

6. Referenzen

1. Akkerveeken PF, O'Brian JP, Park WM. Experimentally induced hypermobility in the lumbar spine. A pathologic and radiologic study of the posterior ligament and anulus fibrosus. *Spine* 1979;4:236-241.
2. Allbrook D. Movements of the lumbar spinal column. *J Bone Joint Surg (Br)* 1957;39:2:339-345.
3. Aston-Miller JA, Schultz AB. Spine instability and segmental hypermobility biomechanics: a call for the definition and standard use of terms. *Semin Spine Surg* 1991;3:136-148.
4. Axelsson P, Johnsson R, Strömqvist B. Is there increased intervertebral mobility in isthmic adult spondylolisthesis? *Spine* 2000;25:1701-1703.
5. Bakke SN. Röntgenologische Beobachtungen über die Bewegungen der Wirbelsäule. *Acta Radiologica Supplementum* 1931;13:1-75.
6. Begg AC, Falconer MA. Plain radiography in intraspinal protrusion of lumbar intervertebral discs: correlation with operative findings. *Brit J Surg* 1949;36:225-239.
7. Bernau A. *Orthopädische Röntgendiagnostik – Einstelltechnik*. Urban und Schwarzenberg, München, Wien, Baltimore, 1995.
8. Blant JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurements. *Lancet* 1986;1:307-310.
9. Boden SD, Wiesel SW. Lumbosacral segmental motion in normal individuals. Have we been measuring instability properly? *Spine* 1990;15:571-576.
10. Böhm H. 1999. Persönliche Mitteilung.
11. Bogduk N. *Klinische Anatomie von Lendenwirbelsäule und Sakrum*. Springer, Berlin, Heidelberg, New York, 2000.
12. Bortz J. *Statistik für Human- und Sozialwissenschaftler*. Springer, Berlin, Heidelberg, New York, 2005. 218-236.
13. Brown MD, Holmes DC, Heiner AD. Measurement of cadaver lumbar spine motion segment stiffness. *Spine* 2002;27:918-922.
14. Brown MD, Holmes DC, Heiner AD, Wehman KF. Intraoperative measurement of lumbar spine motion segment stiffness. *Spine* 2002;27:954-958.

15. Brown RH, Burstein AH, Nash CL, Schock CC. Spinal analysis using three-dimensional radiographic technique. *J Biomechanics* 1976;9:355-365.
16. Burton AK, Tillotson KM. Reference value for 'normal' regional lumbar sagittal mobility. *Clin Biomech* 1988;3:106-113.
17. Cherkin DC, Deyo RA, Loeser JD, Bush T, Waddell G. An international comparison of back surgery rates. *Spine* 1994;19:1201-1206.
18. Crawford NR, Cagli S, Sonntag VKH, Dickmann CA. Biomechanics of grade I degenerative spondylolisthesis. Part I: In-vitro model. *J Neurosurg (Spine 1)* 2001;94:45-50.
19. Davis H. Increasing rate of cervical and lumbar surgery in the United States. *Spine* 1994;15:1117-1124.
20. Degreif J, Wenda K, Runkel M, Ritter G. Die Rotationsstabilität der thorakolumbalen Wirbelsäule nach interlaminaärer Fensterung, Hemilaminektomie und Laminektomie. *Unfallchirurg* 1994;97:250-255.
21. Delank KS, Gercek E, Bauerfeind A, Eysel P. Intraoperative measurement of lumbar spinal motion. In Löhr JF (ed): *Abstracts 54th Annual Congress NOV "Knee joint and spine – state of the Art"*. Videel OHG, Niebüll, 2005;30.
22. Dupius PR, Young-Hing K, Cassidy JD, Kirkaldy-Willis WH. Radiologic diagnosis of degenerative lumbar spinal instability. *Spine* 1985;10:262-276.
23. Dvorak J, Panjabi MM, Novotny JE, Chang DG, Grob D. Clinical validation of functional flexion-extension roentgenograms of the lumbar spine. *Spine* 1991;16:943-950.
24. Dvorak J, Vajda EG, Grob D, Panjabi MM. Normal motion of the lumbar spine as related to age and gender. *Eur Spine J* 1995;4:18-23.
