

Proximal Junction Kyphosis (PJK): Risk Factors & Treatment Options

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Disclosures

- Consultant - DePuy Synthes Spine, Zimmer Biomet, Amenia, Stryker
- Stock - Vivex
- Royalties - Zimmer Biomet



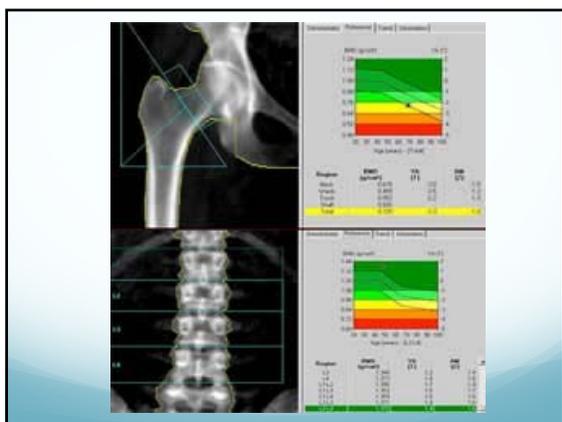
Adult Spinal Deformity: Epidemiology, Health Impact, Evaluation, and Management

Christopher P. Ames, MD^{1,2}, Justin K. Schoro, BS¹, Virginia Lafage, PhD¹, Justin S. Smith, MD, PhD¹, Shay Bess, MD¹, Sigurd H. Berven, MD¹, Gregory M. Mendia, MD¹, Rajiv K. Sethi, MD¹, Donald A. DeWolfe, MD¹, Jeffrey D. Cos, MD¹, Lloyd A. Hey, MD¹, Michael D. Drab, MD¹

- The US population is expected to grow by 9.5% between 2013 and 2025 based on the US Census Bureau.
- Population aged 65 and older projected to grow nearly 45%.
- The prevalence of adult scoliosis in the general population - up to 32%.
 - As high as 68% in the older population.
- Using current prevalence estimates, there are approximately **27.5 million elderly people with some form of spinal deformity**, and with the high rate of growth, this brings the number of **older adults with some spinal deformity to more than 60 million by 2050**.
- **Increasing age correlates with decreasing bone mineral density (BMD).**

Pre-Op Planning

- Standing full-length 36" scoliosis x-rays
- MRI
- CT
- DEXA



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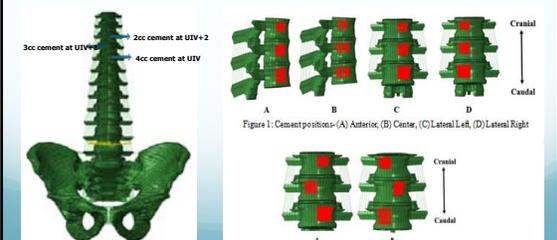
A Comparison of Lateral Versus Anterior-Posterior Spine Dual Energy X-Ray Absorptiometry for the Diagnosis of Osteopenia*

JOEL S. FINKELSTEIN, ROBBIN L. CLEARY, JAMES P. BUTLER, RONNELLA ANTONIELLI, BRUCE H. MITLAK, DONALD J. DERASKA, ROBERT L. ZAMORA-NUSSBAUM, AND ROBERT M. NEER
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- The association between QCT and DXA measurements was stronger when DXA measurements were made in the lateral ($r = 0.784$) or midlateral ($r = 0.823$) projection than in the AP ($r = 0.571$) projection.
- Association of BMD with age was stronger when DXA measurements were made in the lateral ($r = 0.536$) or midlateral ($r = 0.536$) projection than in the AP ($r = 0.382$) projection.
- **Lateral DXA often detected osteopenia in patients whose AP DXA was normal.**
- The 95% confidence limits for changes in BMD attributable to measurement error for AP, lateral, and midlateral DXA were 0.027, 0.038, and 0.057 g/cm³, respectively.
- **Lateral DXA measurements identify patients with osteopenia more often than AP DXA**
 - **Lateral DXA more accurately estimates trabecular bone mass.**

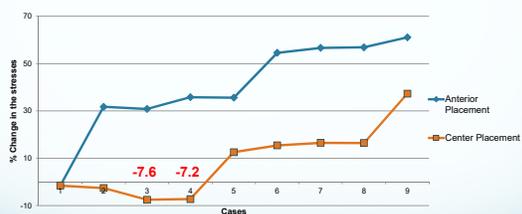
Hypothesis

- Does location and dosage of cement matter?
- Varying the location and dosage of vertebral cement will further affect endplate stresses.
 - Influence rates of VCF and possibly PJK .



