

Conservative Management of Post-Surgical Urinary Incontinence in an Adolescent Using Applied Kinesiology: A Case Report

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Abstract

INTRODUCTION: This case report describes the successful treatment of an adolescent female suffering daily stress and occasional total urinary incontinence with applied kinesiology methods and chiropractic manipulative therapy. **PATIENT PRESENTATION:** A 13-year-old female developed unpredictable urinary incontinence and right hip pain immediately following emergency open appendectomy surgery. The patient was forced to wear an incontinence pad throughout the day and night for 10 months because of unpredictable urinary incontinence. **ASSESSMENT AND INTERVENTION:** Chiropractic and applied kinesiology (AK) methods – a multi-modal diagnostic technique that utilizes manual muscle tests (MMT) for the detection of musculoskeletal impairments and specific AK techniques for correction of identified issues – were utilized to diagnose and treat this patient for muscle impairments in the lumbar spine and pelvis. **RESULTS:** Patient experienced a rapid resolution of her urinary incontinence and hip pain. A six-year follow-up confirmed complete resolution of symptoms. **DISCUSSION:** In this case, utilization of MMT allowed for the identification of several inhibited muscles. Utilizing the appropriate corrective techniques improved the strength of these muscles and resulted in their being graded as facilitated. Symptoms of urinary incontinence and hip pain resolved with this diagnostic and treatment approach. **CONCLUSION:** AK methods were useful for the discovery of a number of apparent causative factors underlying this patient's urinary incontinence and hip pain. Treatment for these pelvic-floor muscle and joint abnormalities resulted in rapid, long-lasting resolution of her urinary incontinence and hip pain.

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Introduction

Urinary incontinence is defined as any involuntary leakage of urine. It occurs most commonly in older patients.¹ Incontinence in children is also a common disorder. Fantl et al state that incontinence affects four of 10 women, about one of 10 men, and about 17 percent of children below the age of 15.²

Continence depends primarily on the optimal function of two systems – the urethral muscular support system and the sphincteric muscular system.³ These systems include the levator ani, detrusor, and pelvic floor muscles, as well as the pudendal nerve that emerges from the sacral plexus. Recent data suggest that patients with stress incontinence may have imbalances in several lumbo-pelvic muscles, which may inhibit the pelvic floor muscles and lead to incontinence.⁴ Recent data also suggests that breathing difficulties and incontinence are associated with increased chances for the development of low-back pain (LBP).⁵ Evidence such as this suggests that, in cases of incontinence, the interactions between the lumbar and pelvic muscles and the joints may be an important consideration.

The structural evaluation and treatment of children appears to date from at least 1727, at which time Nicholas Andry coined the term “ortho-paedics” to depict “straightening the young” – an approach that became the defining principle of the medical procedures that he published.⁶ One reason children may go to chiropractic or orthopedic doctors, physical therapists, or other manual therapists is for pediatric back pain, which is far more prevalent than was assumed several decades ago.⁷ The lifetime prevalence of LBP among schoolchildren has been reported to be anywhere

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from 20-51 percent.⁸⁻⁹ Appropriate chiropractic manipulative therapy (CMT) might improve the function of lumbar and pelvic muscles, and as such could improve symptoms of LBP.

A recent study assessed strength changes using a perineometer (a pressure electromyograph that registers muscular contractions of the pelvic floor) after the application of CMT. This investigation showed that phasic perineal contraction and basal perineal tonus, force, and pressure increased after CMT.¹⁰ Since patients with urinary incontinence can have imbalances in lumbo-pelvic muscle function, this study suggests that CMT might be useful in the treatment of this condition.

This case describes how the manual muscle test (MMT) and other aspects of applied kinesiology (AK) were used to identify the source of, and CMT to treat, the problem. CMT (a combination of manual or digital soft tissue or high-velocity low-amplitude techniques, including the well-established “chiropractic adjustment”) was used to correct muscular inhibitions in the pelvis and low back and to restore strength to the pelvic muscles, thereby improving this patient’s urethral closing mechanisms and incontinence. A glossary of AK terms used in this study is found at the end of this case report.

