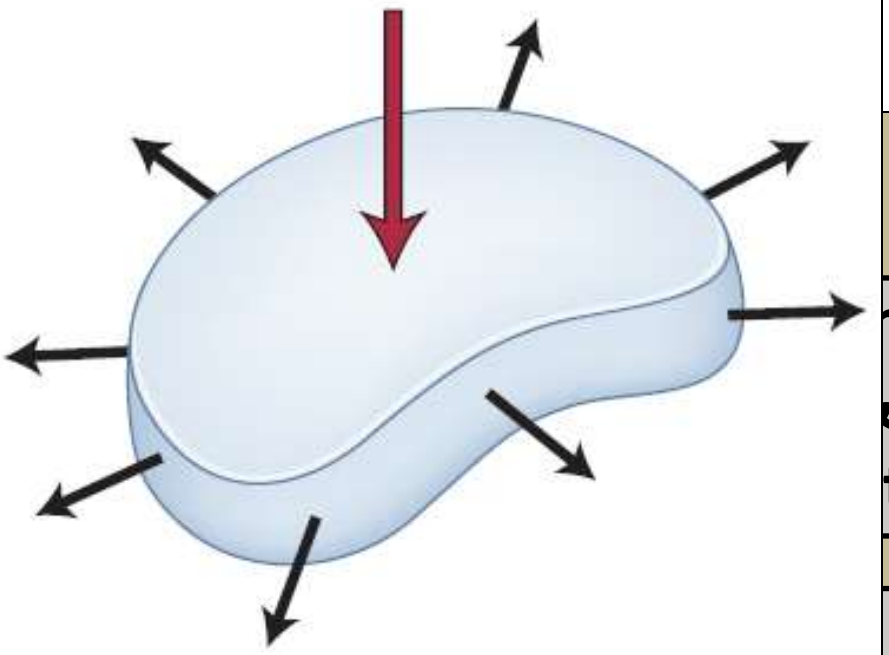
Consultant spine surgeon

SKS Hospitals – Salem, Tamil nadu .

