**SUPPLEMENTAL DIGITAL MATERIAL**

**Table 1. Detailed study demographics, diagnoses, and treatment interventions for studies comparing anterior to posterior surgery in patients with multi-level CSM.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Study Design** | **Population** | | | **Diagnosis (levels)** | | | **Treatment** | |
|
| 1. Laminoplasty (A) versus discectomy (B) | | | | | | | | | |
| Liu  (2011) | Retrospective cohort  F/U time: 24.5 months  F/U rate: NR | A | | B | A | B | | A | B |
| N = 52Mean age: 56 years (range, 36-77)  Sex: 57.7% male | | | 3-level: 10/27 (37%)  4-level: 16/27 (59%)  5-level: 1/27 (4%)  Duration of symptoms: 14.6 ± 13.8 months | 3-level: 17/25 (68%)  4-level: 7/25 (28%)  5-level: 1/25 (4%)  Duration of symptoms: 12.8 ± 11.8 months | | Laminoplasty with:   * Open-door technique * Collar | ACDF with:   * Robinson technique * Plate cage benezech * No collar |
| n = 27  Mean age: 57.3 ± 10.1  Sex: 59.3% male  F/U time: 24.5 ± 11.1 mos  F/U rate: NR | | n = 25  Mean age: 54.6 ± 11.5  Sex: 56.0% male  F/U time: 25.4 ± 13.8 mos  F/U rate: NR |
| Yoshida  (1998) | Retrospective cohort  F/U time:  F/U rate: NR | N = NR  Mean age: NR  Sex: NR | | | Developmental spinal canal stenosis (ventrodorsal canal diameter <13mm): 32/32 (100%)  Confirmed herniated disc: 32/32 (100%)  Duration of Symptoms: 10.5 months | Duration of Symptoms: 15.6 months | | Laminoplasty with:   * Decompression from C3-C7 * Open door | ACDF |
| n = 32  Mean age: 56 years  Sex: NR  F/U time: NR  F/U rate: NR | | n = 44  Mean age: 50.3 years  Sex: NR  F/U time: NR  F/U rate: NR |
| 1. Laminoplasty (A) versus corpectomy (C) | | | | | | | | | |
| Edwards  (2002) | Retrospective matched cohort  F/U rate: NR | A | | C | A | C | | A | C |
| N = 26  Mean age: NR  Sex: 61.5% male | | | 3-level: 1/13 (7.7%)  4-level: 12/13 (92.3%)  Duration of symptoms: 9 mo range (3mo-8yrs) | 3-levels: 11/13 (84.6%)  4-levels: 2/13 (15.4%)  Duration of symptoms: 9 mo range (3mo-5yr) | | Laminoplasty with:   * Open door method 3/13 (23.1%) * T-saw Laminoplasty 10/13 (76.9%) * Hirahayashi method * Autograft strut | ACCF with:  Autograft |
| n = 13\*  Mean age: 53 range (35-67) years  Sex: NR  F/U time: 40 months  F/U rate: NR | | n = 13  Mean age: 53 range (39-72) years  Sex: NR  F/U time: 49 months  F/U rate: NR |
| Hosono  (1996) | Retrospective cohort  F/U time: >2 years  F/U rate: NR | N = 98  Mean age: 57.9 years  Sex: 62.2% male | | | NR | NR | | *En bloc*Laminoplasty using Itoh and Tsuji method | Anterior interbody fusion with subtotal corpectomy |
| n = 72  Mean age: 59.2 years  Sex: 62.5% male  F/U time: 40.1 range (24-102) months  F/U rate: NR | | n = 26  Mean age: 54.9 years  Sex: 61.5% male  F/U time: 52.6 range (24-86) months  F/U rate: NR |
