

Adolescent lumbar disc herniation in a Tae Kwon Do martial artist: a case report

Mohsen Kazemi, RN, DC, FCCSS(C)*

Lumbar disc herniations are rare in children. The etiology and clinical picture may be different in children than in adults. Conservative management is the treatment of choice. Tae Kwon Do is a Korean martial art which is notorious for its high fast kicks. Tae Kwon Do will be an official Olympic sport in the year 2000. Low back pain is occasionally reported by Tae Kwon Do athletes but there are no reported cases in the literature on disc herniation in a Tae Kwon Do athlete. A case report is presented to illustrate clinical presentation, diagnosis, radiological assessment and conservative management of lumbar disc herniation in children. (JCCA 1999; 43(4):236-242)

KEY WORDS: adolescent, children, chiropractic, disc herniation, low back pain, martial arts, rehabilitation, sports injury

Introduction

Lumbar disc herniations are rare in children and adolescents. Although the true incidence rate is not known, the incidence of surgery for disc herniation in patients less than 20 years of age is less than 3%.¹⁻⁸ Ishihara et al.⁹ reported that only 3% of all their Japanese patients operated upon for disc herniation were under 16 years of age, whereas Kurihara and Kataoka¹⁰ reported this to be 15% in their Japanese population. Lumbar injuries in junior (less than 17 years of age) Tae Kwon Do martial artists are

Les hernies discales lombaires se rencontrent rarement chez les enfants. L'étiologie et le tableau clinique d'un enfant peuvent différer de celui d'un adulte. Un traitement conservateur est privilégié. Le tae kwon do est un art martial coréen reconnu pour ses coups de pied rapides et portés haut. Il sera reconnu officiellement comme discipline olympique en l'an 2000. Les athlètes pratiquant le tae kwon do se plaignent à l'occasion de lombalgie, mais la documentation scientifique ne fait état d'aucun cas de hernie discale. Voici un cas de hernie discale lombaire chez un enfant, qui permettra d'illustrer la démarche thérapeutique depuis les manifestations cliniques jusqu'au traitement conservateur, en passant par le diagnostic et le bilan radiologique. (JACC 1999; 43(4):236-242)

MOTS CLÉS : adolescent, enfants, chiropratique, hernie discale, lombalgie, arts martiaux, réadaptation, blessures sportives.

reported to be about 2%.¹¹

The clinical presentation and etiology of lumbar disc herniation in children and adolescents may be different from that in adults. However, trauma and sport injuries are the most common etiological factors in this age group.^{1,2,6,7,12} Apophyseal ring fracture is often associated with a disc herniation in children and adolescents.^{8,10,13}

A case is presented to illustrate the diagnosis, the differential diagnosis and the conservative management of lumbar disc herniation in the adolescent athlete.

* Sports Injury & Rehabilitation Center, 2780 Jane Street, Suite 202, Downsview, Ontario M3N 2J2.
Tel: (416) 745-2162. Fax: (416) 745-2168.
© JCCA 1999.

Case report

A 14-year-old male, with a third degree black belt in Tae Kwon Do, presented with severe low back pain which radiated to his left gluteal region. The pain had started two weeks before and was attributed to a jumping reverse hook kick without any warm-up. He was unable to move for two to three days after this incident. The pain was described as “sharp” and constant. The pain was aggravated by bending forward and flexing the left hip, and was slightly relieved by icing the area. Past clinical history revealed mild left thoracic “C” curve scoliosis, L5–S1 facet dysfunction, left sacroiliac dysfunction and right trochanteric bursitis.