Optimal Cement Dosage

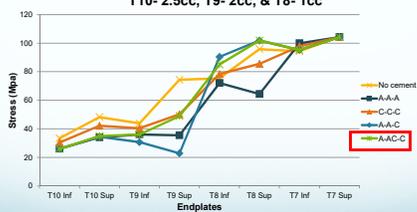
Change in Stress at T8 Sup & T7 Inf endplates for the tapered cement dosage



Case	1	2	3	4	5	6	7	8	9
T10 (cc)	0	2	2.5	3	4	4	3	4.5	5
T9 (cc)	0	1.5	2	2.5	3	3.5	3	4	4
T8 (cc)	0	0.5	1	1.5	2	2.5	3	3	3.5

Stress Values for Different Cement Location

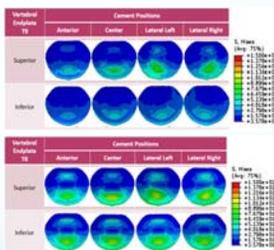
Stress for different placement of T10- 2.5cc, T9- 2cc, & T8- 1cc



Lowest Endplate Stresses: Anterior - T10, Anterior Central - T9, Central - T8

Results

- Anterior cement placement (4cc, 3cc, 2cc)
 - 26% decrease in endplate stress at T9.
 - 21% decrease at T8.
 - 2% decrease in posterior ligamentous strain at T8-T9.
 - **No increased endplate stresses at T7.**



Conclusions

- Lowest observed endplate stresses in this osteoporotic FE model
 - Cemented T10, T9, & T8
 - **Non-cemented unadulterated T7**
 - Optimal dose
 - T10 (UIV) - **2.5cc anteriorly**
 - T9 (UIV+1) - **2cc anterior central**
 - T8 (UIV+2) - **1cc central**

Predictive Factors for Acute Proximal Junctional Failure after Adult Deformity Surgery with Upper Instrumented Vertebrae in the Thoracolumbar Spine*

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Michael D. Daub³ Daniel S. Brodke¹

- 135 consecutive patients with minimum 2-year follow-up, fusions were divided into 3 cohorts based on the UIV location (T9-T10 vs. T11-T12 vs. L1-L2).
- The incidence of APJF was 38.5%, with a trend toward higher APJF in the T9-T10 group (p = 0.07)
- **UIV was at T10, the incidence of APJF was 57.1%**, significantly higher than T9 and T11 (p=0.03 and p=0.01).
 - Overall revision rate for APJF was 17%.
- **Risk factors for APJF**
 - Pre-op sagittal vertical axis > 5 cm
 - Post-op PJA > 5 degrees
 - Thoracic kyphosis > 30 degrees
 - Instrumentation to the pelvis as risk factors for APJF.
 - Greater correction of lumbar lordosis (LL)
- **PJK > 15 degrees WITHOUT fracture or hardware failure had the longest revision-free survival (2-5 years, 100%).**
- Post-op PJA > 5 degrees and greater correction of LL are independent risk factors for APJF.
- **FRacture AT THE UIV LEAD TO THE HIGHEST RATES OF REVISION SURGERY!**

PJK

- Risk factors:
 - Posterior ligaments disruption
 - High mechanical stresses due to the transition from rigid instrumentation to mobile segments (T/L junction).
 - ↑ Age
 - Sagittal deformity under / over-correction **PI = LL**
 - ↑ BMI
 - **Poor bone quality**

Conclusion

- Poor bone quality is a concern in most ASD patients due to age.
- CT scan (Hounsfield Units) vs. DEXA
- Teriparatide vs. bisphosphonates
- **Do not over-correct, particularly in patients > 55 y.o. PI = LL**
- **Prophylactic vertebral cement UIV, UIV + 1**
 - **Tapered dose UIV, UIV + 1, UIV + 2?**

- Further clinical analysis is required.
- To date:
 - 14 patients with UIV at the T/L junction
 - Mean DEXA T-score -2.6
 - Mean follow-up 32 months
 - **Tapered cement UIV, UIV + 1, UIV + 2**
 - **PI + LL +/- 10**
- **No PJK**



Thank you