| Shibuya  (2010) | Retrospective cohort  F/U time: >3 years  F/U rate: NR | N = 83  Mean age: NR  Sex: 57.8% male | | | 4 levels: 16/49 (32.7%)  3 levels: 22/49 (44.9%)  2 levels: 11/49 (22.4%)  Duration of symptoms: 17.6 ± 38.1 months | 3 levels: 13/34 (35.3%)  2 levels: 16/34 (47.1%)  1 level: 6/34 (17.6%)  Duration of symptoms: 12.1 ± 10.3 months | | Laminoplasty with:   * Expansive open door | ACCF with:   * Autologous strut bone grafting |
| n = 49  Mean age: 64.8 ± 11.7 years  Sex: NR  F/U time: 8 yr 3 mo range (range, 3-15 yr 2 mo)  F/U rate: NR | | n = 34  Mean age: 60.4 ± 8.4 years  Sex: NR  F/U time: 11 yr 11 mo (range, 3-21 yr 2 mo)  F/U rate: NR |
| Yonenobu  (1992) | Retrospective cohort  F/U rate: NR | N = NR  Mean age: NR  Sex: NR | | | 2-levels: 19/42 (45%)  3-levels: 19/42 (45%)  4-levels: 4/42 (10%)  Duration of symptoms: 19.7 ± 22.6 months | 2-levels: 22/41 (53.7%)  3-levels: 17/41 (41.4%)  4-levels: 2/41 (4.9%)  Duration of symptoms: 24.2 ± 29 months | | Itoh and Tsuji method with reconstruction of the nuchal attachment to the spinous process of the axis | ACCF with:   * Strut graft |
| n = 52  Mean age: 56 ± 11.5  Sex: 69% male  F/U time: 43 months  F/U rate: 42/52 (80.8%) | | n = 48  Mean age: 54.3 ± 8.9  Sex: 78% male  F/U time: 53 months  F/U rate: 41/48 (85.4%) |
| 1. Laminectomy (D) versus discectomy (B) | | | | | | | | | |
| Benzel  (1991) | Retrospective cohort  F/U rate: NR | D | B | | D | B | | D | B |
| N = 35\*  Mean age: NR  Sex: NR | | | 1-level: 1/18 (5.6%)  2-levels: 2/18 (11%)  3-levels: 5/18 (27.8%)  4-levels: 6/18 (33.3%)  5-levels: 4/18 (22.2%) | 2-level: 14/17 (82.4%)  3-level: 3/17 (17.6%) | | Laminectomy:   * Never extended cadually to include the first thoracic segment | ACDF with:   * Multiple level with osteophyte removal * Single level with dural sac decompression |
| n = 18  Mean age: 59.1 years  Sex: 77.8% male  F/U time: NR  F/U rate: NR | | n = 17  Mean age: 47.8 years  Sex: 94% male  F/U time: NR  F/U rate: NR |
| 1. Laminectomy with fusion (E) versus corpectomy (C) | | | | | | | | | |
| Kristof  (2009) | Retrospective cohort  F/U time: 2 years  F/U rate: NR | E | | C | E | | C | E | C |
| N = 103  Mean age: NR  Sex: NR | | | Median operated levels: 3 range (1-5)  Duration of symptoms: 7 range (1-120) months | | Median operated levels: 2 range (2-3)  Duration of symptoms: 12 range (0.5-192) months | Laminectomy with:   * Rod-screw-fixation | ACCF with:   * Resection of the dorsal longitudinal ligament * Autologous iliac crest fusion * Dynamic locking plate-screw system |
| n = 61  Mean age: 66 (range, 34-85) years  Sex: 75.4% male  F/U time: NR  F/U rate: NR | | n = 42  Mean age: 62.5 (range, 39-85) years  Sex: 73.8% male  F/U time: NR  F/U rate: NR |