Examination revealed a flattened lumbar lordosis. His pulse was 80 beats per minute and his oral temperature was 37 degree centigrade. Lumbar neurological examination, patellar and Achilles reflexes, light touch sensation and motor strength were unremarkable. During lumbar flexion, the patient could only touch the mid thigh with the tip of his finger, due to the restriction caused by left gluteal pain. Left lateral flexion was more restricted than on the right and both reproduced the left buttock pain. Bilateral Kemp’s test, bilateral straight leg raises (SLR) at 30 degrees, left Braggard’s test and left bowstring test reproduced the left buttock pain. Yeoman’s test and posterior-anterior compression of the left sacroiliac joint caused pain in the left posterior superior iliac spine region. Left hip range of motion and joint play were unremarkable. Palpation revealed hypertonic and tender lumbar paraspinal and quadratus lumborum muscles. Facet joint dysfunctions at the left L4–L5 and L5–S1 were noted upon palpation. Valsalva, coughing, Patrick (Faber) test, Thomas’ test, heel to buttocks (Ely’s) test, spinous percussion and piriformis muscle palpation were unremarkable. Routine lumbar spine radiographs revealed reduced lumbar lordosis. (Figure 1)

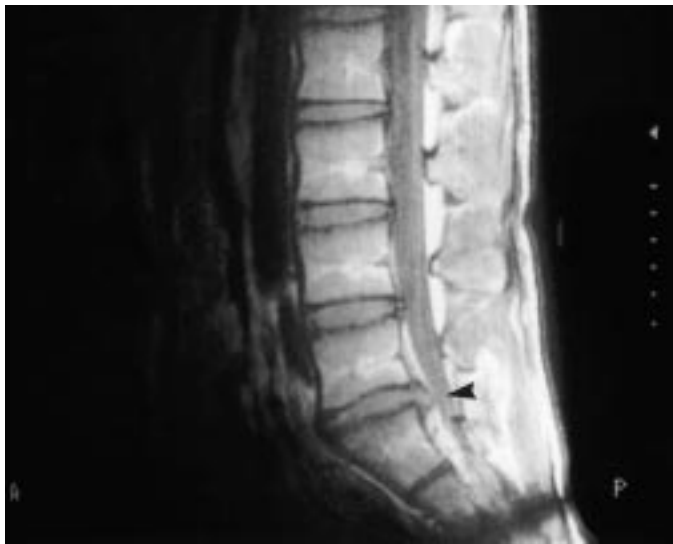
A diagnosis of possible left posterolateral lumbar disc herniation was made. Initial treatment consisted of side posture lumbar spinal mobilization, interferential current therapy and cryotherapy for two weeks. The patient was referred to an orthopaedic surgeon for a second opinion. The specialist agreed with the diagnosis, requested a lumbar MRI study and referred the patient back to his chiropractor for further conservative treatment. The lumbar MRI indicated a left posterolateral L5–S1 disc herniation. (Figure 2a–d)

At the end of the second week, the patient could touch



Figure 1 Lateral lumbar spine radiograph. Note the decreased lumbar lordosis as a result of muscle spasm and the patient’s antalgic posture.

his knees with the tip of his fingers, the left SLR was 45 degrees and there was no muscular tenderness. At this time, the treatment was changed to intermittent lumbar traction, side posture lumbar spinal manipulation therapy and an exercise rehabilitation program, two to three times per week for four weeks. The rehabilitation program consisted of treadmill walking for 15 minutes to maintain the cardiovascular fitness, stretching exercises for the back, gluteal region and hamstrings, back extension exercises, strengthening exercises of the hip flexors, extensors, back, latissimus dorsi and rectus abdominus muscles. At the one