Lumbar Disc







Nucleus

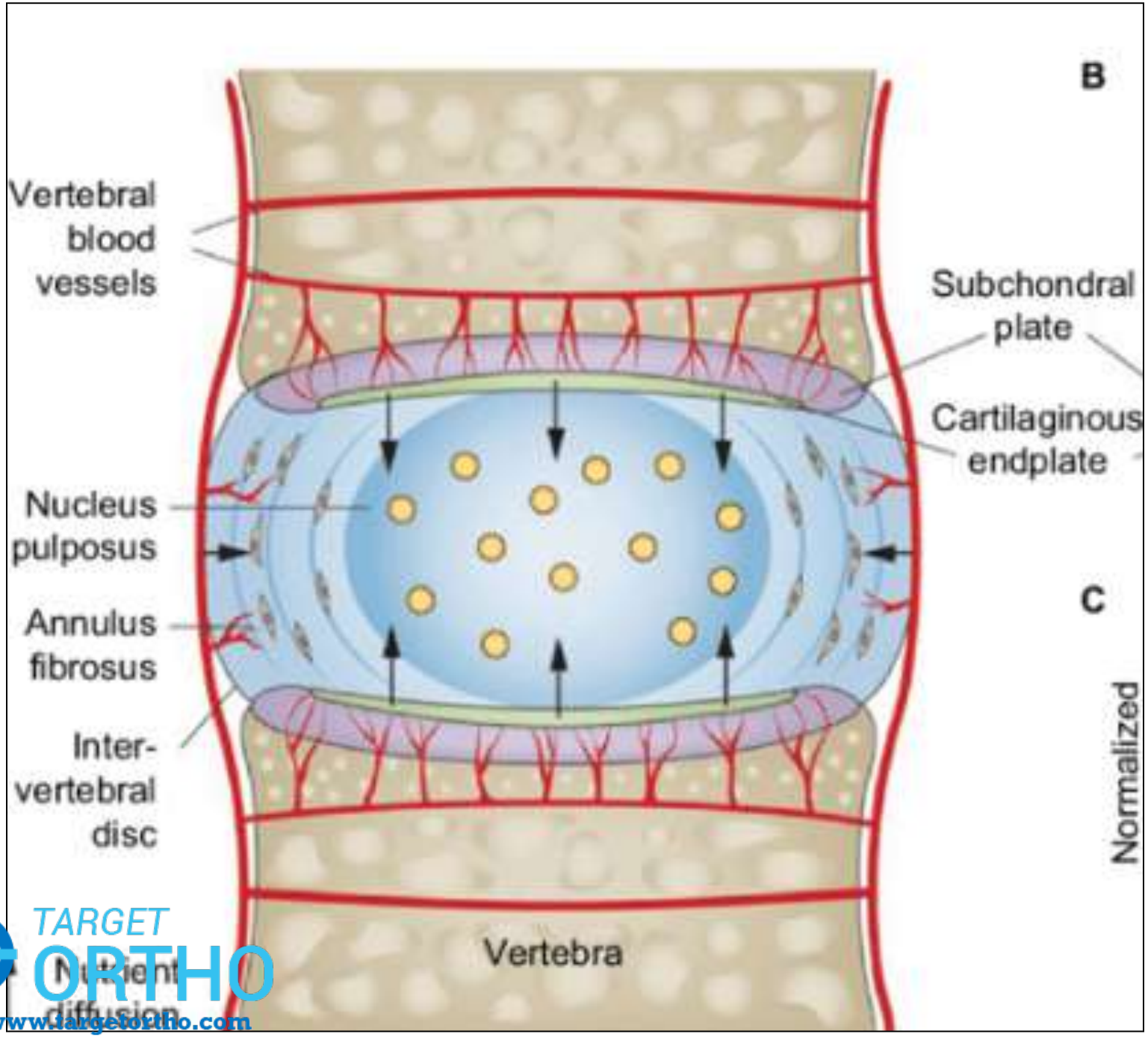
ts

Proteoglycans (glycosaminoglycans) & chondrocytes

Resists tension & expands circumferentially

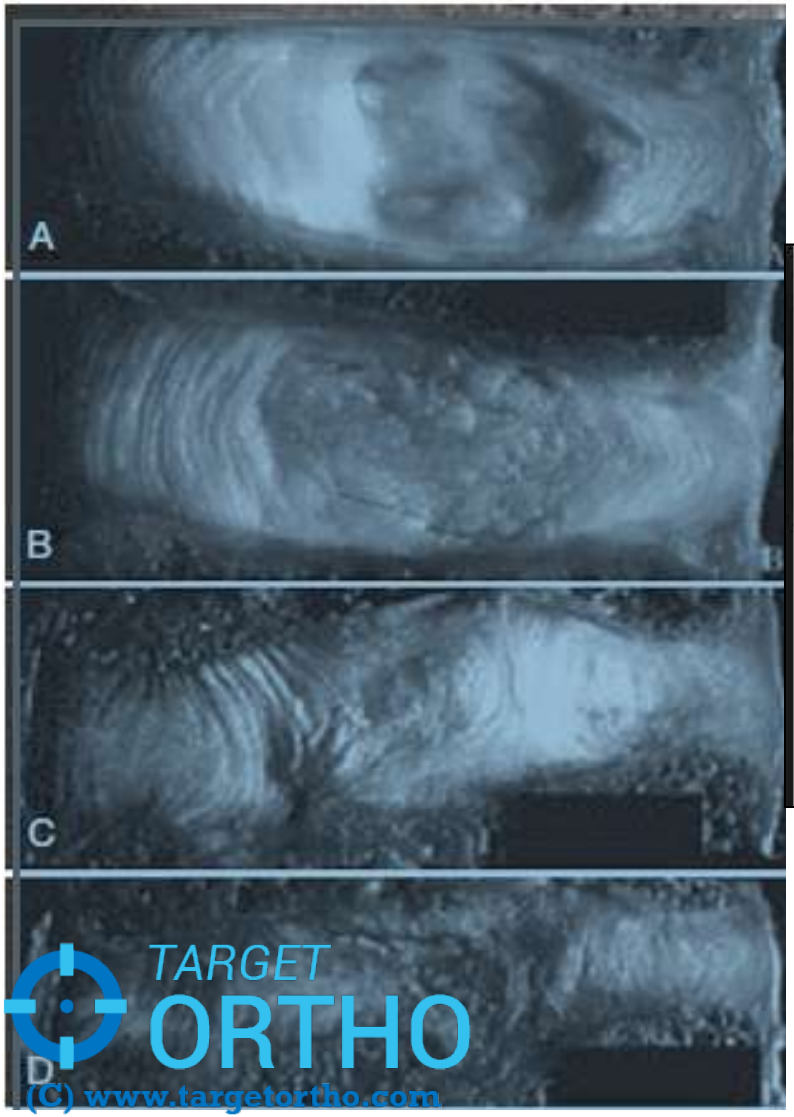
Glycosaminoglycans- hydrophilic .

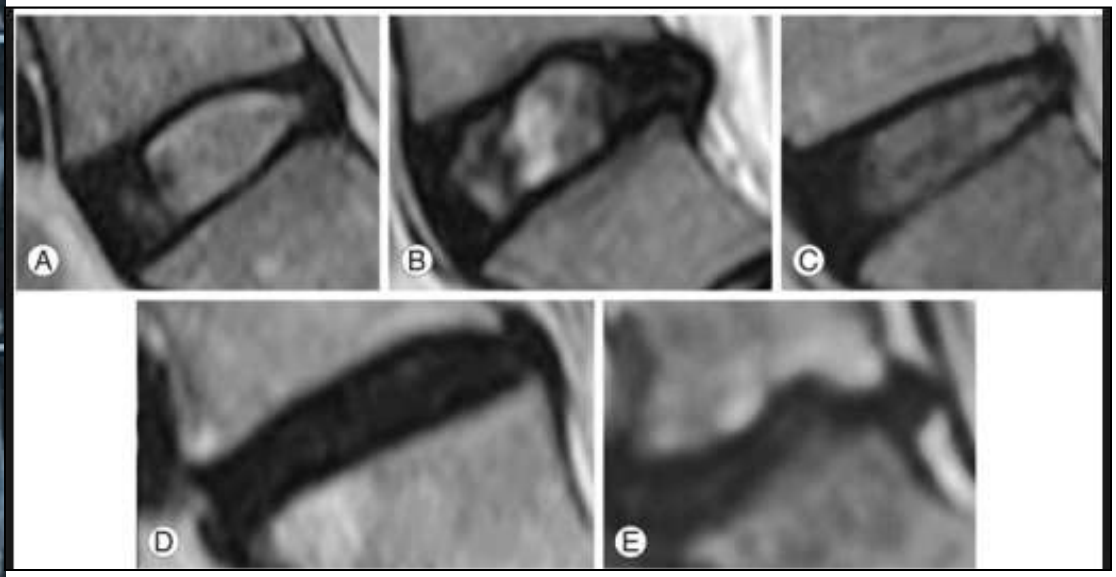
Receives the axial load & converts into radial force