Edwards (2002): \*Originally n = 25 for laminoplasty, but only 13 of these were used for comparison.

Benzel (1991): \*This number does not include n = 40 patients that underwent laminectomy plus dentate ligament section.

ACCF: anterior cervical corpectomy and fusion

ACDF: anterior cervical discectomy and fusion

**Table 2. Detailed clinical outcome results for studies comparing anterior to posterior surgery in patients with multi-level CSM.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Neurological** | | **Function** | | **Pain** | | |
| Laminoplasty (A) versus discectomy (B) | | | | | | | |
| Liu  (2011) | A | B | A | B | A | | B |
| JOA:  Pre: 8.59 ± 2.98  Post: 13.67 ± 2.7\*  Recovery Rate: 59.54% ± 29.37% | JOA:  Pre: 8.16 ± 3.14  Post: 13.20 ± 2.73\*  Recovery Rate: 59.79% ± 23.43% | ROM (°):  Pre: 40.44 ± 10.25  Post: 36.15 ± 10.58\*  Decrease rate of ROM (%): 11.39 ± 8.05 | ROM (°):  Pre: 46.83 ± 6.47  Post: 33.14 ± 8.04\*  Decrease rate of ROM (%): 29.45 ± 13.2 | Axial neck pain: 1/27 (3.7%) | | NR |
| Yoshida  (1998) | JOA:  Pre: 8.5 ± 5.6  Post: 14.4 ± 5.6  Recovery rate: 67.9% | JOA:  Pre: 10.6 ± 9.5  Post: 14.9 ± 2.6  Recovery rate: 68.8% | NR | NR | NR | | NR |
| Laminoplasty (A) versus corpectomy (C) | | | | | | | |
| Edwards  (2002) | A | C | A | C | A | | C |
| NR | NR | Subjective improvement (% of patients):  Strength: 69\*  Dexterity: 62\*  Numbness: 69\*  Gait: 64\*  Nurick grade:  Improvement: 1.5  Pre: 2.3 range  Post: 0.8 range (0 - 3) | Subjective improvement (% of patients):  Strength: 55\*  Dexterity: 67\*  Numbness: 88\*  Gait: 55\*  Nurick grade:  Improvement: 0.9  Pre: 1.9 range  Post: 1.0 range (-1 - 2) | Subjective pain improvement (% of patients): 69\*  Robinson scale improvement: 1.0 grades\*  Axial pain:  Preoperative: NR  Postoperative 8/13 (61.5%) | | Subjective pain improvement (% of patients): 88\*  Robinson scale improvement: 0.5 grades\*  Axial pain:  Preoperative: NR  Postoperative 8/13 (61.5%) |
| Hosono  (1996) | JOA:  Pre: 9.2  Post: 13.7 | JOA:  Pre: 9.1  Post: 13.0 | NR | NR | Axial symptoms:  Pre: NR  Post: 43 (59.7%)\* | | Axial symptoms:  Pre: NR  Post: 5 (19.2%)\* |
| Shibuya  (2010) | JOA:  Pre: 7.9  Post: NR  Recovery Rate:  1 yr: 61.4 **±** 21.2%  5 yr: 52.4 **±** 28.1%  12 yr: 50.9 **±** 25.9% | JOA:  Pre: 8.6  Post: NR  Recovery Rate:  1 yr: 55.5 **±** 25.3%  5 yr: 49.3 **±** 29.3%  12 yr: 41.0 **±** 26.6% | ROM:  Pre: 42.0°  Post: NR | ROM:  Pre: 44.3°  Post: NR | Preoperative Axial Pain: 41/49 (83.7%)  Grade 0: 19/41 (46.3%)  Grade 1: 16/41 (39.0%)  Grade 2: 6/41 (14.6%)  Postoperative Axial Pain:\*  Grade 0: 9/41 (22.0%)  Grade 1: 10/41 (24.4%)  Grade 2: 11/41 (26.8%)  Grade 3: 11/41 (26.8%) | | Preoperative Axial Pain: 20/34 (58.8%)  Grade 0: 15/20 (75.0%)  Grade 1: 4/20 (20.0%)  Grade 2: 1/20 (5.0%)  Postoperative Axial Pain:\*  Grade 0: 10/20 (50.0%)  Grade 1: 4/20 (20.0%)  Grade 2: 6/20 (30.0%)  Grade 3: 0/20 (0%) |
| Yonenobu  (1992) | JOA:  Pre: 9.3 ± 3.0  Max: 13.6 ± 2.0  Final: 12.8 ± 2.7  Rate of Recovery: Max: 53.9 ± 22.2  Final: 44.9 ± 26.2 | JOA:  Pre: 8.2 ± 2.2  Max: 13.7 ± 2.5  Final: 13.3 ± 2.6  Rate of Recovery:  Max: 60.4 ± 28.0  Final: 55.3 ± 30.2 | NR | NR | NR | | NR |
| Laminectomy (D) versus discectomy (B) | | | | | | | |
| Benzel  (1991) | D | B | D | B | D | | B |
| mJOA:  Pre: 10.8 ± 3.6  Post: 13.6  Mean change: 2.7 | mJOA:  Pre: 12.0 ± 2.7  Post: 15  Mean change: 3 | NR | NR | NR | | NR |
| Laminectomy with fusion (E) versus corpectomy (C) | | | | | | | |
| Kristof  (2009) | E | C | E | C | | E | C |
| NR | NR | Nurick Score:  Pre: 3 range (1-5)  Change: 0 range (-2 - 2) | Nurick Score:  Pre: 3 range (0-5)  Change: 0 range (-2 - 3) | | VAS:  Pre: 3.54 range (0-8)  Change: 0.50 range (-8 - 8) | VAS:  Pre: 4 range (0-10)  Change: 1.0 range (-8 - 9) |