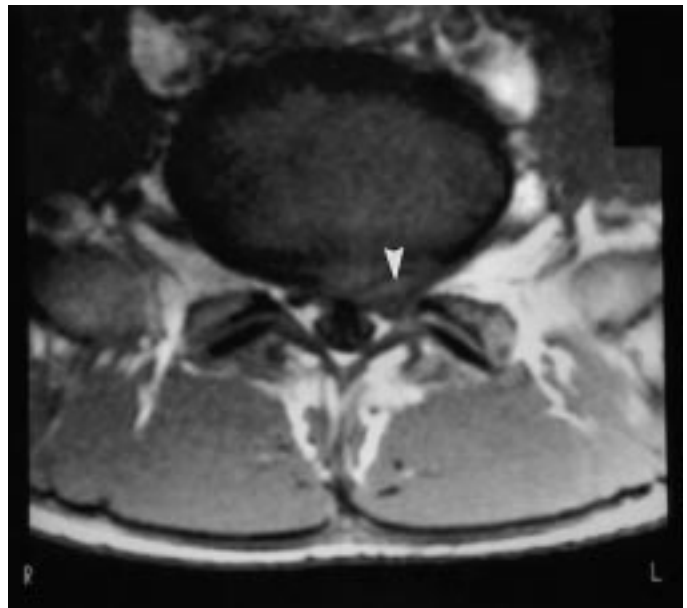
A



B



C



D

Figure 2 Lumbar spine MRI. **A.** T1-weighted; **B.** T2-weighted; **C.** Proton density, arrow heads point to the L5 herniated disc. **D.** Cross section: arrow head points to the L5 herniated disc on the left.

month reassessment, there was no low back pain, but the left gluteal pain persisted with less intensity. Bilateral SLR at 45 degrees, left Braggard's and bowstring tests, and coughing for the first time reproduced the left gluteal pain. In addition, left Achilles' reflex (S1) was also reduced for the first time but the sensory and motor component of the lumbar neurological examination remained intact. Therapeutic ultrasound, moist heat and rehabilitation exercises two times per week for four weeks were recommended. At the end of this period, i.e., two months after the first treatment, the patient was able to touch his mid tibia with the tip of his fingers. The right SLR was 120 degrees and pain free and the left bowstring was unremarkable. However, the left S1 reflex remained diminished, the left SLR at 45 degrees and the left Braggard's tests reproduced his left buttock pain. Intermittent lumbar traction, SMT and exercises two times per week for the next five weeks were administered. At this time, the patient felt much better, and started playing basketball and Tae Kwon Do. At this time, the left SLR improved to 60 degrees. Lumbar flexion and the S1 reflex remained the same. The same treatment was continued one to two times per week for four weeks. At the end of this treatment course, the athlete felt 80–85% better than at his first visit. While the right SLR was 130 degrees and pain free, left SLR at 75 degrees reproduced the buttock pain. However, left S1 reflex and left Braggard's test were unremarkable. Treatment was continued with addition of infrared laser therapy, one to two times per week for the next four weeks. At the end of this period, the athlete reported 90% improvement since day one, and played basketball with no pain. However, during Tae Kwon Do practice, only the left front rising kick at the head level caused discomfort in his left buttock area. The left SLR caused the left buttock pain at 85 degrees and the patient could now touch his ankles with the tip of his fingers. The same treatment was continued once a week for five weeks. Seven months after his first visit, the athlete reported 100% recovery. The athlete reported slight left buttock pain only with front rising kick higher than his head. The left SLR caused a slight left buttock pain at 100 degrees. In one year follow-up, the athlete was pain free with 130 degrees left SLR.

Discussion

The clinical features of lumbar disc herniation are not always the same for young and adults. This may contribute

to delay in diagnosis of this ailment in children and adolescents. Ghabrial and Tarrant¹² reported that 41 of their 87 adolescents with disc herniation had no leg pain and signs of neurological deficit were often absent. However, antalgic posture or scoliosis, severely restricted lumbar range of motion, markedly restricted straight leg raise and an abnormal shuffling gait are reported by many authors.^{1,4,5,7,10,12} This description nicely matches the case presented above, as the athlete had buttock pain without any leg pain, antalgic posture, severe restriction in lumbar flexion and markedly positive straight leg raise. Kurihara and Kataoka¹⁰ noted scoliosis, vertebral muscle spasm and decreased lumbar lordosis to be much more common in their young patients. Our athlete also presented with decreased lumbar lordosis and lumbar muscle spasm. Hard neurological signs are less frequently found in adolescents than they are in adults with herniated disc.^{1,4,5,7,10,12} However, others have found no significant difference between the clinical presentation in adults and that in the young.^{2,6}

There are a number of differential diagnoses to be considered in an adolescent with herniated disc. The most important ones to rule out are apophyseal ring fracture, disc infection and tumors causing a radiculopathy.⁸ The ring apophyses does not undergo complete osseous union with the vertebral body until age eighteen.¹⁴ Therefore, this junction is considered weaker than that in adults. This weakness has been accounted for frequent associated ring fracture with disc herniation in the young. In this case the ring fracture and disc space infection were ruled out by radiographs, blood work and MRI.