25. Ebara S, Harada T, Hosono N, Inoue M, Tanaka M, Morimoto Y, Ono K. Intraoperative measurement of lumbar spinal instability. *Spine* 1992;17:44-50.
26. Ensink FBM, Saur PMM, Frese K, Seeger D, Hildebrandt J. Lumbar range of motion: Influence of time of day and individual factors on measurements. *Spine* 1996;21:1339-1343.
27. Esses SI, Sachs BL, Dreyzin V. Complications associated with the technique of pedicle screw fixation. A selected survey of ABS members. *Spine* 1993;18:2231-2239.
28. Farfan HF. *Mechanical disorders of the low back*. Lea and Febiger, Philadelphia, 1973.

29. Fick R. *Handbuch der Anatomie und Mechanik der Gelenke unter Berücksichtigung der beweglichen Muskeln*. Fischer, Jena, 1910.
30. Fitzgerald GK, Wynveen KJ, Rheault W, Rothschild B. Objective assessment with establishment of normal values for lumbar spinal range of motion. *Phys Ther* 1983;63:1776-1781.
31. Frank FH, Instrumentation for intraoperative measurement of cervical spine stiffness. *Neurolog Res* 1996;18: 217-219.
32. Friberg O. Lumbar instability: A dynamic approach by traction-compression radiography. *Spine* 1987;12:119-129.
33. Frymoyer JW, Frymoyer WW, Pope MH. The mechanical and kinematic analysis of the lumbar spine in normal living human subjects in vivo. *J Biomech* 1979;12:165-172.
34. Frymoyer JW, Pope MH, Wilder DG. Segmental instability. In: Weinstein JN, Wiesel SW (eds.): *The lumbar spine (ISSLS)*. WB Saunders, Philadelphia, 1990;612-636.
35. Gardner-Morse MG, Stokes IA. Physiological axial compressive preloads increase motion segment stiffness, linearity and hysteresis in all six degrees of freedom for small displacements about the neutral posture. *J Orthop Research* 2003;21:547-552.
36. Gardner-Morse MG, Stokes IA. Structural behaviour of human lumbar spinal motion segments. *J Biomech* 2004;37:205-212.
37. Gertzbein SD. Accuracy of pedicular screw placement in vivo. *Spine* 1990;15:11-14.
38. Gertzbein SD, Seligman J, Holtby R, Chan KW, Ogston N, Kapasouri A, Tile M. Centrode characteristics of the lumbar spine as a function of segmental instability. *Clin Orthop* 1986;208:48-51.
39. Gertzbein SD, Seligman J, Holtby R, Chan KW, Ogston N, Kapasouri A, Tile M, Cruichshank B. Centrode patterns and segmental instability in degenerative disc disease. *Spine* 1985;10:257-261.
40. Gertzbein SD, Wolfson N, King G. *The diagnosis of segmental instability in vivo by centrode length*. Vortrag auf der ISSLS-Tagung, Miami, 1988.
41. Gianturco C. A roentgen analysis of the motion of the lower lumbar vertebrae in normal individuals and in patients with low back pain. *AJR Am J Radiol* 1944;52:261-268.
42. Haaker R. *Biomechanische und klinische Untersuchungen zur Fusionsoperation der Lendenwirbelsäule*. Habilitationsschrift. Ruhr-Universität Bochum, 1997.

43. Harada M, Abumi K, Ito M, Kaneda K. Cineradiographic motion analysis of normal lumbar Spine during forward and backward flexion. *Spine* 2000;25:1932-1937.
44. Haughton VM, Lim TH, An H. Intervertebral disc appearance correlated with stiffness of lumbar spinal motion segments. *AJNR Am J Neroradiol* 1999;20:1161-1165.
45. Hayes MA, Howard TC, Gruel CR, Kopta JA. Roentgenographic evaluation of lumbar spine flexion-extension in asymptomatic individuals. *Spine* 1989;14:327-331.
46. Hedtmann A. Das so genannte Postnukleotomiesyndrom – Fehlschläge der Bandscheibenoperation? *Z Orthop* 1992;130:456-465.