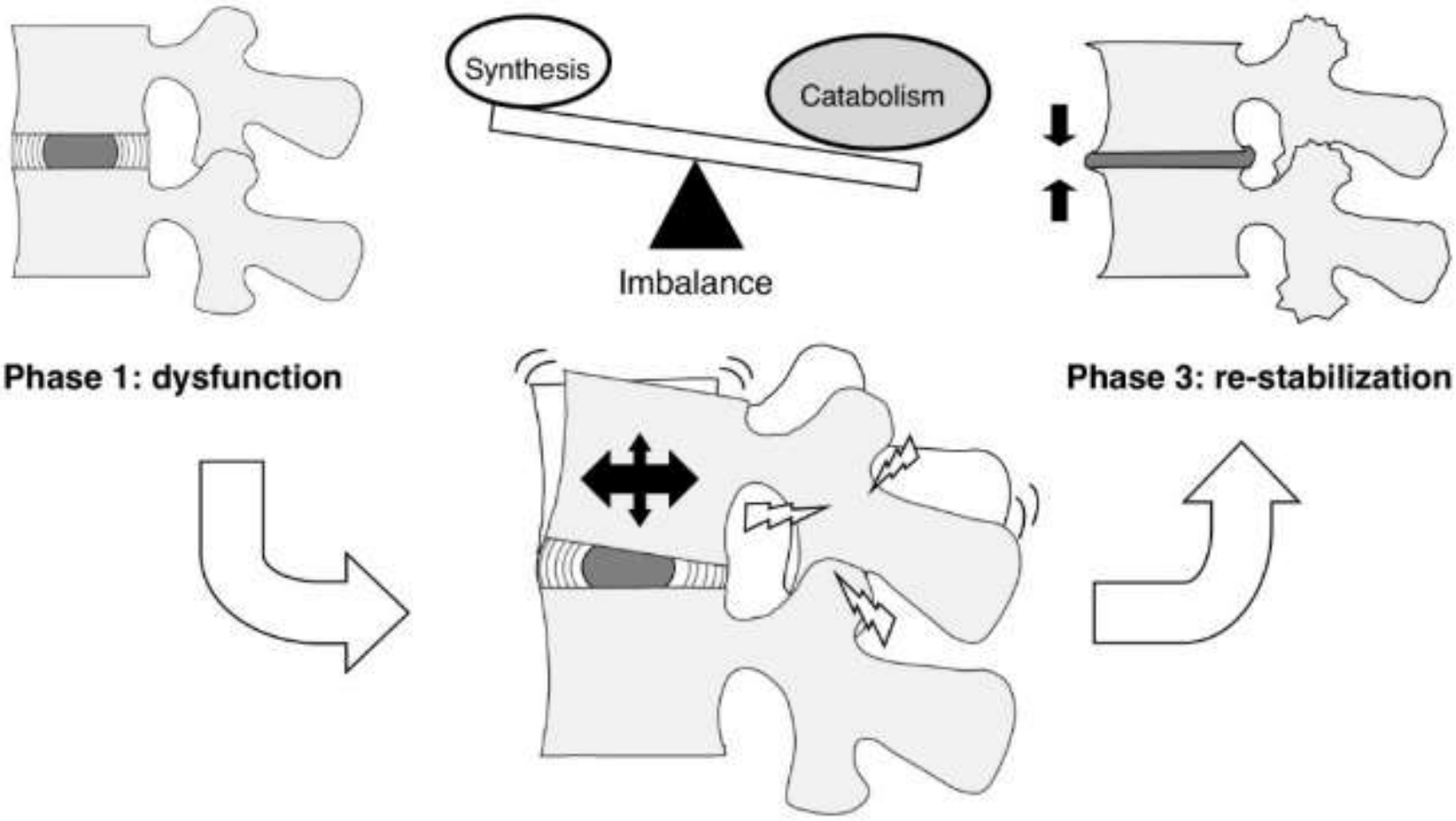


Disc degeneration

Disc degeneration
Pfirmanns grading



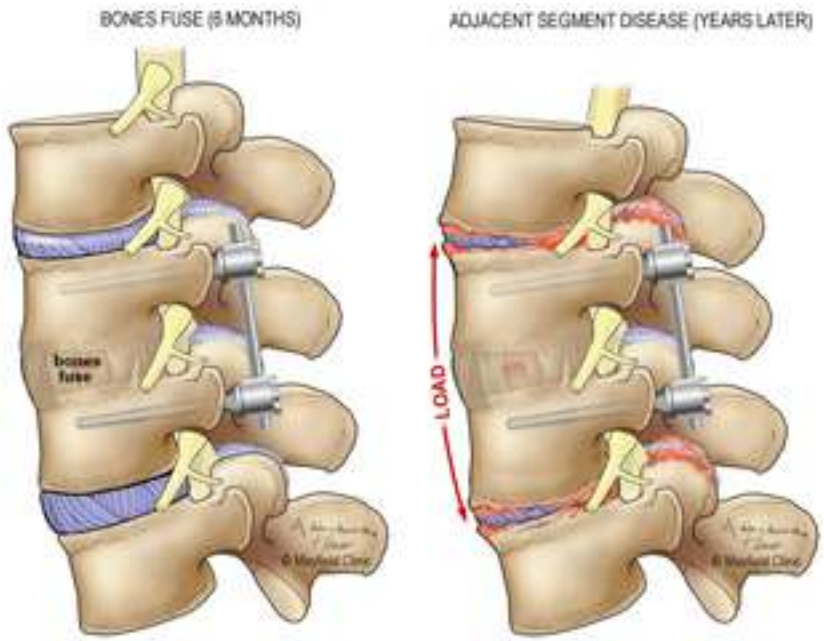




Instability

Adjacent segment disease

- 10% - within 10 years after index lumbar fusion – Sx for ASD
- >60 years - another independent risk factor.
- Surgeons should carefully consider these factors at the time of surgical planning of lumbar fusion.



Origins of back pain in DDD

Disc - chemical factors from degenerated nucleus →
Nociceptive nerve endings within AF and/or DRG

Abnormal load transfer

Theoretical mechanism of pain relief after TDR

"based on a blending of both mechanical and chemical pathomechanisms"

- Two crucial components are
  - Complete excision of the nucleus
  - Restoration or improvement of normal intervertebral mechanics.

Spinal arthroplasty

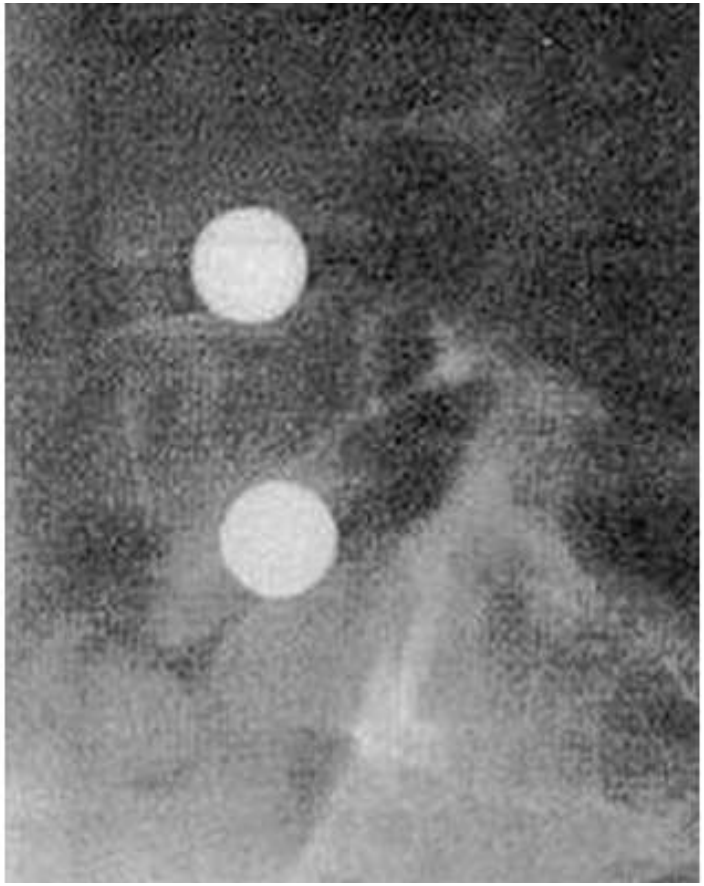
- Temporally and technologically → lagged behind TJA

Fernstrom's steel balls –

"approximately same time of Charnley's total hip prosthesis emerged."

Nachemson(1950's)

injecting a silicone rubber device into discs.



Characteristics of the Ideal Total Disc replacement

1. • Restore **normal physiologic motion**
2. • Device that transmits and absorbs loads
3. • Device that allows translation
4. • Restores disc and foraminal height
5. • Modular design
6. • Stable device that allows for **bony ingrowth**
7. • Biocompatible
8. • Durable

- Non-constrained designs
  - do not require perfect centering
  - impose greater stress on the posterior joints.
- Constrained designs
  - Requires excellent stability and thus perfect anchorage.
- Semi-constrained designs
  - stable, since translation is exerted within the nucleus, increasing with the nuclear radius

Indications for Lumbar TDR

Wong et al.

"Ideal TDR patient is likely earlier in the Kirkaldy-Willis degenerative cascade than a fusion patient"

- The primary indication for lumbar TDR - **Symptomatic DDD.**

Inclusion Criteria for Lumbar Total Disc Replacement

1. • Severe discogenic low back pain who have failed prolonged nonsurgical management
2. • Males or females with VAS 4 and a Oswestry score 40%
3. • Age 18 to 60 y (optimally below age 50 y)
4. • Must have objective evidence for symptomatic degenerative disc disease or lumbar spondylosis

Contraindications

1. • Spondylolisthesis
2. • Spondylolysis
3. • Posterior element disease (facet joint arthritis or previous facet joint resection)
4. • Central or lateral recess stenosis
5. • Fixed deformity
6. • Infection
7. • Osteoporosis
8. • Herniated nucleus pulposis with radiculopathy

Investigating a patient for TDR

1. MRI- for diagnosing DDD
2. CT- Facet arthritis
3. Xray- dynamic x-rays to r/o instability
4. DEXA scan -TDR be avoided in patients with T-scores <-2.
5. Provocative discography - DDD.
   - Failed nonoperative treatment
   - X-rays and MRI show now other obvious pathologies.