**Table 3. Detailed physiological outcome results for studies comparing anterior to posterior surgery in patients with multi-level CSM.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Study** | **Fusion Rate (%)** | | **Sagittal Alignment (degrees)** | | **Complication Rate (%)** | |
| Laminoplasty (A) versus discectomy (B) | | | | | | |
| Liu  (2011) | A | B | A | B | A | B |
| NR | NR | Cervical Alignment (°):  Pre: 12.76 ± 18.67  Post: 14.08 ± 14.52  Cobb Angle (°):  Pre: 9.83 ± 11.95  Post: 9.75 ± 9.21  Sagittal Diameter (mm):  Pre: 3.7 ± 1.18  Post: 5.74 ± 0.98\* | Cervical Alignment (°):  Pre: 21.92 ± 13.46  Post: 21.02 ± 13.82  Cobb Angle (°):  Pre: 8.74 ± 10.31  Post: 10.37 ± 5.89  Sagittal Diameter (mm):  Pre: 4.38 ± 1.22  Post: 5.61 ± 1.63\* | Operative time (min): 187.78 ± 25.01\*\*  Blood loss (mL): 361.11 ± 57.80\*\*  C5 root palsy: 2/27 (7.4%)  Axial neck pain: 1/27 (3.7%)  Overall: 3/27 (11.1%)\* | Operative time (min): 115.92 ± 24.14\*\*  Blood loss (mL): 118.48 ± 27.62\*\*  Late deterioration: 2/25 (8%)  Screw back out: 1/25 (4%)  Pseudarthrosis: 1/25 (4%)  Subjacent ankylosis: 1/25 (4%)  Temporary odynophagia: 2/25 (8%)  Temporary dysphonia: 2/25 (8%)  Overall: 9/25 (36.0%)\* |
| Yoshida  (1998) | NR | NR | NR | NR | ASD: 0/32 (0%)  Malalignment: 0/32 (0%)  Reoperation: 0/32 (0%)  Neck Pain/Stiffness: 3/32 (9.4%) | ASD: 8/44 (18.8%)  Malalignment: 6/44 (13.6%)  Reoperation: 0/44 (0%) |
| Laminoplasty (A) versus corpectomy (C) | | | | | | |
| Edwards  (2002) | A | C | A | C | A | C |
| NR | NR | Mean Sagittal Motion C2-C7 (°):  Pre: 39  Post: 24  % decrease: 38\*  Lordosis (°):  Pre: 13  Post: 13-14  Mean lordosis (C2-C7) Ishihara Index: 0.12 | Mean Sagittal Motion C2-C7:  Pre: 37  Post: 16  % decrease: 57\*  Lordosis (°):  Pre: 13  Post: 6-9  Mean lordosis (C2-C7) Ishihara Index: 0.12 | Mean operative time (hr:min): 3:36  Mean blood loss (mL): 360  Mean hospital stay (days): 3  HNP/Radiculopathy: 1/13 (7.7%)  Overall: 1/13 (7.7%)\* | Mean operative time (min): 3:44  Mean blood loss (mL): 572  Mean hospital stay (days): 5  Mylopethy progression: 1/13 (7.7%)  Pseudarthrosis: 1/13 (7.7%)  Subjacent Ankylosis: 1/13 (7.7%)  Persistent Dysphagia: 4/13 (30.8%)  Persistent Dysphonia: 2/13 (15.4%)  Overall: 9/13 (69.2%)\* |
| Hosono  (1996) | NR | NR | NR | NR | Nuchal pain: 19/72 (26%)\*  Shoulder pain: 21/72 (29%)\*  Shoulder muscle spasm: 30/72 (42%)\* | Nuchal pain: 1/26 (4%)\*  Shoulder pain: 3/26 (12%)\*  Shoulder muscle spasm: 2/26 (8%)\* |