47. Herkowicz HN. Degenerative lumbar spondylolisthesis. *Spine* 1995;20:1084-1090.
48. Holmes DC, Brown MD, Eckstein EC. Quantitative instability assessment of the lumbar functional spinal unit. *Trans Orthopaedic Research Society* 1988;13:326.
49. Hoag JM, Kosok M, Moser JR. Kinematic analysis and classification of vertebral motion. *J Am Osteopath Ass* 1960;59:899-908.
50. Huang RC, Girardi FP, Cammisa Jr FP, Tropiano P, Marnay T. Long-trem flexion-extension range of motion of the prodisc total disc replacement. *J Spinal Disord Techn* 2003;16:435-440.
51. Huang RC, Girardi FP, Cammisa Jr FP, Tropiano P, Marnay T. Correlation between range of motion and outcome after lumbar total disc replacement: 8.6-year follow up. *Spine* 2005;30:1407-1411.
52. Iguchi T, Kanemura A, Kasahara K, Kurihara A, Doita M, Yoshiya S. Age distribution of three radiologic factors for lumbar instability: Probable aging process of the instability with disc degeneration. *Spine* 2003;28:2628-2633.
53. Iguchi T, Kanemura A, Kasahara K, Sato K, Kurihara A, Yoshiya S, Nishida K, Miyamoto H, Doita M. Lumbar instability and clinical symptoms: Which is the more critical factor for symptoms: Sagittal translation or segment angulation? *J Spinal Disord Tech* 2004;17:284-290.
54. Israel M. A quantitative method of estimating flexion and extension of the spine. *Mil Med* 1959;124:181-186.
55. Junghanns H. Spondylolisthesen ohne Spalt im Zwischengelenkstück („Pseudospondylolisthesen“). *Archiv für Orthopädische und Unfallchirurgie* 1930;29:118.
56. Kahanovitz N. *Diagnosis and treatment of low back pain*. Raven press, New York, 1991.

57. Kaigle AM, Holm SH, Hansson T. Experimental instability in the lumbar spine. *Spine* 1995;20:421-430.
58. Kaigle AM, Pope MH, Fleming BC, Hansson T. A method for the intravital measurement of interspinous kinematics. *J Biomechanics* 1992;5:451-456.
59. Kaigle AM, Wessberg P, Hansson TH. Muscular and kinematic behaviour of the lumbar spine during flexion-extension. *J Spinal Disord* 1998;11:163-174.
60. Kalebo P, Kadziolka R, Sward L. Compression traction radiography of lumbar segmental instability. *Spine* 1990;15:351-355.
61. Kanayama M, Abumi K, Kaneda K, Tadano S, Ukai T. Phase lag of the intersegmental motion in Flexion-Extension of the lumbar and lumbosacral Spine. *Spine* 1996;21:1416-1422.
62. Kanayama M, Hashimoto T, Shigenobu K, Oha F, Ishida T, Yamane S. Intraoperative biomechanical assessment of lumbar spine instability: Validation of radiographic parameters indicating anterior column support in lumbar spinal fusion. *Spine* 2003;28:2368-2372.
63. Kato Y, Panjabi MM, Nibu K. Biomechanical study of lumbar stability after osteoplastic laminectomy. *J Spinal Disord* 1998;11:146-150.
64. Kauppila LI, Eustace S, Kiel DP, Felson DT, Wright AM. Degenerative displacement of lumbar vertebrae: A 25-year follow-up study in Framingham. *Spine* 1998;23:1868-1874.
65. Key JA. The conservative and operative treatment of lesions of the intervertebral disc in the low back. *Surgery* 1945;17:297-303.
66. Kirkaldy-Willis WH. Presidential symposium of instability of the lumbar spine. *Spine* 1985;10:254.
67. Kirkaldy-Willis WH, Farfan HF. Instability of the lumbar spine. *Clin Orthop Relat Res* 1982;165:110-123.
68. Knutsson F. The instability associated with disc degeneration in the lumbar spine. *Acta Radiol (Stockh)* 1944;25:593-609.