Psychosocial and psychological factors

- More impact on back pain disability
- Depression, anxiety, self-perceived poor health, and sexual and/or physical abuse
- Significantly affect surgical outcomes.

TDR Design and Material

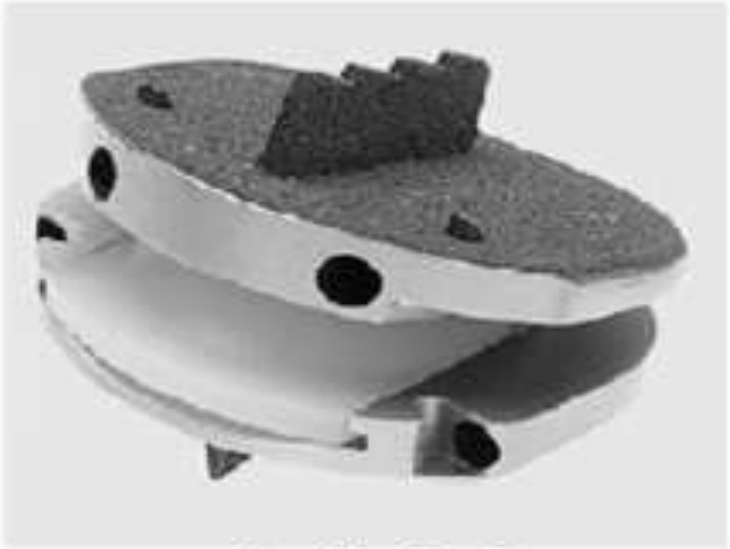
Lemaire et al.

> "disc prosthesis is indicated particularly in situations where restoration of a center of rotation and redefinition of segmental kinematics are required."

- Current designs- disc height restoration, intervertebral angle, and varying degrees of motion and stability.