Another cause of radiculopathy in children could be tumors. Spinal tumors may be Intradural or Extradural in origin. Intradural tumors are less common and include astrocytomas, ependymomas, neurofibroma and meningiomas.⁸ Extradural tumors in adolescents are usually benign and include osteoid osteoma and osteoblastoma.⁸ The presence of a spinal tumor was ruled out by radiograph, blood work and MRI.

Trauma is believed to be a common cause of disc herniation in children and adolescents.^{2,3,5,6,7,10,15} Sports injuries are reported to be a more common cause of trauma in the young, however, lifting injuries and chronic repetitive trauma have also been observed.^{5,6,10,16} In this case the precipitating factor was the flying reverse hooking kick without warm-up. This kick involves jumping from a standing position, 180 degrees rotation of the trunk in the

air and execution of the kick at the highest point of the jump. This causes rotation and flexion of the lumbar spine at the beginning stages of the kick and rotation and extension when the kick is completed. The annulus fibrosis of the lumbar spine is most vulnerable during rotation and flexion. The other contributing factor might have been the landing from the jump which caused compressive forces acting on the intervertebral disc. In this case the combination of these forces probably induced the herniation of the disc.

Routine x-rays are not recommended in acute low back pain of 4–6 weeks duration in the absence of clinical red flags in adults.^{17,18,19} The Agency for Health Care Policy and Research (AHCPR) guidelines for acute low back pain¹⁷ in adults recognizes the following red flags: prior cancer or recent infection, fever over 100 degrees F, IV drug abuse, prolonged steroid use, low back pain worse with rest and unexplained weight loss. However, the Royal College of General Practitioners (RCGP) national low back pain clinical guidelines¹⁸ adds the following red flags to the above list: presentation under age 20 or onset over 55, non-mechanical pain, thoracic pain, widespread neurological and structural deformity. In the case presented, none of the above was present except the presentation under age 20, therefore, the routine lumbar x-rays were taken to rule out any osseous lesion. RCGP¹⁸ recommends prompt referral within the first 4 weeks of the presentation in the presence of any red flag. The athlete was referred to an orthopaedic surgeon who confirmed the L5–S1 disc herniation by clinical examinations and MRI. The other reason for this referral was to obtain a MRI since chiropractors in Ontario, Canada are unable to directly order MRI. The specialist referred the athlete back to the chiropractor for continuation of the conservative treatment. Herzog²⁰ believes that MRI is the best imaging device in assessment of a lumbar disc herniation. “Advantages of MRI over Computerized Tomography (CT) includes its performance without using ionizing radiation and its capability to provide direct multiplanar images with spatial and contrast resolution that is superior to CT. Also, MRI provides a more comprehensive examination of the entire lumbar spine, including assessment of the conus medullaris and cauda equina.”²⁰

Conservative treatment is the recommended first choice of care. Surgery is not recommended in the first 6–12 weeks because of a favorable natural history.^{17,18,19,21,22}

Many authors have reported success in the treatment of adolescent lumbar disc herniation using bed rest, heat, analgesics, corsets, spinal manipulation and other physical modalities.^{4,8,12,16} Others, however reported different outcomes. Bulos reported failure of the conservative treatment, bed rest, in 7 out of 8 patients. Ishihara et al.,⁹ Kurihara and Kataoka¹⁰ advised against prolonged conservative treatment of lumbar disc herniation in the young, and advocated surgical interventions for an early return to the school life.

