**Table 1. Details of the 14 pairs of specimens tested**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Spine | Gender | Age (years) | Spinal level | | Disc Degeneration# | | BMD  (g/cm3) + | | Yield strength  (kN) | | Compressive stiffness (kN/mm) | | Fracture type | |
| C | P | C (U:L) | P (U:L) | C | P | C | P | C | P | C | P |
| 1 | Female | 87 | T9-T11 | T12-L2 | 4:4 | 3:3 | 0.075 | 0.077 | 1.5 | 1.5 | 1.60 | 0.42 | AC | EP |
| 2 | Male | 90 | T10-T12 | L2-L4 | 3:3 | 3:2 | 0.086 | 0.129 | 1.5 | 1.9 | 0.82 | 0.87 | EP+AC | EP+AC |
| 3 | Male | 79 | L2-L4 | T11-L1 | 2:2 | 3:3 | 0.298 | 0.270 | 4.7 | 5.5 | 1.49 | 2.57 | EP | EP |
| 4 | Male | 71 | T11-L1 | T8-T10 | 2:3 | 3:3 | 0.270 | 0.172 | 2.8 | 2.5 | 1.98 | 3.17 | EP+AC | EP+AC† |
| 5 | Male | 67 | T11-L1 | L2-L4 | 2:3 | 2:2 | 0.261 | 0.267 | 3 | 4.9 | 2.15 | 1.42 | EP+AC | EP+AC |
| 6 | Female | 81 | L1-L3 | T10-T12\* | 2:2 | 3:3 | 0.122 | 0.097 | 1.3 | 1.6 | 0.78 | 2.08 | EP+AC | EP+AC |
| 7 | Male | 83 | T11-L1 | L2-L4 | 3:3 | 3:3 | 0.205 | 0.175 | 2.2 | 2.9 | 1.67 | 1.39 | EP | EP+AC |
| 8 | Male | 92 | T11-L1 | T8-T10 | 4:4 | 4:3 | 0.090 | 0.089 | 1.9 | 1.5 | 1.42 | 1.24 | AC | AC |
| 9 | Female | 85 | L2-L4 | T11-L1 | 3:3 | 2:2 | 0.199 | 0.200 | 3.1 | 1.4 | 1.90 | 1.12 | EP | EP+AC |
| 10 | Male | 78 | T11-L1 | L2-L4 | 3:2 | 3:3 | 0.153 | 0.178 | 3.6 | 3.5 | 1.85 | 1.39 | AC | AC |
| 11 | Male | 76 | T10-T12 | L2-L4 | 3:4 | 3:3 | 0.138 | 0.237 | 2.0 | 2.4 | 1.45 | 0.89 | AC | AC |
| 12 | Female | 68 | L2-L4 | T11-L1 | 2:2 | 2:2 | 0.162 | 0.136 | 3.2 | 3.8 | 1.25 | 2.14 | AC | EP+AC |
| 13 | Male | 83 | T10-T12 | L1-L3 | 2:2 | 3:3 | 0.135 | 0.269 | 3.3 | 3.9 | 2.19 | 1.94 | EP | EP |
| 14 | Male | 82 | L1-L3 | T10-T12 | 3:2 | 2:2 | 0.122 | 0.108 | 2.3 | 1.9 | 0.99 | 1.75 | EP | AC |
| Mean  (SD) | | 80  (8) |  |  |  |  | 0.165  (0.071) | 0.172  (0.069) | 2.6  (0.9) | 2.8  (1.4) | 1.54  (0.46) | 1.60  (0.73) |  |  |

Note: The cement used for vertebroplasty is denoted as follows: C, Cortoss; P, PMMA. # Grade of disc degeneration is shown for the upper (U) and lower (L) discs of each three-vertebra specimen. + Volumetric BMD values are those of the fractured vertebra. \* Cement leakage observed during vertebroplasty (leakage volume 1 ml). Fracture types defined as endplate (EP), anterior cortex (AC) or endplate plus anterior cortex (EP+AC). †In this specimen, two vertebrae sustained fracture of the endplate and anterior cortex.

