JACO

Journal of the Academy of Chiropractic Orthopedists

2019

Volume 16

Issue 1

March 2019

JACO
Journal of the Academy of Chiropractic Orthopedists

The Open Access, Peer-Reviewed and Indexed Publication of the Academy of Chiropractic Orthopedists

March 2019 – Volume 16, Issue 1

Journal of the Academy of Chiropractic Orthopedists

March 2019 – Volume 16, Issue 1

The Editor's Desk

Shawn M. Neff, DC, MAS, FACO
Editor-in-Chief

I want to use this month's editor's letter to extend my appreciation to Drs. James Demetrious and David Swensen. This will be their last issue serving as associate editors of the Journal of the Academy of Chiropractic Orthopedists. They will certainly be missed.

Dr. Demetrious has served as an editor at the journal for many years as well as serving on the editorial advisory board and as a member of the academy board. He is a clinician, educator, and researcher. He is a great colleague and a true servant leader in our specialty. His hard work and dedication have been a benefit to chiropractic orthopedists and the entire chiropractic profession.

Dr. Swensen has also served the journal for years. He is an officer in the American College of Chiropractic Orthopedists. He is an accomplished clinician and researcher. His dedication to the profession and the specialty of chiropractic orthopedics are evident in his tireless work and enthusiasm.

Please join me in expressing thanks to Drs. Demetrious and Swensen for their years of service and wishing them well in their future endeavors.

I hope you all enjoy this issue.

Sincerely,

-Shawn

Original Article

Increased Low Back Pain in Performance of a Pelvic Tilt Maneuver: A Report of Two Cases

Salvatore J. Minicozzi, DC, CCEP[1], Brent S. Russell, MS, DC[2]

[1] Private practice of chiropractic, Sandy Springs, Georgia, USA

[2] Professor, Dr. Sid E. Williams Center for Chiropractic Research, Life University, Marietta, Georgia, USA

drsal@intelligentchiropractic.com

Published: March 2019

Journal of the Academy of Chiropractic Orthopedists

March 2019, Volume 16, Issue 1

Abstract

Background

This report discusses the pelvic tilt therapeutic exercise as an examination procedure for low back pain (LBP). In the authors' experience, most patients with mechanical LBP attain some relief from posterior tilting of the pelvis. This report describes 2 patients who experienced increased pain from the maneuver.

Case presentation

Two patients presented to the principal author with pain in the low back and right lower extremity. They had similar orthopedic, neurologic, and MRI examination findings, and received similar conservative chiropractic care, including drop-assisted manipulation, Active Isolated Stretching and Strengthening, and instruction in a home exercise program. One substantially

improved, while the other went on to surgery. The pelvic tilt maneuver was a convenient method for monitoring patient response in both cases.

Discussion

In some ways this report simply evokes the mystery of why some patients improve and others, seemingly similar, do not. The authors do not claim to definitively answer the question; rather, we offer a useful examination tool. One objective is to inspire other practitioners to use the pelvic tilt maneuver and investigate further.

Conclusions

With patients who demonstrate an increase in symptoms during a pelvic tilt maneuver, clinical decisions may be aided by repeated use of the maneuver to monitor patient progress. Additional investigation could clarify whether it can be a reliable indicator and with which patients.

Indexing terms: Lordosis; lumbar region; low back pain; chiropractic

Background

The following report involves the longtime use by the principal author of a common therapeutic exercise, known as the “pelvic tilt”, as an examination procedure for patients with low back pain (LBP) and radicular thigh and leg pain. The pelvic tilt exercise is performed with the patient supine. The hips are flexed to 45 degrees, knees flexed to 90 degrees, and the patient is instructed to tilt the pelvis posteriorly and flatten the lumbar spine without raising their buttocks off the examining table or floor. [1] Performance of the posterior pelvic tilt maneuver involves some degree of flexion of the lumbar spine with a “flattening”, or reduction, of the lumbar lordosis. The pelvic tilt has long been recommended as exercise for relief of low back pain [1,2,3] and can

still occasionally be found in patient education literature. Clinically, the authors have observed that most patients with mechanical LBP attain some relief from the maneuver. However, there are some for whom posterior tilting of the pelvis causes increased pain.

In a study [4] of 46 patients with LBP, lumbar radicular symptoms or both, those patients who experienced increased pain with a posterior pelvic tilt were found to have higher levels of pain and disability in activities of daily living than patients who experienced pain relief. [4] Both groups had mean decreased pain levels following chiropractic care, but only those who found the posterior pelvic tilt palliative appreciated a statistically significant change in disability. There were no statistically significant differences between those who found the posterior pelvic tilt palliative or provocative regarding whether they had pain only, paresthesia only, or both pain and paresthesia; whether their symptoms were more proximal or distal; or whether symptoms were more acute, subacute, or chronic. [4] For the convenience of the reader, those major findings have been reproduced in Tables 1 and 2.