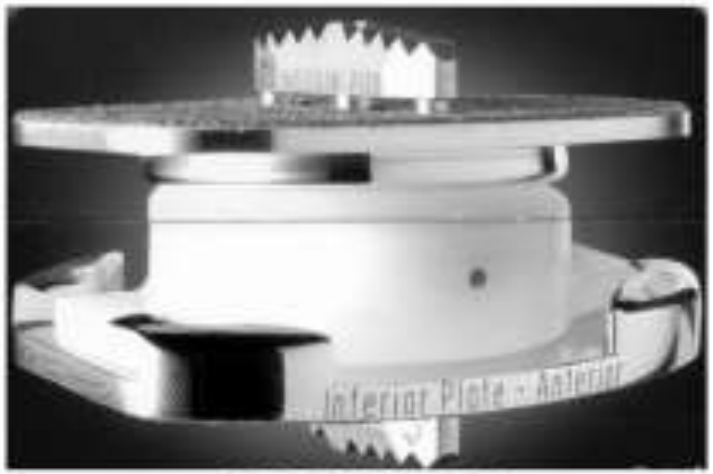
LTDR

SB Charité ®



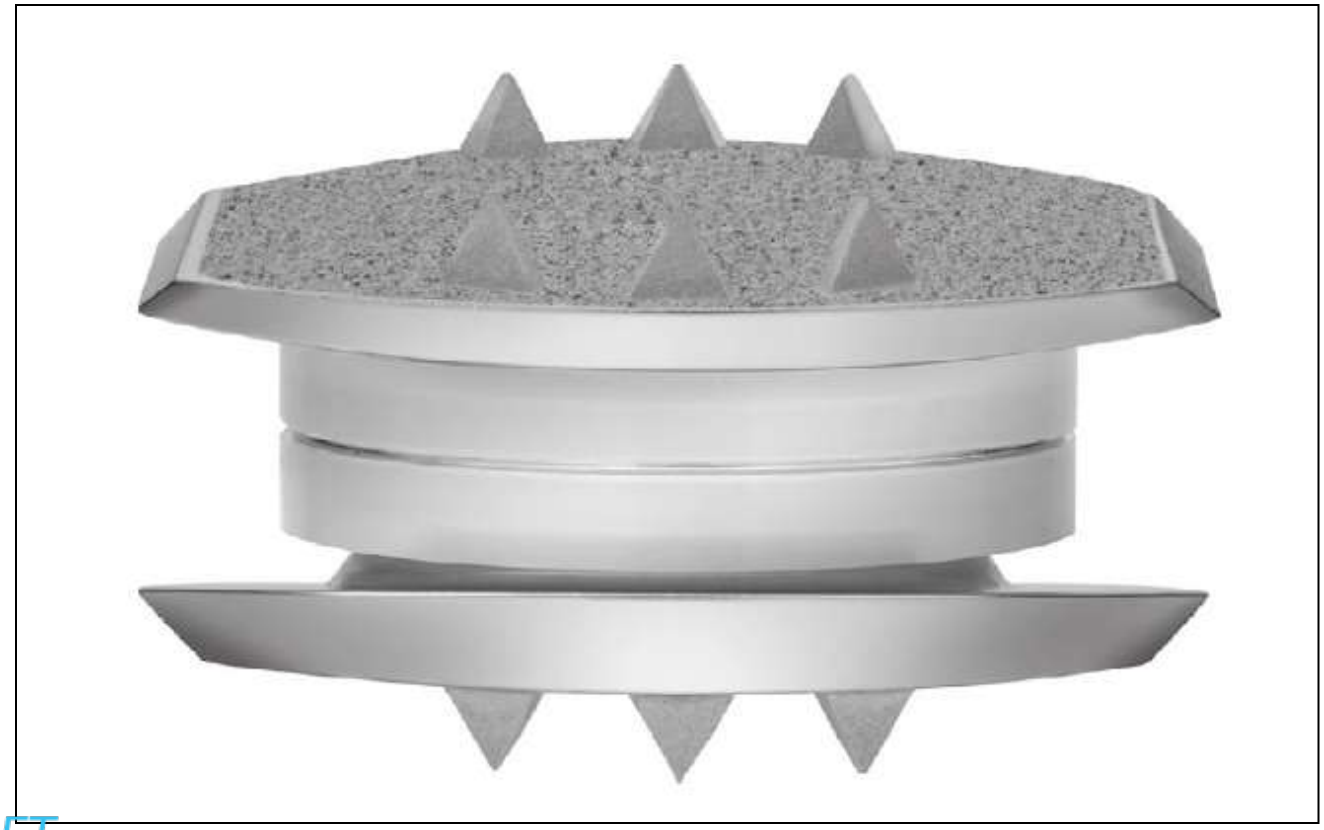
Prodisc L ®

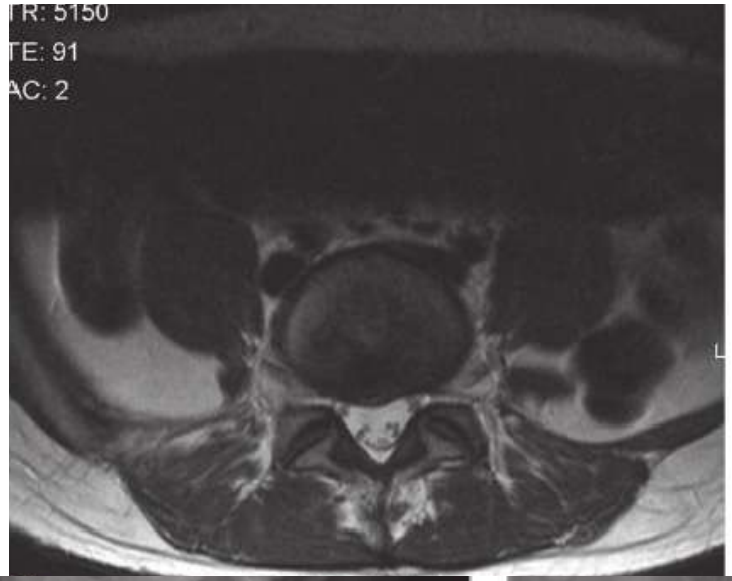
Maverick ®



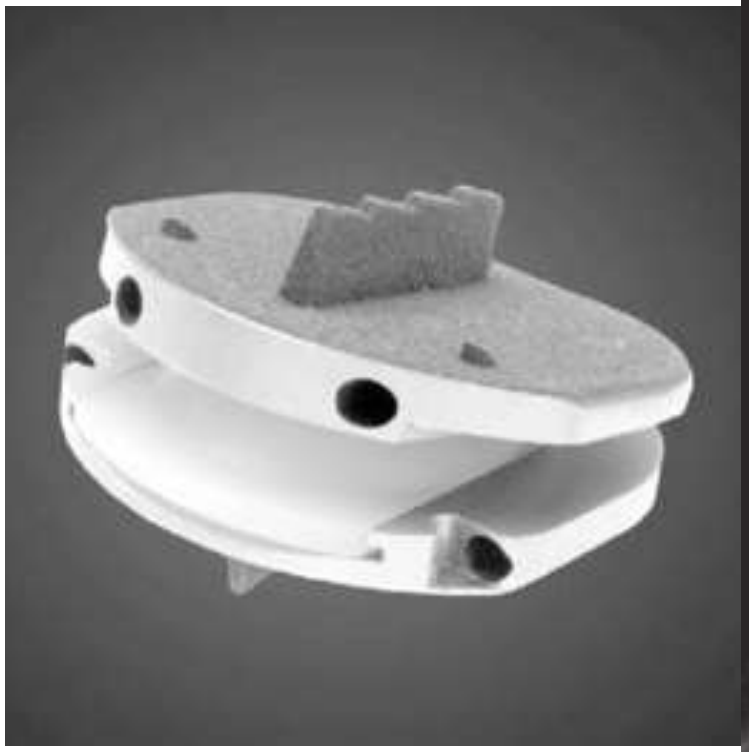
Mobidisc ®

Charite artificial disc





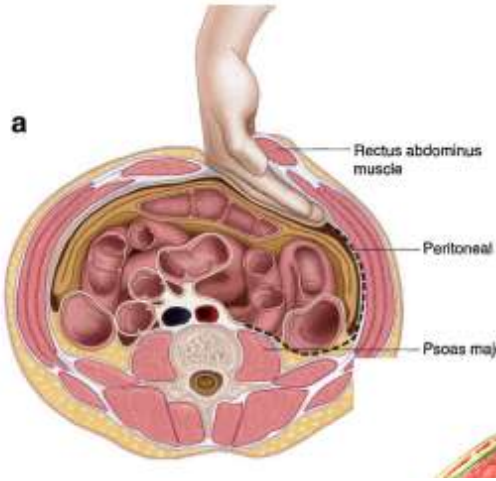