69. Kothe R, Panjabi MM, Lui W. Multidirectional instability of the thoracic spine due to iatrogenic pedicle injuries during transpedicular fixation. *Spine* 1997;22:1836-1842.
70. Krämer J. *Bandscheibenbedingte Erkrankungen*. Thieme, Stuttgart, New York, 1994.
71. Krämer J. 2001. Persönliche Mitteilung.

72. Krag MH, Cohen MC, Haugh LD, Pope MN. Body height changes during upright and recumbent posture. *Spine* 1990;15:202-207.
73. Krappel FA. Minimalinvasive Fusionen an der Lendenwirbelsäule. Vortrag auf der 53. Jahrestagung Süddeutscher Orthopäden e.V., Baden-Baden, 2005
74. Krismer M, Haid C, Ogon M, Behensky H, Wimmer C. Biomechanik der lumbalen Instabilität. *Orthopäde* 1997;26:516-520.
75. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;33:159-174.
76. Ledet EH, Tymeson MP, DiRisio DJ, Cohen B, Uhl RL. Direct real-time measurement of in vivo forces in the lumbar spine. *Spine J* 2005;5:85-94.
77. Lee CK. Lumbar spinal instability after extensive posterior spinal decompression. *Spine* 1983;8:429-433.
78. Lehmann TR, Brandt RA. Instability of the lower spine. *Orthopaedic Transactions* 1983;7:97.
79. Lim MR, Girardi FP, Zhang K, Huang RC, Peterson MG, Cammisa FP Jr. Measurement of total disc replacement radiographic range of motion: A comparison of two techniques. *J Spinal Disord Techn* 2005;18:252-256.
80. Lin RM, Yu CY, Chang ZJ, Lee CC, Su FC. Flexion-extension rhythm in the lumbosacral spine. *Spine* 1994;19:2204-2209.
81. Lindahl D. Determination of the sagittal mobility of the lumbar spine. *Acta Orthop Scand* 1966;37:241-254.
82. Lorenz M, Patwardhan A, Vanderby R. Load-bearing characteristics of lumbar facets in normal and surgically altered spinal segments. *Spine* 1983;8:122-130.
83. Lovett RW. Die Mechanik der normalen Wirbelsäule und ihr Verhältnis zur Skoliose. *Z Orthop Chir* 1905;14:399-445.
84. Magerl F. *Der Wirbel-Fixateur externe*. In: Weber BG, Magerl F (Hrsg.): *Fixateur externe*. Springer, Berlin, Heidelberg, New York, 1985;290-302.
85. Maigne JY, Lapeyre E, Morvan G, Chatellier G. Pain immediately upon sitting down and relieved by standing up is often associated with radiologic lumbar instability or marked anterior loss of disc space. *Spine* 2003;28:1327-1334.
86. Marras WS, Wonsam PE. Flexibility and velocity of the normal and impaired lumbar spine. *Arch Phys Med Rehabil* 1986;67:213-217.

87. McGregor A, McCarthy ID, Hughes SP. Motion characteristics of the lumbar spine in normal population. *Spine* 1995;20:2421-2428.
88. McGregor AH, McCarthy ID, Doré CJ, Hughes SP. Quantitative assessment of the motion of the lumbar spine in the low back pain population and the effect of different spinal pathologies on this motion. *Eur Spine J* 1997;6:308-315.
89. Melamed A, Ansfield DJ. Posterior displacement of lumbar vertebrae. Classification and criteria for diagnosis of true retrodisplacement of lumbar vertebrae. *AJR Am J Radiol* 1947;58:307-328.
90. Moeini SMR, Lemons JE, McCutcheon MJ, Molz IV FJ. Investigation of video technique for dynamic measurement of relative vertebral body motion in vitro. *Biomed Instrum Techn* 1996;30:62-70.
91. Morgan FP, King T. Primary instability of lumbar vertebrae as a common cause of low back pain. *J Bone Joint Surg* 1957;39(Br):6-22.
92. Murata M, Morio Y, Kuranobu K. Lumbar disc degeneration and segmental instability: A comparison of magnetic resonance images and plain radiographs of patients with low back pain. *Arch Orthop Trauma Surg* 1994;113:297-301.