| Shibuya  (2010) | NR | NR | Hyperlordotic:  Pre: 28.6%  Post: 28.6%  Lordotic:  Pre: 53%  Post: 44.9%  Straight:  Pre: 18.4%  Post: 20.4%  Kyphotic:  Pre: 0%  Post: 6.1% | Hyperlordotic:  Pre: 23.5%  Post: 2.9%  Lordotic:  Pre: 55.9%  Post: 26.5%  Straight:  Pre: 20.6%  Post: 44.1%  Kyphotic:  Pre: 0%  Post: 26.5% | Operative time (min):\*\*  175 ± 60  Blood loss (ml):\*\*  404 ± 426  Blood transfusion (ml):\*\*  134 ± 318  C5 palsy: 5/49 (10.2%) | Operative time (min):\*\*  1 level: 265 ± 51  2 level: 334 ± 73  3 level: 371 ± 89  Blood loss (ml):\*\*  1 level: 662 ± 553  2 level: 1292 ± 942  3 level: 1818 ± 1607  Blood transfusion (ml):\*\*  1 level: 487 ± 386  2 level: 917 ± 994  3 level: 1330 ± 1063  C5 palsy: 3/34 (8.8%)  Pseudoarthrosis: 6/34 (17.6%) |
| Yonenobu  (1992) | NR | NR | Kyphotic deformity: 4/42 (10%)  Anterolisthesis>3mm: 2/42 (5%) | NR | Neurologic complications: 3/42 (7.1%)  \*Transient paralysis of the fifth cervical nerve root was the sole feature of clinical deterioration  Kyphosis: 4/42 (9.5%)  Anterolisthesis>3mm: 2/42 (4.8%)  Kyphosis and Anterolisthesis did not result in neurologic deterioration | No. of major complications: 12/41 (29.3%)  Graft complications: 10/12 (83.4%)  Esophageal fistula: 1/12 (8.3%)  Retrolisthesis: 1/12 (8.3%)  Neurologic deterioration: 4/41 (9.8%) |
| Laminectomy (D) versus discectomy (B) | | | | | | |
| Benzel  (1991) | D | B | D | B | D | B |
| NR | NR | NR | NR | Fibrile Period: 2/18 (11%)  Subendocardial infection: 1/18 (5.6%) | Graft dislodgement: 2/17 (11.8%)  Wound infection: 1/17 (5.9%)  Pneumonia: 1/17 (5.9%) |
| Laminectomy with fusion (E) versus corpectomy (C) | | | | | | |
| Kristof  (2009) | E | C | E | C | E | C |
| NR | NR | Cobb Angle C3-C7:  Pre: 5.03 range (-20-38)  Change: 0 range (-15-28) | Cobb Angle C3-C7:  Pre: 10 range (-11-41)  Change: 0 range (-21-35) | Duration of surgery (min): 183.84 ± 46.62\*  Blood loss (mL): 839.83 ± 876.6  Transfusion rate (%): 11.4  Surgical complications: 20/61 (32.7%)  Radiculopathy: 12/61 (19.6%)  Dysphagia, hoarseness: 0/61 (0%)  Wound infection: 4/61 (6.5%)  Hardware failure: 4/61 (6.5%)  Medical complications (pneumonia, renal failure, sepsis): 4/61 (7.1%)  Operative mortality: 1/61 (1.6%)  Overall Complications: 22/61 (36.0%) | Duration of surgery (min): 229.24 ± 60.1\*  Blood loss (mL): 743.33 ± 748.9  Transfusion rate (%): 2.9  Surgical complications: 16/42 (38%)  Radiculopathy: 5/42 (11.9%)  Dysphagia, hoarseness: 3/42 (7.1%)  Wound infection: 1/42 (2.3%)  Hardware failure: 7/42 (16.6%)  Medical complications (pneumonia, renal failure, sepsis): 3/42 (7.1%)  Operative mortality: 2/42 (4.7%)  Overall Complications: 17/42 (40.4%) |