Table 1: pain and disability findings from previous investigation. [4] Patients grouped according to increased or decreased pain upon performing a pelvic tilt maneuver.

Pre-care values (n = 46)	Increased pain (n=12)	Decreased pain (n=34)	differences
QVAS [a]	6.0 ± 2.0	4.9 ± 1.5	1.1 (P = .04)
RODI [b]	55.5 ± 17.7	36.1 ± 13.8	19.4 (P < .001)

[a] QVAS: Quadruple Visual Analog Scale, [b] RODI: Revised Oswestry Disability Index

Table 2: pre-post results from previous investigation [4]		
Participants with post-care data [c] (n = 30)	Increased pain (n=8)	Decreased pain (n=22)
QVAS, Pre-care	6.3 ± 1.9	4.8 ± 1.7
QVAS, Post-care	3.6 ± 2.7	2.7 ± 1.3
Pre-post change	2.8 (P = .02)	2.1 (P < .001)
RODI, Pre-care	55.0 ± 17.3	36.1 ± 13.8
RODI, Post-care	33.0 ± 27.7	20.3 ± 12.8
Pre-post change	22.0 (P = .07)	18.4 (P < .001)

Such a maneuver might be expected to provoke pain in patients with conditions that are flexion intolerant, as flexion increases intradiscal pressure [5] and induces strain in the facet joints. [6,7,8]

The authors have observed that patients who find the posterior pelvic tilt especially provocative also tend to exhibit signs and symptoms of neural tension. Some of these patients have been observed to have poor responses to chiropractic and other conservative care.

One objective of this current report to describe 2 cases of LBP in which the pelvic tilt maneuver elicited an increase in symptoms, and to describe how each case differed in response to a therapy plan that included the pelvic tilt. Another is to provide a description of how use of the pelvic tilt response informed treatment planning and prognosis. Additionally, we hope that such case studies will inspire more research in this area.

Case presentation

Case 1: A 52-year-old data entry office worker, referred by her primary care physician, complained of severe bilateral low back pain radiating to the posterior right thigh, calf, and

lateral aspect of the right foot, as well as burning and stabbing in both buttocks, ache in the lateral pelvic girdle bilaterally, and a general sense of weakness in both lower extremities. These symptoms had begun the previous day, after "turning the wrong way." The pain was constant and severe, at 9 of a possible 10 on a Numeric Rating Scale (NRS), with aggravation by coughing and sneezing. She had to be assisted into the office. Her clinical features are summarized in Table 3.

On examination she was unable to achieve any active lumbar range of motion, and attempts in any direction aggravated her pain. A positive Minor's sign was recorded. Straight Leg Raise on the right increased the patient's low back pain at approximately 45 degrees, and Bragard's and Sicard's tests were positive, while a Well Leg Raise on the left was negative. Bechterew's and Kemp's tests bilaterally aggravated her pain. She was unable to lie on her right side. While lying on her left side, an Iliac Compression test increased her pain on the right. There was also an increase in her low back pain when she performed a posterior pelvic tilt, a phenomenon referred to as "Minicozzi's sign". [4] There was mildly diminished strength of the right tibialis anterior muscle. The patellar reflexes were increased bilaterally, and the Achilles reflexes were diminished bilaterally. The area along the S1 dermatome was hyperalgesic on the right. Her lumbar and lumbosacral erector spinae were hypertonic on the right side, with tenderness to palpation, particularly overlying the right L4-5 and L5-S1 facet joints. Passive joint end play was decreased bilaterally at L4-5 and L5-S1.

Magnetic resonance imaging of the low back, done approximately 1 year prior, showed evidence of a right hemi-laminotomy at L4-5. There was a disc bulge with a focal protrusion in the right paracentral region exerting mild mass effect on the right L5 nerve root. Adjacent epidural scar

tissue was present as well. At T12–L1 and L1-2 there were disc bulges causing mild mass effect on the thecal sac. The original working diagnosis was severe low back muscle strain; but after reviewing the MRI, nerve root adhesion secondary to epidural scar tissue was added to the differential.