**Table 2.** Average (SD) results in flexed and erect posture for 36 ‘affected’ and 16 ‘adjacent’ discs. P values indicate main effects across the four stages of the experiment (ANOVA). Post-hoc paired comparisons indicate differences from pre-fracture (a p < 0.05; b p < 0.01; c p < 0.001) and post-fracture (A p < 0.05; B p < 0.01; C p < 0.001) values. Post-consolidation measurements were obtained following a 1 hr period of compressive loading at 1 kN following vertebroplasty to allow cement consolidation. Intradiscal pressure in the nucleus (IDP) and the size of stress peaks in the anterior (SPA) and posterior (SPP) annulus are given in megapascals (MPa).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Pre-fracture | Post-fracture | Post-vertebroplasty | Post-consolidation | P |
| IDP- flexed (MPa) | Affected | 0.80 (0.47) | 0.55 (0.30)c | 0.70 (0.34)C | 0.66 (0.31)bC | <0.001 |
| Adjacent | 0.90 (0.45) | 0.78 (0.44)a | 0.79 (0.50) | 0.76 (0.45)a | 0.016 |
| IDP- erect (MPa) | Affected | 0.75 (0.40) | 0.35 (0.28)c | 0.57 (0.29)cC | 0.53 (0.28)cC | <0.001 |
|  | Adjacent | 0.94 (0.39) | 0.70 (0.51)b | 0.76 (0.53)aA | 0.72 (0.47)b | 0.003 |
| SPA – flexed (MPa) | Affected | 1.39 (1.17) | 1.10 (0.66)a | 1.17 (0.94) | 1.26 (0.97)A | 0.166 |
|  | Adjacent | 1.58 (1.87) | 0.81 (1.35) | 0.90 (1.09) | 1.20 (1.51) | 0.120 |
| SPA – erect (MPa) | Affected | 0.60 (0.58) | 0.70 (0.49) | 0.75 (0.56) | 0.63 (0.48) | 0.158 |
|  | Adjacent | 0.62 (0.77) | 0.44 (0.72) | 0.52 (0.58) | 0.44 (0.54) | 0.457 |
| SPP - flexed (MPa) | Affected | 0.45 (0.67) | 0.86 (0.82)b | 0.42 (0.49)C | 0.41 (0.49)C | 0.001 |
|  | Adjacent | 0.22 (0.38) | 0.76 (0.88) | 0.39 (0.55)a | 0.40 (0.54)a | 0.109 |
| SPP - erect (MPa) | Affected | 0.69 (0.73) | 1.52 (1.09)c | 0.92 (0.70)C | 0.95 (0.77)C | <0.001 |
|  | Adjacent | 0.85 (1.01) | 1.17 (0.87) | 0.92 (0.74) | 0.84 (0.64) | 0.431 |
| FA - flexed (%) | Affected | 55.2 (17.4) | 40.7 (11.7)c | 46.9 (14.4)aB | 46.3 (13.0)bB | <0.001 |
|  | Adjacent | 55.5 (21.5) | 35.6 (15.1)a | 42.4 (14.0)a | 45.5 (19.0) | 0.003 |
| FA - erect (%) | Affected | 35.3 (13.1) | 26.3 (13.2)c | 30.4 (11.8)aA | 29.1 (11.9)cA | <0.001 |
|  | Adjacent | 37.1 (16.3) | 27.9 (15.3)b | 31.4 (12.5)a | 30.2 (12.6)a | 0.007 |
| FP - flexed (%) | Affected | 31.4 (14.0) | 32.4 (14.3) | 29.3 (12.7) | 26.6 (11.5)bB | 0.005 |
|  | Adjacent | 28.1 (13.5) | 34.1 (15.4) | 28.3 (16.2) | 27.7 (15.4) | 0.148 |
| FP - erect (%) | Affected | 37.2 (14.8) | 35.2 (16.9) | 34.7 (15.2) | 35.2 (16.7) | 0.618 |
|  | Adjacent | 39.5 (11.8) | 38.7 (19.3) | 35.6 (17).4 | 34.4 (15.1) | 0.162 |
| FN - flexed (%) | Affected | 13.4 (14.3) | 26.9 (16.1)c | 23.8 (15.8)a | 27.1 (13.8)c | <0.001 |
|  | Adjacent | 16.4 (16.9) | 30.3 (15.9)a | 29.3 (17.8)a | 26.9 (18.8)a | 0.022 |
| FN - erect (%) | Affected | 28.6 (16.9) | 38.2 (21.2)b | 34.8 (17.9)a | 36.1 (21.2)a | 0.011 |
|  | Adjacent | 21.4 (18.4) | 34.3 (24.2)b | 33.7 (22.7)a | 34.7 (21.1)b | 0.001 |