93. Nachemson AL. Disc pressure measurement. *Spine* 1981;6:93-97.
94. Nachemson A. Lumbar spine instability: a critical update and symposium summary. *Spine* 1985;10:290-291.
95. Nathan M, Keller TS. Measurement and analysis of the in-vivo posteroanterior impulse response of the human thoracolumbar spine: A feasibility study. *J Manip Physiol Therap* 1994;17:431-440.
96. Ng JKF, Kippers V, Richardson CA, Parnianpour M. Range of motion and lordosis of the lumbar spine. Reliability of measurement and normative values. *Spine* 2001;26:53-60.
97. Ogston NG, King GJ, Gertzbein SD, Tile M, Kapasouri A, Rubenstein JD. Centrode patterns in the lumbar spine. Baseline studies in normal subjects. *Spine* 1986;11:591-595.
98. Okawa A, Shinomiya K, Komori H, Meneta T, Arai Y, Nakai O. Dynamic motion study of the whole lumbar spine by videofluoroscopy. *Spine* 1998;23:1743-1749.
99. Okuda, S, Iwasaki M, Miyauchi A, Aono H, Morita M, Yamamoto T. Risk factors for adjacent segmental degeneration after PLIF. *Spine* 2004;29:1535-1540.

100. Oxland TR, Panjabi MM, Southern EP, Duranceau JS. An anatomic basis for spinal instability: A porcine trauma model. *J Orthop Research* 1991;9:452-462.
101. Paajanen H, Erkintalo M, Dahlstrom S, Kuusela T, Svedstrom E, Komano M. Disc degeneration and lumbar instability: Magnetic resonance examination of 16 patients. *Acta Orthop Scand* 1989;60:375-378.
102. Panjabi MM. Centers and angles of rotation of body joints: Study of errors and optimization. *J Biomechanics* 1979;12:911-920.
103. Panjabi MM. The stabilizing system of the spine. Part I. Function, dysfunction, adaptation and enhancement. *J Spinal Disord* 1992;4:383-389.
104. Panjabi MM. The stabilizing system of the spine. Part II. Neutral zone and instability hypothesis. *J Spinal Disord* 1992;4:390-397.
105. Panjabi MM, Goel VK, Tarata K. Physiological strains in lumbar spinal ligaments, an in vitro biomechanical study. *Spine* 1982;7:192-201.
106. Panjabi MM, Oxland TR, Yamamoto I, Crisco JJ. Mechanical behavior of the human lumbar and lumbosacral spine as shown by three-dimensional load-displacement curves. *J Bone Joint Surg (Am)* 1994;76:413-424.
107. Panjabi MM, Takata K, Goel VK. Kinematics of lumbar intervertebral foramen. *Spine* 1983;8:348-357.
108. Panjabi MM, White AA. Physical properties and functional biomechanics of the spine. In: White AA, Panjabi MM (eds.) *Clinical Biomechanics of the Spine*. Lippincott, Williams & Wilkens, Philadelphia, Baltimore, New York, 1990;1-84.
109. Panjabi MM, White AA. The problem of clinical instability in the human spine. A systematic approach. Part IV: The lumbar and lumbosacral spine. In: White AA, Panjabi MM (eds.) *Clinical Biomechanics of the Spine*. Lippincott, Williams & Wilkens, Philadelphia, Baltimore, New York, 1990;342-361.
110. Percy MJ. Stereo-radiography of lumbar spine motion. *Acta Orthop Scand Supp* 1985;212:1-41.
111. Percy MJ. Measurement of back and spinal mobility. *Clin Biomech* 1987;1:44-51.
112. Percy MJ, Bogduk N. Instantaneous axes of rotation of the lumbar intervertebral joints. *Spine* 1988;13:1033-1041.
113. Percy M, Shepherd J. Is there a instability in spondylolisthesis. *Spine* 1985;10:175-177.

114. Pearcy MJ, Timbrowal MS. Axial rotation and lateral bending in the normal lumbar spine measured by three-dimensional radiography. *Spine* 1984;9:582-587.