Prodisc -L



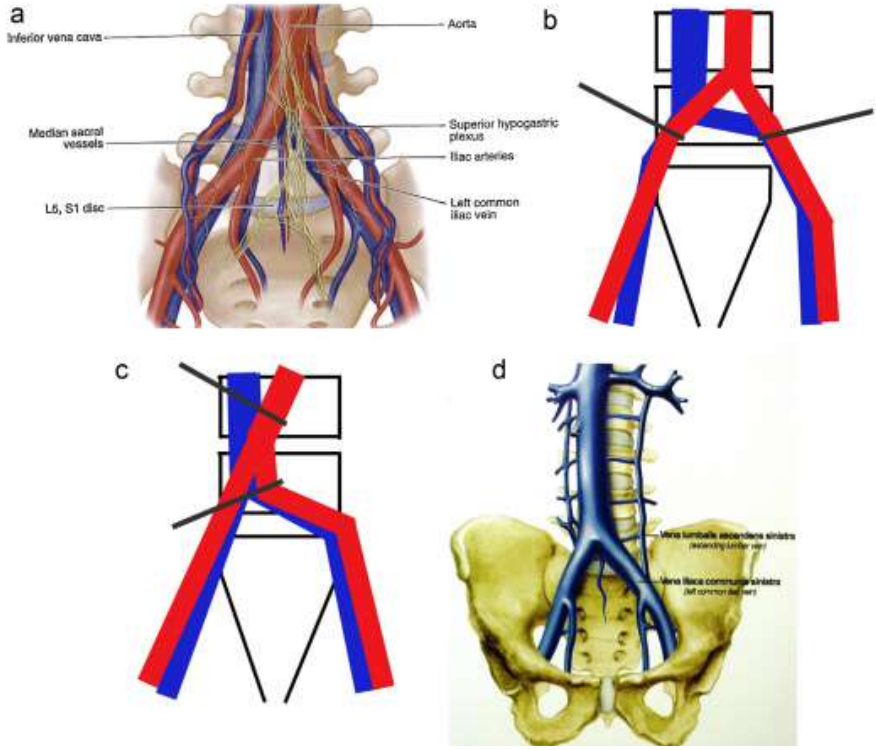
Maverick Metal on Metal TDR

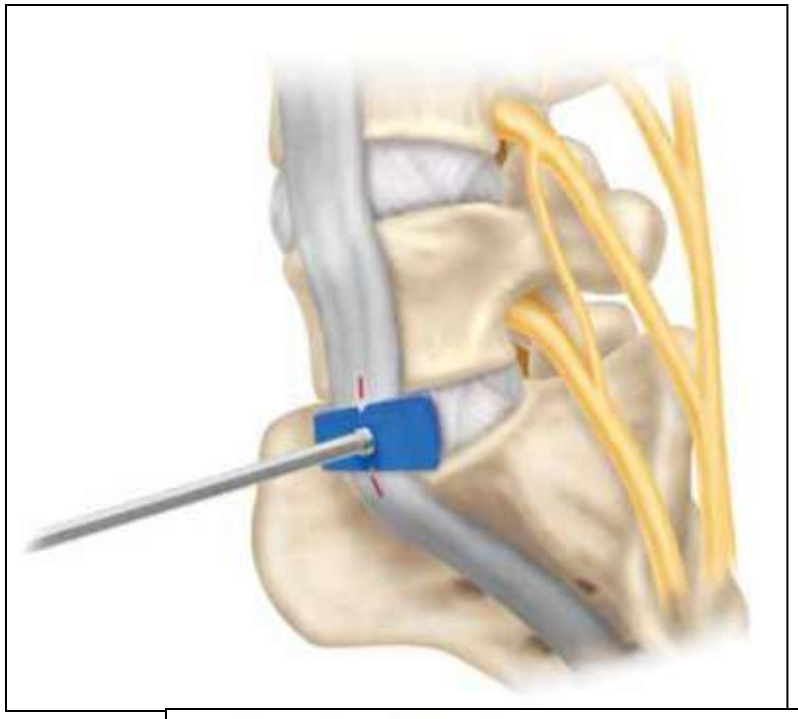
Surgical technique

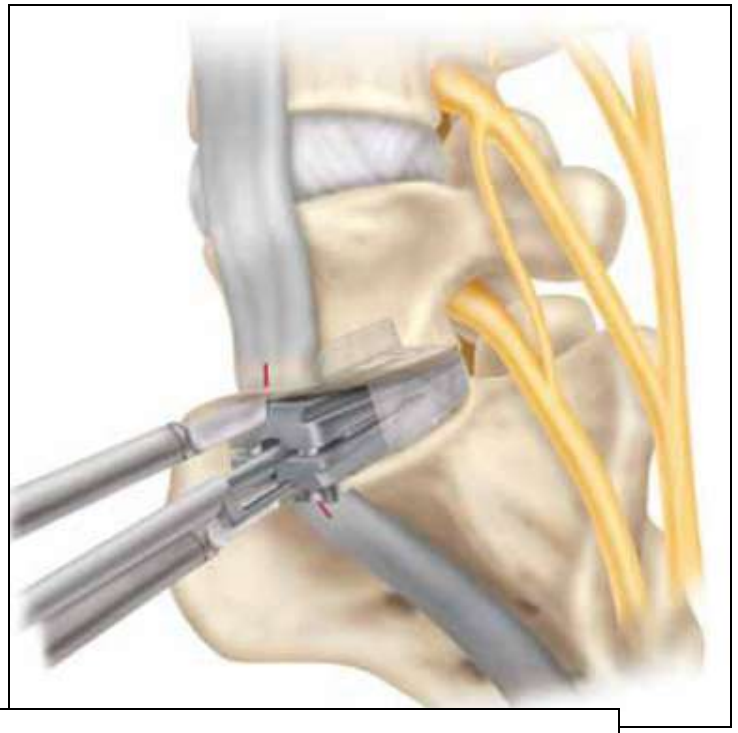
- LTDR and CTDR – “Anterior approach”

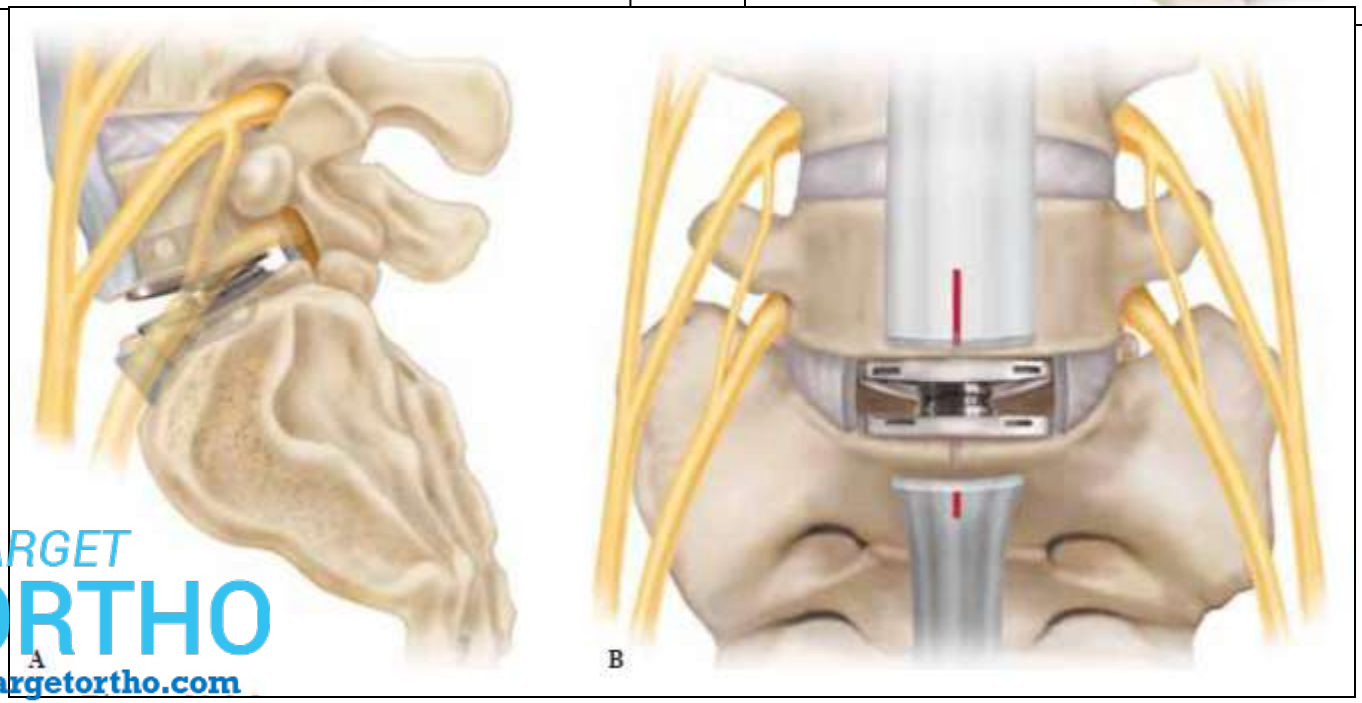


- LTDR:
  - “French position”