Patient Presentation

A 13-year-old female presented with a chief complaint of urinary incontinence accompanied by right hip pain. The patient’s incontinence and right hip pain began 10 months earlier immediately following an emergency open appendectomy. After the surgery the patient experienced frequent and daily stress incontinence, as well as occasional total incontinence. Her quantity of urine loss was severe enough that she had worn an incontinence pad constantly since the surgery.

The patient was first seen by her pediatrician, who was unable to find a cause for her condition. She was subsequently referred to a urologist who performed a number of tests; but again, no etiology was determined. She was referred to the Chiropractic Health Center, a clinic that focuses on pediatric health concerns and also the office of the lead author.

Assessment and Intervention

The approach used in this case combined aspects of AK and CMT. The theory behind AK holds that the diagnosis of the causes for muscle inhibition proceeds more directly toward correction because

the “challenge” and/or “therapy localization” methods used in AK guide the clinician toward the most effective therapy for the diagnostic finding (inhibitions found during MMT).¹¹⁻¹³ (Note: See glossary of AK terms at the end of the case report)

The testing of the muscle is based upon the procedures and principles of Kendall and Kendall, who over half a century ago established that a given muscle, when tested from a contracted position against increasing applied pressure from the examiner, could either maintain its position and be rated as “facilitated” (strong), or break away and thus be graded as “inhibited” (weak).¹⁴ A recent detailed literature review found the reliability of MMT to be good (Cohen *kappa* values, interclass coefficients, or percent agreement at 0.6 or higher) in 10 controlled clinical trials. The review also established the validity of MMT (construct, convergent and discriminant, concurrent, and predictive validity) in over 40 controlled clinical trials.¹³ Extensive clinical guidelines for the effective and reproducible use of MMT as used in this report have recently been presented.¹⁵

The muscle tests in the patient’s examination that were facilitated were equivalent to 5 on the five-point strength scale provided in the *Guides to the Evaluation of Permanent Impairment*, 5th Edition, by the American Medical Association.¹⁶ Muscles graded 4 or less were considered inhibited, warranting the AK and CMT interventions described in Table 1.

On initial examination, small incision scars associated with the appendectomy were observed at the umbilicus, above the pubic bone, and diagonally across the right lower quadrant. Pinching the appendectomy scar gently as well as stretching the right lateral abdominal oblique muscle on the right produced inhibition of the muscle on MMT. AK mechanical treatment to the scar using a mechanical percussion device abolished both findings.^{11,12,18}

Results

The first consultation, examination, and treatment lasted one hour. At the end of this visit the patient reported that her hip pain was much reduced and she felt that her posture was improved. She stated, “I feel like I’m breathing deeper and standing up straighter.” The patient was instructed to return in three days for a second evaluation. At that time the patient reported that the urinary incontinence had completely resolved, hip pain was reduced, and she no longer wore an incontinence

Table 1. AK Examination Findings, Corrective Treatments, and Outcomes

AK Examination Finding (using MMT)	Corrective Treatment/Outcome
Palpation of the tissues above the right levator ani muscle with the valsalva maneuver revealed bulging (indicating inhibition of the right levator ani).	Digital or thumb pressure to the levator ani muscle and sacro-tuberous and sacro-spinous ligaments corrected the right levator ani finding.
Positive mechanical challenge for a pelvic articular dysfunction caused a previously facilitated indicator muscle to become inhibited.	CMT to the pelvis abolished challenge to the pelvis and strengthened the previously inhibited left hamstring muscle. In CMT, this dysfunction is called a category II pelvic fault. This is an osseous disrelation between the sacrum and the innominate, and is commonly corrected using pelvic wedges in order to gently realign the sacroiliac joints.
Positive respiratory challenge to the diaphragm muscle caused a previously facilitated indicator muscle to become inhibited.	CMT to correct fixations at the C3-5 cervical levels abolished diaphragm challenge (Figure 1)
Lower trapezius muscles were inhibited bilaterally.	CMT for thoracolumbar fixations strengthened the lower trapezius muscles bilaterally.
There was a stretch induced inhibition of the previously facilitated left gluteus maximus and right lateral abdominal oblique muscles.	Percussion and ischemic compression (two methods of trigger point therapy in AK using an instrument ¹⁷) on the appendectomy scar for approximately 1 minute corrected stretch-induced inhibition of left gluteus maximus and right lateral abdominal oblique muscles. ¹⁸
Psoas muscles were inhibited bilaterally.	CMT for an occipital fixation strengthened psoas muscles bilaterally.
Sternocleidomastoid (SCM) muscles on the right and anterior scalene muscles were inhibited bilaterally.	Right inspiration, left expiration assist cranial fault corrections to the temporal bones bilaterally strengthened SCM on right and anterior scalene bilaterally.

