Disc replacement or fusion

What is the difference?

Ulrich Hähnle, MD, PhD
Cell: 083 407333
E-mail: hahnleu@mdh-africa.org
Website: www.ulrichhahnle.com
www.kineflex.co.za
TDR versus Fusion

Indications: lumbar total disc replacement (TDR)

- Over 600 lumbar TDRs on around 450 patients TDR performed

- **Indications:**
  - 18 – 60 years old
  - Single or double level DDD
  - Positive discogram
  - Good bone density
  - Primarily LBP

- **Contraindications:**
  - Facet arthritis
  - Spinal stenosis
  - Non-contained herniation
  - Previous fusion
  - Leg pain > LBP

- **Our own indications are quite different**
  - >25 – > 60 years old
  - Degenerative listhesis
  - Advanced facet arthritis
  - Previous fusion
  - discogram unreliable

  thoracic kyphosis > 55-60 degrees
  flexible thoraco lumbar kyphosis
  poorly aligned fusion
TDR versus Fusion
What are the advantages?

- Maintain motion
- Decrease of stress on the other discs
- Restore spinal lordosis (backwards curve of spine)
- Open up exit foramina without direct interference with nerve roots
- Reduced risk of nerve root damage
- Avoidance of posterior muscle damage
- Potential decrease of Adjacent Segment Disease (ASD)
- Reduction of blood loss
- No risk of non-union
- Single approach surgery from the tummy
TDR versus Fusion
What are the disadvantages?

- Motion may cause pain
  - Facet degeneration
  - Hypermobility (increased motion)
- Nerve root decompression indirect without direct vision of nerve roots
- Dangers of anterior approach
  - Vascular and other abdominal organ damage
  - Higher risk in revision (repeat) surgery
- Long term results less well known
- Indications are more limited than for fusion surgery
- Salvage surgery might be more difficult
- Shock absorption and motion pattern are not like in a natural disc
TDR versus fusion surgery
How does surgery affect balance?

Anterior Cage or Prothesis
Adjacent discs balanced

Fusion

Disc replacement
Adjacent discs balanced
Anterior Cage or Prothesis

Pain

Disc replacement in degenerative spondylolisthesis (DSPL)

46 y old aircraft engineer
Disc replacement in degenerative spondylolisthesis (DSPL)
46 y old aircraft engineer

3 years po
Disc replacement in degenerative spondylolisthesis (DSPL)

Is Degenerative Spondylolisthesis a Contraindication for Total Disc Replacement? Kinetflex Lumbar Disc Replacement in 7 Patients With 24-Month Follow-up

Ulrich R. Hähnel, MD, FCS (Ortho),*‡ Karen Sliwa MD, PhD,* Malan de Villiers, PhD,*
Ian R. Weisberg, MD, FCS (Neuro),* Barry M.B.E. Sweer, MD, PhD* and Geoffrey P. Candy, PhD*

ABSTRACT

Background
Degenerative spondylolisthesis is associated with a significant segmental kyphosis at the level of the listhesis. We treated 7 disc spaces with Grade 2 listhesis and/or kyphosis of the slipped disc level with Kinetflex disc replacement.

Methods
Out of a single-center prospective registry, involving 310 lumbar disc replacement patients, 7 patients underwent a single-level Kinetflex disc replacement at the level of a degenerative spondylolisthesis with either segmental kyphosis or a Grade 2 slip.

Preoperative and follow-up radiological parameters studied were pelvic incidence, pelvic tilt, sacral slope, lumbar lordosis L1-S1, degree of segmental listhesis, segmental lordosis, and range of motion (ROM). Clinical outcome measures were Visual Analog Scale pain score (VAS), Oswestry Disability Index (ODI), and patient satisfaction.

Results
Five replacements were performed at the L4-L5 level, and 2 were performed at L3-L4 level above a pre-existing L4-L5 posterior lateral fusion. Mean age was 50 (32-62) years. Average follow-up was 23.8 ± 13.1 months. Six of 7 patients considered their outcome as good or excellent. The mean VAS score decreased from 8.4 ± 1.9 to 2.7 ± 2.2 (P < .01). The ODI decreased from 45.2 ± 9.9 preoperatively to 17.7 ± 12.8 (P < .01).

There were increases in lumbar lordosis (from 47.4° ± 10.6 to 61.3° ± 8.0 (P < .03)), in segmental lordosis (from 0.17° ± 7.0° to 16.4° ± 2.0° (P < .03)), and in sacral slope (from 34.9° ± 4.8° to 40.7° ± 4.5° (P < .03)). There were decreases in pelvic tilt (from 22.6° ± 6.3° to 15.5° ± 5.9° (P < .03)), and degree of segmental listhesis (from 24.4% ± 7.7% to 3.7% ± 3.4% (P < .03)). Pelvic incidence and ROM did not change.

Conclusions
Disc replacement resulted in significant improvement in clinical outcome and excellent sagittal balance and slip correction. However, the influence of improved sagittal spinal alignment on clinical outcomes needs to be investigated in larger studies including a control group.

Clinical Relevance
This study is the first focused on disc replacement in degenerative spondylolisthesis.