115. Pennal GF, Conn GS, McDonald G, Dale G, Garside H. Motion studies of the lumbar spine. A preliminary report. *J Bone Joint Surg (Br.)* 1972;54:442-452.
116. Pennig L, Blickmann JR. Instability in lumbar spondylolisthesis: A radiologic study of several concepts. *AJR Am J Radiol* 1980;134:293-301.
117. Pennig L, Wilmink JT, van Woerden HH. Inability to prove instability. A critical appraisal of clinical-radiological flexion-extension studies in lumbar disc degeneration. *Diagn Imag Clin Med* 1984;53:186-192.
118. Pfeiffer M, Sigg A. *Zwei neue einfache Verfahren zur intraoperativen Ermittlung der Segmentstabilität der Lendenwirbelsäule*. Vortrag auf dem Deutschen Orthopädenkongress, Berlin, 2004.
119. Pitkanen M, Manninen HI, Lindgren KA, Turunen M, Airaksinen O. Limited usefulness of traction-compression films in the radiographic diagnosis of lumbar spinal instability. *Spine* 1997;22:193-197.
120. Pitnar FA, Cusick FJ, Yoganandan N, Reinertz J, Malesh M. The biomechanics of the lumbar facetectomy under compression-flexion. *Spine* 1992;17:804-810.
121. Pope MH, Frymoyer JW, Krag MH. Diagnosing instability. *Clin Orthop* 1992;279:60-67.
122. Pope MH, Panjabi M. Biomechanical definitions of spinal instability. *Spine* 1985;10:255-256.
123. Pope MH, Wilder DG, Matteri RH, Frymoyer JW. Experimental measurement of vertebral motion under load. *Orthop Clinics North Am* 1977;8:155-167.
124. Posner I, White AA III, Edwards T, Hayes WC. A biomechanical analysis of the clinical stability of the lumbar and lumbosacral spine. *Spine* 1982;7:374-389.
125. Quinnell RC, Stockdale HR. Flexion and extension radiography of the lumbar spine: A comparison with lumbar discography. *Clin Radiol* 1983;34:405-411.
126. Quint U, Wilke HJ, Lör F, Claes LE. Funktionelle Folgen operativer Dekompressionen an lumbalen Bewegungssegmenten – eine biomechanische Studie in vitro. *Z Orthop* 1998;136:350-357.
127. Rab GT, Chao EY. Verification of radiographic landmarks in the lumbar spine. *Spine* 1977;2:287-293.

128. Ransom N, La Rocca H, Thalgott J. The case for pedicle fixation of the lumbar spine. *Spine* 1994;19:2702-2706.
129. Rohlmann A, Bergmann G, Graichen F. A spinal fixation device for in vivo load measurement. *J Biomechanics* 1994;27:961-967.
130. Rohlmann A, Bergmann G, Graichen F: Telemetrische Belastungsmessung am Wirbel-Fixateur interne beim Gehen. *Orthop Praxis* 1996;32:86-87.
131. Rohlmann A, Bergmann G, Graichen F, Weber U. Comparison of loads on internal spinal fixation devices measured in-vitro and in-vivo. *Med Eng Phys* 1997;19:539-546.
132. Rohlmann A, Neller S, Claes L, Bergmann G, Wilke HJ. Influence of a follower load on intradiscal pressure and intersegmental rotation of the lumbar spine. *Spine* 2001;26:E557-E561.
133. Rosenberg P. The R-Center method. A new method of analysing vertebral motion by x-rays. *J Am Osteopath Assoc* 1955;55:103-111.
134. Sato H, Kikuchi S. The natural history of radiographic instability of the lumbar spine. *Spine* 1993;18:2075-2079.
135. Schmidt TA, An HS, Lim TH, Nowicki BH, Haughton VM. The stiffness of lumbar spine motion segments with a high-intensity zone in the annulus fibrosus. *Spine* 1998;23:2167-2173.
136. Schulthess W. Zur normalen und pathologischen Anatomie der jugendlichen Wirbelsäule. *Z Orthop Chir* 1899;6:399-434.