**Liu 2011: \*** P < 0.05 for Post-JOA score, Post-ROM score, Post-SD score, and complication rate; \*\* P < 0.001 for operative time and blood loss. JOA = Japanese Orthopaedic Association scale; CA = cervical alignment; SD = sagittal diameter of dural sac at maximum compression.

**Hosono 1996:** \* P < 0.05 for presence of postoperative axial symptoms.

**Edwards 2002: \*** P < 0.05 for subjective improvement of strength, dexterity, numbness, pain, gait, Robinson scale improvement, % decrease of sagittal plane motion from C2-C7and overall complication rate.

**Shibuya 2010: \*** P < 0.05 for axial pain intensity and prevalence. **\*\*** P < 0.05 for operative time and blood loss between two groups.

**Kristof 2009: \*** P < 0.001 for operative time.

Recovery Rate= (Postoperative JOA score – preoperative JOA score) / (17 (full score) – preoperative JOA score)

**Table 4. Studies comparing anterior to posterior surgery for CSM based on JOA and mJOA scores.**

|  | **Anterior surgery** | | | **Posterior surgery** | |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author** | **Pre and post score**  **(mean ± SD)** | | **Change score**  **(mean ± SD\*)** | **Pre and post score**  **(mean ± SD)** | | **Change score**  **(mean ± SD)** | **Difference in**  **change scores\*\*** | **p-value** | **SMD†** |
| **Liu**  **(2011)** | **Pre**  n = 25 | **Post**  25.4 mos | **Pre**  n = 27 | **Post**  24.5 mos |  |  |
|  | 8.16 ± 3.41 | 13.2 ± 2.73 | 5.04 ± 2.73 | 8.59 ± 2.98 | 13.67 ± 2.7 | 5.08 ± 1.82 | -0.48 | .95 | -0.032 |
| **Yoshida**  **(1998)** | **Pre**  n = 44 | **Post**  F/U time: NR | 4.3 ± 7.58 | **Pre**  n = 32 | **Post**  F/U time: NR | 5.9 ± 3.54 | -1.6 | .27 | -0.308 |
| 10.6 ± 9.5 | 14.9 ± 2.6 | 8.5 ± 5.6 | 14.4 ± 5.6 |
| **Hosono**  **(1996)** | **Pre**  n = 26 | **Post**  52.6 mos | 3.9 | **Pre**  n = 72 | **Post**  40.1 mos | 4.5 | -0.6 |  | NC |
| 9.1 | 13.0 | 9.2 | 13.7 |
| **Yonenobu**  **(1992)** | **Pre**  n = 48 | **Post**  53 mos | 5.1 ± 1.58 | **Pre**  n = 52 | **Post**  43 mos | 3.5 ± 1.82 | 1.6 | **<.001** | **1.455** |
| 8.2 ± 2.2 | 13.3 ± 2.6 | 9.3 ± 3.0 | 12.8 ± 2.7 |
| **Benzel**  **(1991)** | **Pre**  n = 17 | **Post**  1-2 mos | 3.0 ± 2.0 | **Pre**  n = 18 | **Post**  1-2 mos | 2.7 ± 2.0 | 0.3 | .66 | 0.237 |
| 12.0 ± 2.7 | 15.1 ± 2.9 | 10.8 ± 4.0 | 13.6 ± 3.6 |

\*Imputed using formula that includes pre and post standard deviation and a correlation coefficient coefficient of 0.80

\*\*Calculated by subtracting the posterior surgery change score from the anterior surgery change scores.

†Standardized Mean Difference calculated by subtracting the mean change scores and dividing by the change score standard deviations. Positive scores indicate treatment favors anterior surgery.NC = not calculable (standard deviations not reported)

**Table 5. Studies comparing anterior to posterior surgery for CSM based on post-operative axial pain rates.**

|  | **Anterior surgery** | **Posterior surgery** | **Risk Difference\*(%)** | **RR\*\***  **(95% CI)** |
| --- | --- | --- | --- | --- |
| **Author** | **n/N (%)** | **n/N (%)** |  |  |
| **Liu**  **(2011)** | **Post**  n = 25  25.4 mos | **Post**  n = 27  24.5 mos |  |
|  | 0/25  (0%) | 1/27  (3.7%) | -3.7% | RR (NC)  P=.34 |
| **Edwards**  **(2002)** | **Post**  n = 13  49 mos | **Post**  n = 13  40 mos | 0% | 1.0  (.54,1.8)  P=1.0 |
| 8/13  (61.5%) | 8/13  (61.5%) |
| **Hosono**  **(1996)** | **Post**  n = 26  52.6 mos | **Post**  n = 72  40.1 mos | -40.5% | .32  (.14, .72)  P=.0004 |
| 5/26  (19.2%) | 43/72  (59.7%) |
| **Shibuya**  **(2010)** | **Post**  n = 20  11.9 yrs | **Post**  n = 41  8.25 yrs | -28% | .64  (.40, 1.0)  P=.03 |
| 10/20  (50.0%) | 32/41  (78.0%) |