pad. On the third follow-up visit (one week later), her incontinence had not returned and her hip pain was eliminated. Patient has subsequently been followed for an additional six years, during which time her hip pain and distressing 10-month incontinence problem has not returned.

Discussion

Arnold Kegel was the first to advocate pelvic floor muscle strengthening and retraining for

stress incontinence.¹⁹ His premise was that women with stress incontinence needed first to establish awareness of their pelvic floor muscles and then to strengthen them through exercise. This program of strengthening the inhibited pelvic floor muscles has shown some promise.²⁰ The Kegel approach of repetitive exercises for strengthening the pelvic floor muscles was not offered in this patient's previous medical treatments.

While the Kegel approach might have been beneficial, in a case like this where muscle inhibition of the pelvic floor played some role in the urinary incontinence, Sherrington's law of reciprocal innervation is operational ("when one muscle contracts, its direct antagonist relaxes to an equal extent"). This law suggests that some of the pelvic floor muscles – the antagonists to the inhibited pelvic floor muscles – may already be hypertonic; therefore, toning exercises for the pelvic floor muscles may be counterproductive.

Inhibition of muscles, especially those with a stabilization role, is commonly found in people with spinal complaints.²¹ Research has demonstrated that there is an immediate strengthening effect (measured electromyographically and with other objective instrumentation) on the peripheral muscles after CMT.^{10,22-26}

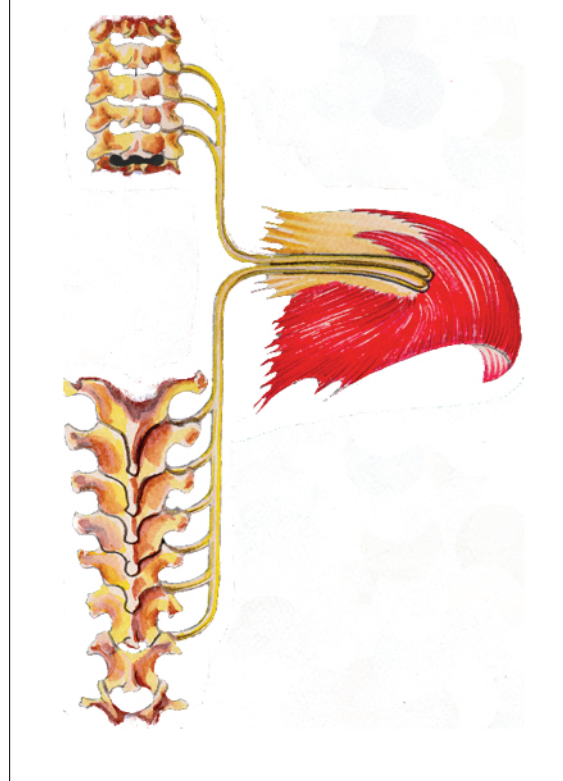
Many disturbances have also been attributed to mechanical interference of the sacral nerve roots in children and adolescents.²⁷ Numerous case reports, studies, and randomized controlled clinical trials, outlined in *Somatovisceral Aspects of Chiropractic: An Evidence-Based Approach*, report improvement in chronic pelvic pain and genito-urinary system dysfunction with CMT of pelvic and lumbar spinal dysfunctions.²⁷