137. Seligman JV, Gertzbein SD, Tile M, Kapasouri A. Computer analysis of spinal segment motion in degenerative disc disease with and without axial loading. *Spine* 1984;9:566-573.
138. Shaffer WO, Spratt KF, Weinstein J, Lehmann TR, Goel V. The consistency and accuracy of roentgenograms of measuring sagittal translation in the lumbar vertebral motion segment. *Spine* 1990;15:741-750.
139. Sharma M, Langrana NA, Rodriguez J. Role of ligaments and facets in lumbar spinal stability. *Spine* 1995;20:887-900.
140. Shirazi-Adl A, Parnianpour M. Load-bearing and stress analysis of the human spine under a novel wrapping compression loading. *Clin Biomech* 2000;15:718-725.
141. Shono Y, Kaneda K, Albumi K, McAfee PC, Cunningham BW. Stability of posterior spinal instrumentation and its effect on adjacent motion segments in the lumbosacral spine. *Spine* 1998;23:1550-1558.

142. Soini J, Antti-Poika I, Tallroth K, Knttinen YT, Honkanen V, Santavirta S. Disc degeneration and angular movement of the lumbar spine: Comparative study using plain and flexion-extension radiography and discography. *J Spinal Disord* 1991;4:183-187.
143. Solinger AB. Theory of small vertebral motions: An analytical model compared to data. *Clin Biomech* 2000;15:87-94.
144. Steffen T, Rubin RK, Baramki HG, Antoniou J, Marchesi D, Aebi M. A new technique for measuring lumbar segmental motion in-vivo. *Spine* 1997;22:156-166.
145. Stokes IAF, Frymoyer JW. Segmental motion and segmental instability. *Spine* 1987;12:688-691.
146. Stokes IAF, Gradner-Morse M. Spinal stiffness increases with axial load: Another stabilizing consequence of muscle action. *J Electromyogr Kinesiol* 2003;13:397-402.
147. Stokes, IAF, Wilder DG, Frymoyer JW, Pope MH. Assessment of patients with low back pain by biplanar radiographic measurement of intervertebral motion. *Spine* 1981;3:233-240.
148. Strasser H. *Lehrbuch der Muskel- und Gelenkmechanik*. Springer, Berlin, 1913.
149. Takayanagi K, Takahashi K, Yamagata M, Moriya H, Kitahara H, Tamaki T. Using cineradiography for continuous dynamic motion analysis of the lumbar spine. *Spine* 2001;26:1858-1865.
150. Tanz SS. Motion of the lumbar spine. A roentgenologic study. *AJR Am J Radiol* 1953;69:399-412.
151. Tanz SS. To-and-fro motion range at fourth and fifth lumbar interspace. *J Mt Sinai Hosp* 1950;16:303-307.
152. Taylor VM, Deyo RA, Cherkin DC, Kreuter W. Low back hospitalization; recent U.S. trends and regional variations. *Spine* 1994;19:1207-1213.
153. Taylor VM, Deyo RA, Goldberg H, Ciol M, Kreuter,W, Spunt B. Low back hospitalization in Washington State; Recent trends and geographical variations. *J Spinal Disord* 1995;8:1-7.
154. Teo EC, Ng HW. Evaluation of the role of ligaments, facets and disc nucleus in lower cervical spine und compression and sagittal moments using finite element method. *Med Engng Phys* 2001;23:155-164.
155. Tibrewal SB, Percy MJ, Portek I, Spivey J, Chir B. A prospective study of lumbar spinal movement before and after discectomy using biplanar radiography. Correlation of clinical and radiographic findings. *Spine* 1985;10:455-460.

156. Tiedjen K, Müller KM. *Pathologie der degenerativen Wirbelsäulenerkrankungen*. Springer, Berlin, Heidelberg, New York, 1998;47-50.
157. Tokuhashi Y, Matsuzaki H, Sano S. Evaluation of clinical instability using the treadmill. *Spine* 1993;15:2321-2324.
158. Viner A, Lee M, Adams R. Posteroanterior stiffness in the lumbosacral spine. The correlation between adjacent vertebral levels. *Spine* 1997;22:2724-2729.