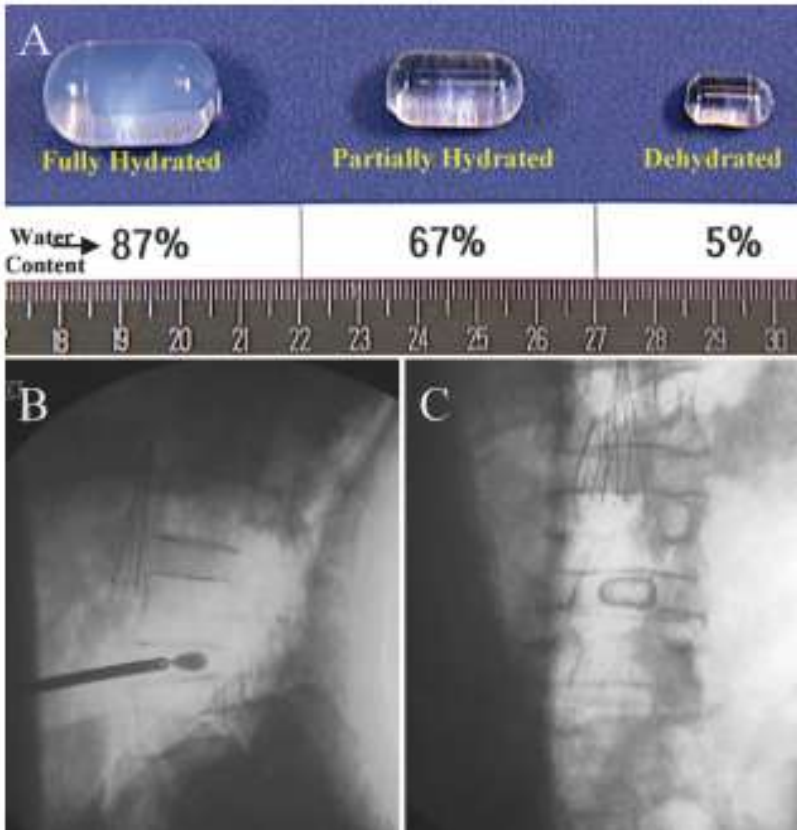


Complications

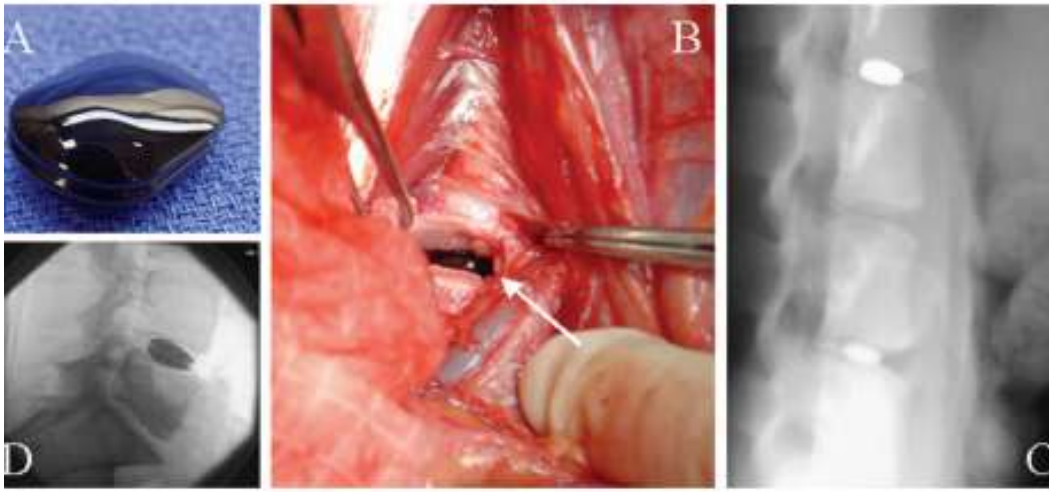
- 1.Approach

- 2.Revision surgery

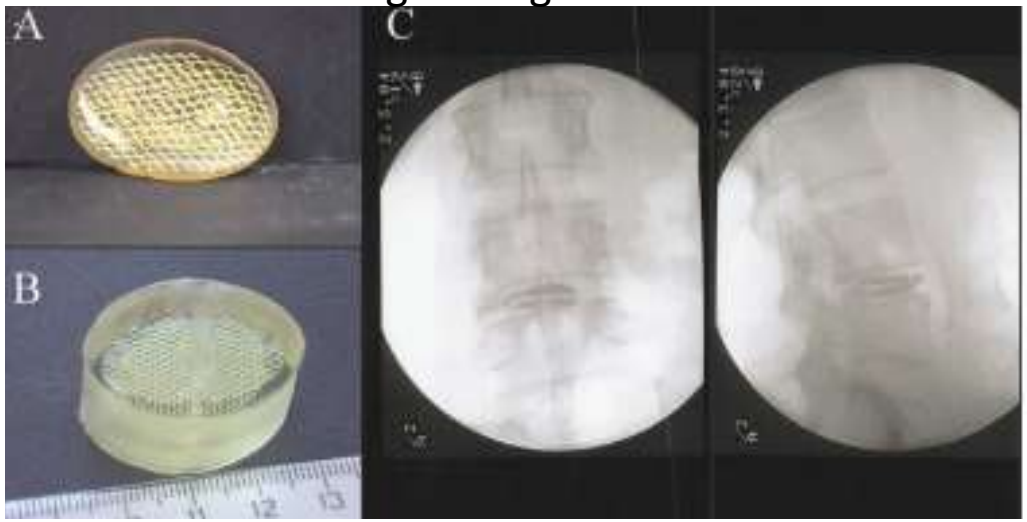
Nucleus implantation



Aquerelle Poly(vinyl alcohol) hydrogel



EBI Regain: rigid device

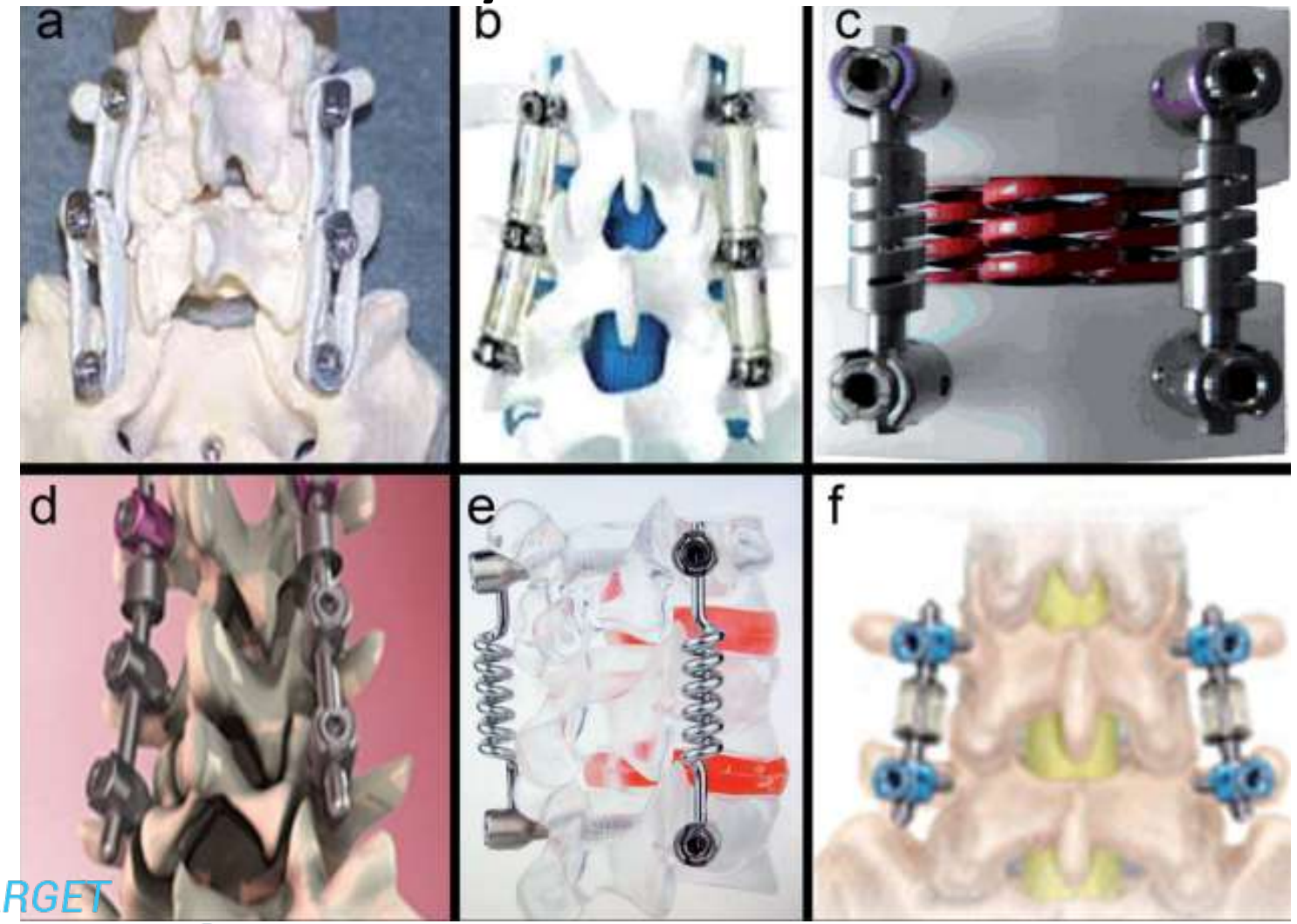


Neudisc hydrogel

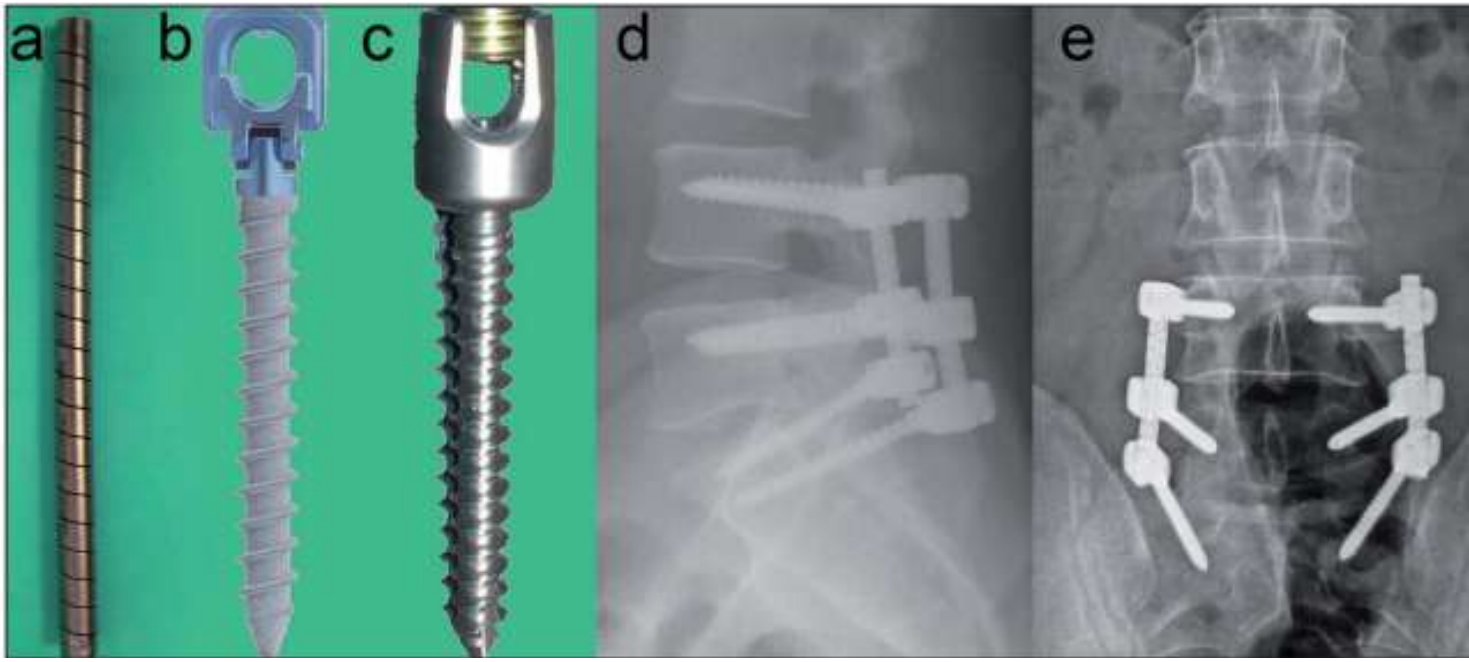
Nucleus replacement

- Tissue preserving
- Simpler
- Posterior approach
- Rely on the function of annulus and endplates
- Extrusion

Posterior Dynamic stabilization