\*Calculated by subtracting post-operative posterior axial pain rates from anterior axial pain rates. A negative number favors anterior surgery suggesting lower post-operative pain rates.

\*\*Relative risk. A number below1.0 indicates anterior surgery less likely to exhibit axial pain than posterior surgery.

Wada\* - Authors reported these percentages and did not give raw numbers (n/N) to calculate axial pain percent.

**Table 6. Studies comparing anterior to posterior surgery for CSM based changes in anteroposterior canal diameter (mm) and sagittal diameter (mm).**

|  | **Anterior surgery** | | | **Posterior surgery** | |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Author** | **Pre and post measure**  **(mm mean ± SD)** | | **Change**  **(mm mean ± SD)** | **Pre and post measure**  **(mm mean ± SD)** | | **Change (mm mean ± SD)** | **Difference in**  **changes\*** | **p-value** | **SMD\*\*** |
| **Liu**  **(2011)** | **Pre**  n = 25 | **Post**  25.4 mos | **Pre**  n = 27 | **Post**  24.5 mos |
| Sagittal diameter | 4.38 ± 1.22 | 5.61 ± 1.63\* | 1.23 ± .98 | 3.70 ± 1.18 | 5.74 ± 0.98\* | 2.04 ± .71 | -.81 | .001 | -1.36 |
| **Yonenobu**  **(1992)** | **Pre**  n = 48 | **Post**  53 mos | .1 ± 2.31 | **Pre**  n = 52 | **Post**  43 mos | .6 ± 1.75 | -.5 | .38 | -.36 |
| Antero-  posterior canal diameter | 12.7 ± 0.8 | 12.8 ± 2.9 | 12.4 ± 1.5 | 13.0 ± 2.7 |
| **Yoshida**  **(1998)** | **Pre**  n = 48 | **Post**  53 mos | -.9 ± 0.68 | **Pre**  n = 48 | **Post**  53 mos | 0 ± 0.95 | -.9 | .0003 | -1.57 |
| Antero-  posterior canal diameter | 13.4 ± 0.9 | 12.5 ± 0.3 | 12.4 ± 1.5 | 12.4 ± 1.5 |

\*Imputed using formula that includes pre and post standard deviation and a correlation coefficient coefficient of 0.80

\*\*Calculated by subtracting the posterior surgery change score from the anterior surgery change scores.

**†**Calculated by subtracting the mean change scores and dividing by the change score standard deviations. Negative scores indicate treatment favors posterior surgery.

Table 7. Level of Evidence

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Methodological Principle** | **Benzel**  **1991** | **Edwards**  **2002** | **Hosono**  **2008** | **Kristof**  **2009** | **Liu**  **2011** | **Shibuya**  **2010** | **Yonenobu**  **1992** | **Yoshida**  **1998** |
| Study design |  |  |  |  |  |  |  |  |
| Randomized controlled trial |  |  |  |  |  |  |  |  |
| Cohort Study | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ |
| Case-series |  |  |  |  |  |  |  |  |
| Statement of concealed allocation† |  |  |  |  |  |  |  |  |
| Intention to treat† |  |  |  |  |  |  |  |  |
| Independent or blind assessment |  | ⏹ |  |  |  |  |  |  |
| Co-interventions applied equally | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ |
| Complete follow-up of >85% |  |  |  |  |  |  |  |  |
| Adequate sample size |  |  | ⏹ | ⏹ | ⏹ | ⏹ | ⏹ |  |
| Controlling for possible confounding |  | ⏹ | ⏹ | ⏹ |  | ⏹ |  |  |
| Prospective study |  |  |  |  |  |  |  |  |
| **Evidence Level** | III | III | III | III | III | III | III | III |