Key Words: Spondylolisthesis, total disc replacement, radiological outcome, clinical outcome. SAS Journal. Spring 2008;242–100. DOI: SASJ-2007-0125-NT

*University of the Witwatersrand, Johannesburg, South Africa; ‡Linkfield Park Clinic, Johannesburg, South Africa; §University of Pretoria, South Africa

Address correspondence to Ulrich R. Hähnel, University of the Witwatersrand, PO Box 52060, Saxonwold 2131, Johannesburg, South Africa.
Disc replacement in DSPL

Baseline characteristics

- 7 patients.
- Grad 2 DSPL and/or segmental kyphosis.
- Mean age: 50 years (32-62 years).
- 5 female, 2 male.
- Previous fusion: n=2 (L4-S1 fusions)
- Presenting symptoms:
  - Spinal stenosis: n=5
  - Mechanical LBP + leg pain: n=7
Disc replacement in DSPL

Operative technique
Disc replacement in DSPL

Clinical outcome

Fig 3: Patients VAS and ODI score pre-op and at last follow up
Disc replacement in DSPL + previous fusion

Case 2: Fusion in poor balance
Disc replacement in DSPL + previous fusion

Case 2: Fusion in poor balance
Disc replacement after fusion surgery

Lumbar Disc Replacement for Junctional Decompensation After Fusion Surgery: Clinical and Radiological Outcome at an Average Follow-Up of 33 Months

Ulrich R. Haiduk, MD, FCS (Ortho), Karen Sivas, MD, PhD, Ian R. Wormald, MD, FCS (Neuros), Barry MBE Streets, MD, PhD, Malan de Villiers, PhD, and Geoffrey Elsandy, PhD

ABSTRACT

Background
Failed fusion surgery remains difficult to treat. Few published data on disc replacement surgery after failed fusion procedures exist. Our objective was to evaluate outcomes of junctional lumbar disc replacement after previous fusion surgery and to correlate outcome with radiological changes in parameters of sagittal balance.

Methods
Out of a single-center prospective registry of 299 patients with 406 lumbar disc replacements, 27 patients had had a previous lumbar fusion operation on 1 to 4 lumbar segments and had completed a mean follow-up of 33 months (range, 18–50). We correlated the clinical outcome measures (patient satisfaction, 10-point pain score, Oswestry Disability Index (ODI) score) with parameters of spinal sagittal alignment (sagittal tilt, pelvic tilt, pelvic incidence, and lumbar lordosis).

Results
Postoperative hospital stay averaged 3.3 days (range, 2–8). Previously-employed patients went back to their jobs with a mean of 32 days (range, 21–62) after the procedure. At the latest follow-up, 1 of the patients considered the outcome to be poor, 3 fair, 8 good, and 15 excellent. Twenty-four patients “would undergo the operation again.” Average pain score decreased from 9.1 ± 1.0 (SD) to 5.2 ± 2.4 (p < .01). Average ODI decreased from 50.2 ± 9.9 preoperatively to 21.7 ± 14.2 (p < .01). We found the change in pelvic tilt to be an independent predictor of better clinical outcome by multivariate analysis (p < .05).

Conclusions
In patients with junctional failure adjacent to a previous protruded fusion, disc replacement at the junctional level(s), compared with osteotomy and fusion surgery, offers the advantage of maintaining segmental mobility and correcting the flat-back deformity through a single approach with less operative time and blood loss. Early- to intermediate-term results are promising. The influence of changes in spinal sagittal alignment on clinical outcome needs to be addressed in future research.

Clinical Relevance
This is the first study on “junctional disc replacement patients” correlating clinical outcome to changes in spinal/pelvic alignment.


INTRODUCTION
Failed fusion surgery patients are difficult to treat. Adjacent disc decompensation with spinal stenosis and pain at the junctional levels are known sequelae after fusion surgery.1,2 Although the association is not universally accepted, previous fusion and lumbar flat-back deformity seem to contribute to low-back pain and accelerated wear of the adjacent motion segments.1,2,3,4 Symptoms arising from loss of sagittal spinal alignment after previous fusion surgery remain therapeutically challenging, and long-term treatment results are satisfactory at best.5,6,7 Because of the associated lumbar spinal flat-back deformity, extensive surgery with combined dorsal-ventral-dorsal, ventral-dorsal, or posterior osteotomy approaches, including an extension of the fusion, are usually applied as salvage procedures for these patients.5,6,7 These procedures entail long surgery time with extensive blood loss and dangers to the spinal canal and nerve roots. Artificial disc replacement in this patient group offers a promising alternative to extensive
TDR versus Fusion
What do we know?

- Easier to restore spinal balance through anterior approach
- Nerve root decompression indirect with limited direct vision of nerve roots
  - Less scaring around nerve roots
- Dangers of anterior approach
  - Vascular and other abdominal organ damage
  - Higher risk in revision surgery
- Decrease of ASD - not finally proven
- No risk of non-union - potential risk of endplate loosening
- Long term results less well known
- Indications are more limited than for fusion surgery
- Salvage surgery might be more difficult
- Shock absorption and segmental motion are close to - but not equal to a natural disc
  - Elastic disc prostheses have not been proven
TDR versus Fusion

Conclusion

- Indications and Contraindications for TDR have not been finally determined

Ulrich Hähnle, MD, PhD
Cell: 083 407333
E-mail: hahnleu@mdh-africa.org
Website: www.ulrichhahnle.com
www.kineflex.co.za