The Clinical Guidelines For Chiropractic Practice In Canada²¹ states that “overall evidence and clinical experience suggest that the electrical modalities are of value in the treatment of back pain.” However, AHCPR¹⁷ found no evidence of benefit from the application of physical agents and modalities. The efficacy of bed rest, and especially complete bed rest has not been established, and is considered to be not indicated.^{17,18,21,22}

Ohshiro and Shirono,²³ Yu and Kim²⁴ reported good to excellent improvement using infrared laser in treatment of patients with lumbosacral radiculopathy. However, the methodology of these studies are questionable.

Lumbar traction has been shown to induce vertebral separation, reduction of disc herniation, and changes in intervertebral disc pressures.²⁵ However, the clinical effectiveness of pelvic traction still remains controversial.²⁵ Heijden et al.²⁶ compared utilization of high-dose traction with sham (low-dose) traction in a randomized clinical trial. They reported that the recovery rate after 5 weeks in the high-dose group was 64% compared to 34% in the sham group. However, Beurskens et al.²⁷ failed to demonstrate any statistically significant improvement at 12-week and at 6-month results. Hence, maximum benefit of the lumbar traction may be achieved during the first five weeks of application.

AHCPR¹⁷ recommends, “aerobic activities that minimally stress the back such as walking, biking or swimming can be started during the first 2 weeks of acute low back problems. Then conditioning exercises for the trunk muscles, in particular the back extensors, may be helpful, especially if the patient’s low back problems persist, although such exercises may initially aggravate symptoms.” Koes et al.²⁸ in their review of the literature could not conclude any superiority of the exercise therapy or any specific type of exercise to the other conservative treatments for back pain.

The Royal College of General Practitioners¹⁸ states, “It is

doubtful that specific back exercises produce clinically significant improvement in acute low back pain (less than 6 weeks duration), or that it is possible to select which patients will respond to which exercises.” However, it acknowledges that McKenzie exercises may produce some short-term symptomatic improvement in acute low back pain.¹⁸ Faas²⁹ in his review of the literature reports that in acute low back pain (less than 6 weeks), exercise therapy is ineffective, whereas in subacute back pain (6 weeks to 3 months), exercises with a graded activity program, and in chronic back pain (3 months and more), intensive exercising, may be helpful. On the other hand, Young et al.³⁰ states that the exercise programs used in different studies in the literature reviewed by Koes et al.²⁸ and Faas²⁹ were not in response to the physical examination findings. Young et al.³⁰ finds it unreasonable to expect to observe specific benefits from an exercise program if specific diagnosis were not made prior to the initiation of the treatment. They recommend McKenzie exercises for the patients with posterolateral disc herniation since these exercises identify postures and motions that centralize radicular/ referred low back pain.³⁰ In contrast, Williams’ flexion exercises were theorized to decrease loading of the posterior portion of the disc and to widen the foramina. Therefore, patients with central spinal stenosis and posterior element pain may benefit from these kind of exercises.³⁰ In the case presented, spinal extension exercises, walking and stretching were used.

Spinal manipulation therapy (SMT) has been suggested to be of benefit in treatment of acute low back pain.^{8,15,16,17,18,21,22} Saal²² recognizes the effectiveness of SMT for acute low back pain, but calls it controversial for the treatment of lumbar herniated disc. Weber¹⁹ deems it ‘contraindicated’ for the treatment of lumbar disc herniation, without any reference to support his statement. AHCP¹⁷ recommends SMT during first month of acute low back pain without radiculopathy. RCGP guidelines¹⁸ recommends it within first 6 weeks for acute low back pain with or without radiculopathy, but finds the evidence inconclusive as to whether SMT for low back pain of more than six weeks duration provides clinically significant improvement in outcomes compared with other treatments. Koes et al.³¹ in their review of literature report that the efficacy of spinal manipulation for patients with acute or chronic low back pain has not been demonstrated with sound randomized clinical trials. However, they³¹ state

that,” There is at least as much as evidence in favor of manipulation for chronic low back pain as there is for acute low back pain.”