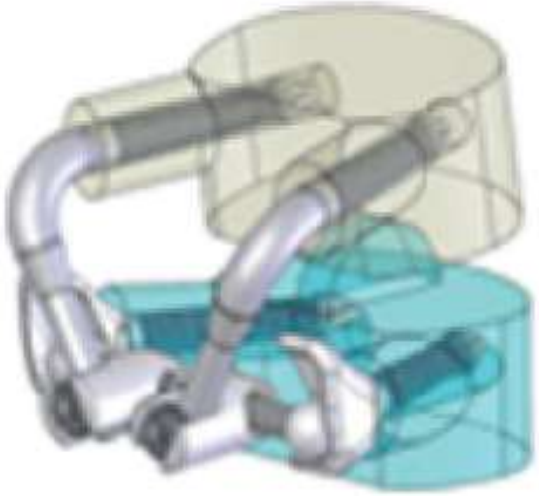


Posterior transpedicular stabilization: A) Graf system, B) Dynesys, C) Talin rod, D) Scient'X Isobar, E) Bioflex, F) CD horizon Agile.



Dynamic Rod-Dynamic Screw: A) Dynamic rod, B) Cosmic screw, C) Safinaz screw,

Total posterior arthroplasty system (TOPS).



Total Facet Replacement Device

Interspinous Stabilization: Wallis system,

Posterior dynamic stabilisation

- Motion preservation
- Prevents abnormal motion
- Prevention of iatrogenic instability after decompression
- Stabilisation of adjacent segment