A number of cases have been reported on the use of CMT for elderly patients with urinary incontinence.²⁸ Stude et al reported a case study of a 14-year-old female who recovered completely from traumatically induced urinary incontinence after CMT.²⁹ CMT has been effective in other reports on bladder control problems.³⁰⁻³² Physical therapy for women with predominantly stress incontinence has also shown reductions in nocturia.^{33,34} Acupuncture has been used successfully as well.³⁵

In the current case, utilization of MMT allowed for the identification of several inhibited muscles. Utilization of the appropriate corrective techniques^{11-13,36,37} improved the strength of these muscles and resulted in a grade of "facilitated." Challenge allowed for the rapid assessment of the relationship between a number of differing structures in the patient and the patient's specific muscular impairments, including the relationship between the fixation identified in the cervical region at the C3-C4 level and inhibition of the respiratory challenge in the diaphragm muscle. A previous case series report³⁸ by one of the authors (SCC) involved 10 pediatric patients with asthma, each of whom had a primary muscular impairment of their diaphragm muscle. Correction of this disturbance, via chiropractic manipulative

treatment to the cervical spine, as well as other impairments in breathing diagnosed and treated with AK methods, led to successful discontinuation of asthma medications in this cohort of 10 children. This report indicates that there can be an important connection between fixations at this level of the cervical spine and the function of the pelvic diaphragm (Figure 1).

Figure 1. Innervation of the Diaphragm Muscle by Nerves from the Cervical and Lower Thoracic Spine



Van Zak reported that procedures to improve strength and control over external urinary sphincter muscles (the gluteal, pubococcygeus, and levator ani muscles) may be beneficial in the treatment of incontinence.⁴⁰ Bo et al used needle electromyogram (EMG) to measure activity in the urethral wall during a cough, the Valsalva maneuver, and activation of other pelvic muscles. They concluded that strengthening the pelvic muscles (including those of the pelvic floor) also strengthens the urethral wall muscles.⁴¹ In this case, positive MMT findings indicating inhibition in these muscle groups may have contributed to failure of the urethral apparatus during stress.

Glossary of Applied Kinesiology Terms

■ Manual Muscle Test: MMT was established by Kendall and Kendall,¹⁴ who held that when pressure is increasingly applied to a contracted muscle, the muscle either maintains its position (rated as “facilitated” or “strong”) or breaks away (rated as “inhibited” or “weak”). The testing of muscle strength itself has been widely practiced in manual medicine for decades by such authorities as Daniels and Worthingham. The use of the MMT for functional conditions continues today with the work of Goodheart, Janda, Chaitow, Sahrmann, Bergmann, Lewit, Liebenson, and Hammer.^{12,44-49} The American Medical Association has accepted that the standard method of MMT used in AK is a reliable tool and advocates its use for the evaluation of disability impairments.¹⁶ According to this rating system, a grade 5 MMT is normal muscle strength, demonstrating complete (100%) range of movement against gravity, with firm resistance offered by the practitioner. Grade 4 is 75-percent efficiency in achieving range of motion against gravity with slight resistance, with decreasing increments of 25-percent efficiency with each lower grade to 0. A muscle graded 4 or less is considered inhibited, warranting interventions as described in the report.

■ Challenge: Challenge using MMT is a diagnostic procedure that originated in AK. It is used to determine the body’s ability to cope with external stimuli, which can be physical, chemical, or mental. Cranial and vertebral challenge has been described in the literature.^{11-13,36,37} After an external stimulus is applied, muscle testing procedures are conducted to determine a change in the muscle strength as a result of the stimulus. Through this approach, ineffective challenges that produce no improvement in muscle strength are rejected, while those that elicit a positive muscle response are used.