159. Virchow H. Über die tiefen Rückenmuskeln des Menschen. *Anat Anz* 1907;30:91-111.
160. Virgin WJ. Experimental investigation into the physical process of the intervertebral disc. *J Bone Joint Surg (Br)* 1951;33:607-611.
161. Washito T, Hasegawa K, Hara T. A practical technique for intraoperative measurement of spinal mobility: in vitro experimental study using porcine FSU. *12th Conference of the European Society of Biomechanics*, Dublin, 2002;172.
162. Weber W, Weber EH. *Mechanik der menschlichen Gehwerkzeuge*. Göttingen, 1836.
163. Weiler PJ, King GJ, Gertzbein SD. Analysis of sagittal plan instability of the in vivo. *Spine* 1990;15:1300-1306.
164. White AA III, Panjabi MM. The bone kinematics of the human spine. *Spine* 1978;3:12-20.
165. White AA, Panjabi MM. Kinematics of the Spine. In: White AA, Panjabi MM (eds.) *Clinical Biomechanics of the Spine*. Lippincott, Williams & Wilkens, Philadelphia, Baltimore, New York, 1990;85-126.
166. Wiesel S. Edior's corner. *Sermin Spine Surg* 1991;3:91.
167. Wilder DG, Seligson D, Frymoyer JW, Pope MH. Objective measurement of L4-L5 instability. A case report. *Spine* 1980;5:56-58.
168. Wiles P. Movements of the lumbar vertebrae during flexion and extension. *Proc Royal Society Med* 1935;28:647-651.
169. Wilke HJ, Claes L, Schmitt H, Wolf S. A universal spine tester for in-vitro experiments with muscle force simulation. *Eur Spine J* 1994;3:91-97.
170. Wilke HJ, Wolfs S, Claes L, Arandt M, Wiesend A. Stability increase of the lumbar spine with different muscle groups. *Spine* 1995;20:192-198.

171. Wilke HJ, Wenger K, Claes L. Testing criteria for spinal implants: Recommendations for the standardisation of in-vitro stability testing of spinal implants. *Eur Spine J* 1998;7:148-154.
172. Wilke HJ, Neef P, Caimi M, Hoogland T, Claes L. New intradiscal pressure measurement in-vivo during daily activities. *Spine* 1999;24:755-762.
173. Wilke HJ, Rohlmann A, Neller S, Schultheiß M, Bergmann G, Fraichen F, Claes L. Is it possible to simulate physiologic loading conditions by applying pure moments? A comparison of in-vivo and in-vitro load components in an internal fixateur. *Spine* 2001;26:636-642.
174. Wiltse LL, Winter RB. Terminology and measurement of spondylolisthesis. *J Bone Joint Surg (Am)* 1983 ;65:768-772.
175. Wittenberg RH, Haacker R. Biomechanik und Biostatik. In : von Stempel A (Hrsg.) : *Die Wirbelsäule*. Thieme, Stuttgart, New York, 2001;16-37.
176. Wood KB, Popp CA, Transfeldt EE, Geissele MAE. Radiographic evaluation of instability in spondylolisthesis. *Spine* 1994;19:1697-1703.
177. Yamamoto I, Panjabi MM, Crisco T, Oxland T. Three-dimensional movements of the whole lumbar spine and lumbosacral joint. *Spine* 1989;14:1256-1260.
178. Yingling VR, McGill SM. Anterior shear of spinal motion segments. Kinematics, kinetics, and resultant injuries observed in a porcine model. *Spine* 1999;24:1882-1889.
179. Yuan HA, Garfin SR, Dickman CA, Mardjetko SM. A historical cohort study of pedicle screw fixation in thoracic, lumbar and sacral spinal fusions. *Spine* 1994;19:2279S-2296S.
180. Zander T, Rohlmann A, Klöckner C, Bergmann G. Influence of graded facetectomy and laminectomy on spinal biomechanics. *Eur Spine J* 2003;12:427-434.
181. Zielke K. Geleitwort. In: von Stempel A (Hrsg.): *Die Wirbelsäule*. Thieme, Stuttgart, New York, 2001, V-VI.