There is clinical evidence to suggest effectiveness of SMT in treatment of lumbar disc herniation.^{8,15,16,32,33,34} All of these studies are case reports, therefore, further research and especially randomized controlled studies are needed to justify their results. Tibbles et al.,⁸ Hession and Donald¹⁶ reported favorable outcomes using manipulation and electrical therapy in management of adolescent disc herniation. However, King et al.³⁵ reported no improvement in their adolescent utilizing SMT. The athlete in this case showed great improvement within 6 month of conservative treatment which is compatible with the reported outcome of surgery and perhaps natural history. Some authors reported a period of 3 months to one year before return of the postsurgical patient to sporting activities.^{3,9} The athlete in this case returned to sports after 3 months of conservative treatment. At one year follow-up, the athlete was pain free and had full range of motion and was fully involved with Tae Kwon Do and basketball.

Conclusions

Adolescent disc herniation is uncommon and is often caused by trauma. The natural history of disc herniation in adolescents is not known. Clinical presentation may be the same as that in adults with less hard neurological signs. Apophyseal ring fracture, disc space infection and spinal tumors should be ruled out. Lumbar x-rays are recommended in the young with radiculopathy. Conservative treatment is the mainstream care. The conservative care in this case report shown compatible results as recorded for surgical interventions. Further research especially randomized controlled studies are warranted to find the effectiveness of the spinal manipulation therapy in adolescent disc herniation.

References

- 1 Borgensen SE, Vang S. Herniation of the lumbar intervertebral disk in children and adolescents. *Acta Orthop Scand* 1974; 45:540–549.
- 2 Bradford DS, Garcia A. Lumbar intervertebral disk herniations in children and adolescents. *Orthop Clin North Am* 1971; 2(2):583–592.
- 3 Bulos S. Herniated intervertebral lumbar disc in the teenager. *J Bone J Surgery* 1973; 55B(2):273–278.