In this female patient, the scar from the appendectomy might have disturbed the respiratory mechanics of the oblique abdominal and diaphragm muscles. The stress from the 10-months of incontinence and constant use of an incontinence pad may have increased this child’s anxiety. This could have produced breathing pattern disorders that further disturbed the diaphragm muscle. These factors might have combined to affect the function of the diaphragmatic muscle, which has been connected to the function of the pelvic floor, bladder, and urethra.³⁻⁵

Scars from previous surgeries may be the site of formation of connective tissue myofascial trigger points (MTrPs).⁴² The possibility of active MTrPs in the left gluteus maximus and right lateral oblique abdominal muscles beneath the appendectomy scars was investigated using the AK methods of pincer palpation and muscle stretch reaction.^{11,12,18} These tests identified the presence of active MTrPs. Travell described a method of treatment for MTrPs called percussion, which was used in this case.⁴²

Mense and Simons state that because the taut band in the muscle (the *locus in quo* of MTrPs) is likely to create enthesopathy, stretching the muscle (as is done in the AK “muscle stretch reaction” test) might inflame its attachments and thereby produce muscle inhibition.⁴³ Mense and Simons also suggest that the recognition of the muscle inhibition caused by MTrPs is often a critical step in the restoration of normal function. In their view, other muscles suffer from compensatory overload due to the inhibition created by the MTrPs in the inhibited muscles.⁴³ This was the rationale in this case for seeking MTrPs in the gluteus maximus muscle and using the MMT to identify this phenomenon. The use of MMT for the identification of MTrPs makes detection of the effects of MTrPs on muscle strength detectable for the examiner and the patient.

Travell and Simons state that “weakness is generally characteristic of muscles with active MTrPs.”⁴² This weakness or inhibition may also be present in cases of incontinence in the urethral and sphincteric muscular support systems (including the levator ani, detrusor, and pelvic floor muscles) of the lower pelvis.^{3,10,43}

In this case (consistent with the initial work of Kegel in the 1940s), analysis of, and treatment for, these inhibited muscles may have been the reason for successful treatment of this patient’s distressing problem. However, the natural resolution of symptoms in this patient cannot be ruled out.

Glossary of Applied Kinesiology Terms (continued)

■ **Therapy Localization:** Therapy localization is a diagnostic procedure that originated in AK. It consists of placing the patient's hand over areas of suspected involvement and observing for a change in the MMT. This method is aimed at assisting the doctor to rapidly identify areas that are involved with the muscle dysfunction found on MMT; it has been used clinically for over 30 years.^{11,12} Pollard et al, in a recent literature review, outlined research supporting the AK concept of therapy localization.³⁹ Collectively, data suggest that stimulating or stabilizing the muscles, joints, ligaments, and skin, and their associated cutaneomotor reflexes (identified during therapy localization) can produce changes in muscle function.

■ **Inhibited and Facilitated Muscles:** While terms like weak or strong are commonly used, the preferred terms are conditionally inhibited and conditionally facilitated, respectively. A conditionally inhibited muscle is a muscle that may or may not develop full power, but on MMT does not neurologically function at its full capacity. A conditionally facilitated muscle is a muscle that functions at its full neurological capacity during MMT.⁵⁰

■ **Indicator Muscle:** An indicator muscle is a muscle tested to determine if there is a change in its strength as a result of some testing mechanism (challenge or therapy localization, for instance) applied to the body. Generally, an indicator muscle is facilitated prior to the test and becomes inhibited as a result of the testing procedure.

Conclusion

A case of urinary incontinence in a 13-year-old female was resolved, subsequent to CMT guided by AK MMT methods. The assessment and treatment using these methods during an initial one-hour session appears to have corrected muscular

Glossary of Applied Kinesiology Terms (continued)

■ **Myofascial trigger points:** MTrPs describe a characteristic referred pain pattern from a specific skeletal muscle. According to Leibenson, the combination of muscular inhibition, joint dysfunction, and trigger point activity is the key peripheral component leading to functional pathology of the motor system.⁴⁵ In AK, the presence of myofascial trigger points can be objectively identified using the muscle stretch procedure that produces detectable changes in muscle strength with MMT.^{11-13,18,42} An MTrP can be treated using percussion. It is thought that the immediate effect of percussion is to modify the physical nature of the myofascial matrix.^{18,42,43} Percussion (using a mechanical device in this case report) may press fluid from the nuclear bag of the muscle spindle cells (part of the MTrPs pathophysiology), reducing the tension in the capsule of the spindles.^{43,51}

■ **Scar Tissue Treatment:** Scar tissue treatment is an approach to dealing with potential functional impairments caused by scar tissue. Kobesova et al suggest that scars may develop adhesive properties that disturb tissue tension, alter proprioceptive input, and create functional changes similar to active myofascial trigger points.⁵² This may create faulty sensory input that can result in disturbed motor output, leading to adaptive postural patterns, impaired muscular strength, disturbed neurovascular activity, and pain syndromes. Moncayo recently demonstrated the usefulness of AK scar treatment on muscular function.⁵³

inhibitions related to articular and soft tissue disorders of the pelvis and lumbar spine, and resolved the urinary incontinence and hip pain. The urinary incontinence and hip pain was believed to have initially begun subsequent to an emergency appendectomy. It persisted for 10 months and might have been further worsened by daily stress

Glossary of Applied Kinesiology Terms (continued)

■ **Cranial Faults:** Cranial faults involve the failure of the skull to move in its normal, rhythmic manner. They were discovered by Sutherland and have been researched by many others.⁵⁴⁻⁵⁶ The open border between the jugular process of the occiput and the petrous portion of the temporal bone begins at the jugular foramen, and this area remains open throughout life. It is not actually a sutural joint or articulation but an extended crevice. At the very center of the cranial base, two of the primary bony structures do not articulate along a portion of their common border – an architectural arrangement that maximizes malleability and motion. This open architectural design at the petrous temporal and jugular process makes the cranial base portion of the temporal area and the occiput vulnerable to displacement, because they lack the mutual bracing of a suture.

and additional muscular imbalances that resulted from symptomatic management of incontinence. Resolution of this distressing condition was verified on yearly follow-up contacts over the subsequent six years.

A bibliography of quantitative case studies could aid in developing larger-scale controlled trials of treatment for incontinence disorders. Based on the findings in this case report and the research literature described, AK and CMT strategies designed to optimize muscle strength, timing, and function for the lumbo-pelvic and pelvic floor muscles may help reduce the severity and/or resolve a burden of disability, dependence, and cost for patients with urinary incontinence.

References

- Ahmadi B, Alimohammadian M, Golestan B, et al. The hidden epidemic of urinary incontinence in women: a population-based study with emphasis on preventive strategies. *Int Urogynecol J Pelvic Floor Dysfunct* 2010;21:453-459.
- Fantl JA, Newman DK, Colling J, et al. *Managing Acute and Chronic Urinary Incontinence*. Clinical Practice Guideline. Quick Reference Guide for Clinicians, No. 2, 1996 Update. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research. AHCPR Pub. No. 96-0686. January 1996.
- Ashton-Miller JA, Howard D, DeLancey JO. The functional anatomy of the female pelvic floor and stress continence control system. *Scand J Urol Nephrol Suppl* 2001;207:1-7;discussion 106-125.
- Smith MD, Coppieters MW, Hodges PW. Postural response of the pelvic floor and abdominal muscles in women with and without incontinence. *Neurol Urodyn* 2007;26:377-385.
- Smith MD, Russell A, Hodges PW. Disorders of breathing and continence have a stronger association with back pain than obesity and physical activity. *Aust J Physiother* 2006;52:11-16.
- Biedermann H. Manual therapy in children: with special emphasis on the upper cervical spine. In: Vernon H, ed. *The Cranio-Cervical Syndrome*. Oxford, UK: Butterworth-Heinemann; 2001:207-230.
- Wedderkopp N, Lebouef-Yde C, Andersen LB, et al. Back pain reporting pattern in a Danish population-based sample of children and adolescents. *Spine (Phila Pa 1976)* 2001;26:1879-1883.
- Balagué F, Troussier B, Salminen JJ. Non-specific low back pain in children and adolescents: risk factors. *Eur Spine J* 1999;8:429-438.
- Korovessis P, Koureas G, Zacharatos S, Papazisis Z. Backpacks, back pain, sagittal spinal curves and trunk alignment in adolescents: a logistic and multinomial logistic analysis. *Spine (Phila Pa 1976)* 2005;30:247-255.
- de Almeida BS, Sabatino JH, Giraldo PC. Effects of high-velocity, low-amplitude spinal manipulation on strength and the basal tonus of female pelvic floor muscles. *J Manipulative Physiol Ther* 2010;33:109-116.
- Walther DS. *Applied Kinesiology Synopsis*. 2nd ed. Pueblo, CO: Systems DC; 2000.
- Goodheart GJ. *Applied Kinesiology Research Manuals*. Detroit, MI: Privately published; 1964-1998.
- Cuthbert SC, Goodheart GJ, Jr. On the reliability and validity of manual muscle testing: A literature review. *Chiropr Osteopat* 2007;15:4.
- Kendall HO, Kendall FP. *Posture and Pain*. Baltimore, MD: Williams & Wilkins; 1952.
- Schmitt WH, Cuthbert SC. Common errors and clinical guidelines for manual muscle testing: "the arm test" and other inaccurate procedures. *Chiropr Osteopat* 2008;16:16.