- 4 Bunnell WP. Back pain in children. *Orthop Clin North Am* 1982; 13(3):587–604.
- 5 Grobler LJ, Simmons EH, Barrington TW. Intervertebral disc herniation in the adolescent. *Spine* 1979; 4(3):267–278.
- 6 Nelson CL, Janecki CJ, Glidenberg PL, Sava G. Disk protrusions in the young. *Clin Orthop Related Research* 1972; 88:142–150.
- 7 Russwurm H, Bjerkreim, Ronglan E. Lumbar intervertebral disc herniation in the young. *Acta Orthop Scand* 1978; 49:158–163.
- 8 Tibbles AC, Cote P, Cassidy JD, Donat J. Adolescent apophyseal ring fracture simulating lumbar disc herniation: a case report. *JCCA* 1992; 36(1):11–16.
- 9 Ishihara H, Matsui H, Hirano N, and Tsuji H. lumbar intervertebral disc herniation in children less than 16 years of age, long term follow-up of surgically managed cases. *Spine* 1997; 22(17):2044–2049.
- 10 Kurihara A, Kataoka O. Lumbar disc herniation in children and adolescents. *Spine* 1980; 5(5):443–451.
- 11 Oler M, Tomson W, Pepe H, Yoon D, Branoff R, and Branch J. Mortality and morbidity in the martial arts: A warning. *The Journal of Trauma* 1991; 31(2):251–253.
- 12 Ghabrial YAE, Tarrant MJ. Adolescent lumbar disc prolapse. *Acta Orthop Scand* 1989; 60(2):174–176.
- 13 Hashimoto K, Kojimoto H, Shimomura Y. Lumbar disc herniation in children, *J Pediatric Orthopaedics* 1990; 10:394–396.
- 14 Dietemann JL, Runge M, Badoz A et al. 1990; 10:394–396. Radiology of posterior lumbar apophyseal ring fractures: report of 13 cases. *Neuroradiol* 1988; 30:337–344.
- 15 Quon JA, Cassidy JD, O'Connor SM, Kirkaldy-Willis WH. Lumbar intervertebral disc herniation: treatment by rotational manipulation. *JMPT* 1989; 12:220–227.
- 16 Hession EF, and Donald GD. Treatment of multiple lumbar disk herniation in an adolescent athlete utilizing flexion distraction and rotational manipulation. *JMPT* 1993; 16:185–192.
- 17 Bigos S, Bowyer O, Braen G et al. (1994) Acute Low-Back Problems in Adults. Clinical practice guideline No.14. AHCPR Publication No.95-0642. Rockville, MD; Agency for Health Care Policy and Research, Public Health Services, U.S. Department of Health and Human Services.
- 18 Waddell G, Feder G et al. (1996) Low-Back Pain Evidence Review, London: Royal College of General Practitioners.
- 19 Weber H. the natural history of disc herniation and the influence of intervention. *Spine* 1994; 19(19): 2234–2238.
- 20 Herzog RJ. The radiologic assessment for a lumbar disc herniation. *Spine* 1996; 21; 24S:19S–38.
- 21 Henderson D, Chapman-Smith D, Mior S, Vernon H. Clinical guidelines for chiropractic practice in Canada. Proceedings of a Consensus Conference Commissioned by the Canadian Chiropractic Association Held at the Glenierin Inn Mississauga, Ontario, Canada, April 3–7, 1993.
- 22 Saal JA. Natural history and nonoperative treatment of lumbar disc herniation. *Spine* 1996; 21, 24S:2S–9S.
- 23 Ohshiro T, Shirono Y. Retroactive study in 524 patients on the application of the 830 nm GaAlAs diode laser in low reactive-level laser therapy for lumbago. *Laser Therapy* 1992; 4:121–126.
- 24 Yu IH, Kim YJ. Therapeutic laser effects on lumbosacral radiculopathy patients: a clinical report. 3rd World Congress International Society for Low Power Laser Applications in Medicine, Bologna, Italy, Sept 9–12, 1992.
- 25 Pellecchia GL. Lumbar traction: a review of the literature. *J Orthop Sports Phys Ther* 1994; 20(5):262–267.
- 26 Heijden GJMG van der, Beurskens AJHM, Dirx MJM, Bouter LM, Lindeman E. Efficacy of lumbar traction: A randomized clinical trial. *Physiotherapy* 1995; 81:29–35.
- 27 Beurkens AJ et al. Efficacy of traction for nonspecific low back pain. 12-week and 6-month results of a randomized clinical trial. *Spine* 1997; 22;23:2756–2762.
- 28 Koes BW, Bouter LM, Beckerman H, van der Heijden GJMG, Knipschild PG. Physiotherapy and back pain: a blinded review. *BMJ* 1991; 302:1572–1576.
- 29 Faas A. Exercises: which ones are worth trying, for which patients, and when? *Spine* 1996; 21;24:2874–2879.
- 30 Young JL, Press JM, Herring S. The disc at risk in athletes: perspective on operative and nonoperative care. *Med & Science in Sports & exercise* 1997; 29(7):S222–S232.
- 31 Koes BW, Assendelft WJJ, van der Heijden GJMG, Bouter LM. Spinal manipulation for low back pain, an updated systematic review of randomized clinical trials. *Spine* 1996; 21;24:2860–2873.
- 32 Cassidy JD, Thiel HW, and Kirkaldy-Willis WH. Side posture manipulation for lumbar intervertebral disk herniation. *JMPT* 1993; 16:96–103.
- 33 Slosberg M. Side posture manipulation for lumbar intervertebral disk herniation reconsidered. *JMPT* 1994; 17(4):258–262.
- 34 Cox JM, Hazen LJ, Mungovan M. Distraction manipulation reduction of an L5–S1 disk herniation. *JMPT* 1993; 16(5):342–346.
- 35 King L, Mior SA, Devonshire-Zielonka K. Adolescent lumbar disc herniation: a case report. *JCCA* 1996; 40(1):15–18.