16. American Medical Association: *Guides to the Evaluation of Permanent Impairment*. 5th ed. Chicago, IL: American Medical Association; 2001:510-511.
17. <http://www.impactinc.net/> [Accessed December 19, 2010]
18. Cuthbert SC. Applied kinesiology and the myofascia. *Int J Applied Kinesiol Kinesiologic Med* 2002;13-14.
19. Kegel AH. Progressive resistance exercise in the functional restoration of the perineal muscles. *Am J Obstet Gynecol* 1948;56:238-248.
20. Jones EG, Kegel AH. Treatment of urinary stress incontinence with results in 117 patients treated by active exercise of pubococcygeal. *Surg Gynecol Obstet* 1952;94:179-188.
21. Radebold A, Cholewicki J, Panjabi MM, Patel TC. Muscle response pattern to sudden trunk loading in healthy individuals and in patients with chronic low back pain. *Spine (Phila Pa 1976)* 2000;25:947-954.
22. Shambaugh P. Changes in electrical activity in muscles resulting from chiropractic adjustment: a pilot study. *J Manipulative Physiol Ther* 1987;10:300-304.
23. Dishman JD, Bulbulian R. Spinal reflex attenuation associated with spinal manipulation. *Spine (Phila Pa 1976)* 2000;25:2519-2524;discussion 2525.
24. Suter E, McMorland G. Decrease in elbow flexor inhibition after cervical spine manipulation in patients with chronic neck pain. *Clin Biomech (Bristol, Avon)* 2002;17:541-544.
25. Floman Y, Liram N, Gilai AN. Spinal manipulation results in immediate H-reflex changes in patients with unilateral disc herniation. *Eur Spine J* 1997;6:398-401.
26. Perot D, Goubel F, Meldener R. Quantification of the inhibition of muscular strength following the application of a chiropractic maneuver. *Journale de Biophysique et de Biomecanique* 1986;32:471-474.
27. Masarsky CS, Masarsky MT. *Somatovisceral Aspects of Chiropractic: An Evidence-Based Approach*. New York, NY: Churchill Livingstone; 2001:109-124.
28. Kreitz BG, Aker PD. Nocturnal enuresis: treatment implications for the chiropractor. *J Manipulative Physiol Ther* 1994;17:465-473.
29. Stude DE, Bergmann TF, Finer BA. A conservative approach for a patient with traumatically induced urinary incontinence. *J Manipulative Physiol Ther* 1998;21:363-367.
30. Leboeuf C, Brown P, Herman A, et al. Chiropractic care of children with nocturnal enuresis: a prospective outcome study. *J Manipulative Physiol Ther* 1991;14:110-115.
31. Blomerth PR. Functional nocturnal enuresis. *J Manipulative Physiol Ther* 1994;17:335-338.
32. Reed WR, Beavers S, Reddy SK, Kern G. Chiropractic management of primary nocturnal enuresis. *J Manipulative Physiol Ther* 1994;17:596-600.
33. Hay-Smith J, Herbison P, Morkved S. Physical therapies for prevention of urinary and faecal incontinence in adults. *Cochrane Database Syst Rev* 2002;2:CD003191.
34. Neumann PB, Grimmer KA, Grant RE, Gill VA. Physiotherapy for female stress urinary incontinence: a multicentre observational study. *Aust N Z J Obstet Gynaecol* 2005;45:226-232.
35. Emmons SL, Otto L. Acupuncture for overactive bladder: a randomized controlled trial. *Obstet Gynecol* 2005;106:138-143.
36. Cuthbert SC, Barras M. Developmental delay syndromes: psychometric testing before and after chiropractic treatment of 157 children. *J Manipulative Physiol Ther* 2009;32:660-669.
37. Cuthbert S, Blum C. Symptomatic Arnold-Chiari malformation and cranial nerve dysfunction: a case study of applied kinesiology cranial evaluation and treatment. *J Manipulative Physiol Ther* 2005;28:e1-e6.
38. Cuthbert SC. A multi-modal chiropractic treatment approach for asthma: a 10-patient retrospective case series. *Chiropr J Aust* 2008;38:17-27.
39. Pollard HP, Bablis P, Bonello R. The ileocecal valve point and muscle testing: a possible mechanism of action. *Chiropr J Aust* 2006;36:122-126.
40. Van Zak DB. Non-invasive feedback of external pubococcygei muscle activity as a treatment for urinary incontinence. *Int J Psychosom* 1993;40:56-59.
41. Bo K, Borgen JS. Prevalence of stress and urge urinary incontinence in elite athletes and controls. *Med Sci Sports Exerc* 2001;33:1797-1802.
42. Travell JG, Simons DG. *Myofascial Pain and Dysfunction: The Trigger Point Manual*. Baltimore, MD: Williams & Wilkins; 1983:103-164.
43. Mense S, Simons DG. *Muscle Pain: Understanding Its Nature, Diagnosis, and Treatment*. Philadelphia, PA: Lippincott Williams & Wilkins; 2001:275-277.
44. Janda V. *Muscle Function Testing*. London, UK: Butterworth-Heinemann Ltd; 1983.
45. Liebensohn C. *Rehabilitation of the Spine: A Practitioner's Manual*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2007.
46. Lewit K. *Manipulative Therapy in Rehabilitation of the Locomotor System*. 3rd ed. London, UK: Butterworth-Heinemann Ltd; 1999.
47. Hammer WI. *Functional Soft Tissue Examination and Treatment by Manual Methods*. 2nd ed. Gaithersburg, MD: Aspen Publishers; 1999:415-445.
48. Sahrman S. *Diagnosis and Treatment of Movement Impairment Syndromes*. St. Louis, MO: Mosby, Inc; 2001.
49. Bergmark A. Stability of the lumbar spine. A study in mechanical engineering. *Acta Orthop Scand Suppl* 1989;230:1-54.
50. Schmitt WH Jr, Yanuck SF. Expanding the neurological examination using functional neurologic assessment: part II neurologic basis of applied kinesiology. *Int J Neurosci* 1999;97:77-108.
51. Fulford RC. *Touch of Life*. New York, NY: Simon & Schuster; 1996.
52. Kobesova A, Morris CE, Lewit K, Safarova M. Twenty-year-old pathogenic "active" postsurgical scar: a case study of a patient with persistent right lower quadrant pain. *J Manipulative Physiol Ther* 2007;30:234-238.
53. Moncayo R, Moncayo H. Evaluation of Applied Kinesiology meridian techniques by means of surface electromyography (sEMG): demonstration of the regulatory influence of antique acupuncture points. *Chin Med* 2009;4:9.
54. Sutherland WG. *The Cranial Bowl*. New York, NY: Free Press Company; 1939.
55. Blum CL, Cuthbert S. Cranial therapeutic care: is there any evidence? *Chiropr Osteopat* 2006;14:10.
56. Chaitow L. *Cranial Manipulation Theory and Practice*. 2nd ed. New York, NY: Churchill Livingstone; 2005.