She was treated over the course of 8 visits with a Category III protocol Sacro-Occipital Technique blocking technique, [9] for approximately 10-15 minutes each time. Cryotherapy was applied for approximately 10-15 minutes each. She received high-velocity, low-amplitude, drop assisted adjustments following a Thompson Technique protocol in the pelvic, lumbar, thoracic, and cervical regions, and Active Isolated Stretching and Strengthening, [10] primarily targeting the pelvic, lumbar, and thigh muscles. Core strengthening was added at the 3rd visit with a focus on posterior pelvic tilt and abdominal hollowing exercises. These exercises, along with cryotherapy, were prescribed to the patient as a home exercise plan for the remainder of her treatment. The pelvic tilt exercises were prescribed to be done at 25 repetitions per session, along with 25 repetitions of abdominal hollowing. Her home therapy instructions were the same, but twice daily, with 20 minutes of cryotherapy to follow. The patient was treated a total of 8 times over a period of 4 weeks during which her symptoms decreased by 89% (from 9 to 1 on an 11-point NRS) and she was able to return to work without restrictions. She was seen once during the next month and reported no significant exacerbations.

Table 3: comparison of two cases	
Case 1, 52 years old	Case 2, 32 years old
Severe bilateral low back pain radiating to the posterior right thigh, calf, and lateral right foot: burning, stabbing, ache, and general weakness	Severe bilateral low back pain radiating to both buttocks, postero-lateral left leg, right posterior thigh and calf, and plantar surface of right foot; w/ right foot drop: at times, sharp, sore, stiff, throbbing, or tingling
Onset: began the previous day. She had to be assisted into the office.	Onset: motor vehicle accident 10 months earlier; had already received injections and 10-12 visits of chiropractic care
Pain: constant and severe (9 on NRS), with aggravation by coughing and sneezing	Pain: constant and severe (10 on NRS), with aggravation by coughing and sneezing
ROM: unable to achieve active lumbar motion; attempts in any direction aggravated pain.	ROM: active motion unrestricted in all planes, but flexion and extension aggravated pain.
Orthopedic tests: SLR on right increased low back pain at 45°, w/Bragard's and Sicard's tests positive, but Well Leg Raise negative on left. Bechterew's and Kemp's tests bilaterally aggravated her pain. Unable to lie on her right side at all; while lying on her left side, an Iliac Compression test increased her pain. Posterior pelvic tilt increased low back pain.	Orthopedic tests: SLR on right increased low back pain at 45°, w/Bragard's and Sicard's tests positive, but Well Leg Raise negative on left. Bechterew's test, bilaterally, aggravated her pain; Kemp's test only on the right side. Able to lie on either side Posterior pelvic tilt increased low back pain.
Neurological tests: mildly diminished strength of the right tibialis anterior muscle; patellar reflexes were hyper-reflexive and Achilles hypo- reflexive, both bilaterally; right S1 dermatome hypersensitive.	Neurological tests: normal motor strength; normal patellar and Achilles reflexes; right L4 dermatome hypersensitive.
Palpation of joints and muscles: right side lumbar and lumbosacral erector spinal muscles hypertonic; tenderness over right L4-5 and L5-S1 facet joints; decreased passive joint end play at L4-5 and L5-S1, bilaterally.	Palpation of joints and muscles: decreased passive joint end play at L4-5 and L5-S1, bilaterally.
Previous magnetic resonance imaging: right hemi-laminotomy at L4-5; disc bulge with a focal protrusion w/ mass effect on right L5 nerve root; adjacent epidural scar tissue; T12-L1 and L1-2 disc bulges w/ mild mass effect on thecal sac.	Previous magnetic resonance imaging: degenerative disc changes at L5-S1 w/ right-central herniation and likely compression right S1 nerve root and free fragment against L5 pedicle; slight retrolisthesis of L5 relative to S1.

Case 2: A 32-year-old sales representative was referred by her neurosurgeon and complained of severe bilateral low back pain radiating to both buttocks, as well as to the postero-lateral left leg and the right posterior thigh and calf, and plantar surface of the right foot. She also had noticed some right foot drop. Her condition was the result of a motor vehicle accident 10 months earlier. The pain was constant and severe, rated 10 out of a possible 10 on the NRS, with aggravation by coughing and sneezing. She described the pain as some combination of sharp, sore, stiff, throbbing, and tingling. By the time of her consultation she had already received several epidural steroid injections and had a date scheduled for a micro-discectomy. She had tried chiropractic care with another physician who provided her with side-posture adjustments and flexion distraction therapy, but she had only temporary relief after an estimated 10-12 visits. The neurosurgeon recommended a final trial of chiropractic care before consideration for surgery. Her clinical features are summarized in Table 3.

Her lumbar active range of motion was unrestricted in all planes, but both flexion and extension aggravated her pain. Straight Leg Raise performed on the right side increased the low back pain at approximately 45 degrees, and Bragard's and Sicard's tests were positive, while a Well Leg Raise on the left was negative. Bechterew's test was provocative bilaterally. Kemp's test aggravated her pain only when performed on the right side and her low back pain was aggravated by performance of a posterior pelvic tilt (Minicozzi's sign). [4] Myotomes and myotatic reflexes were intact. The area along the L4 dermatome was hyperalgesic on the right. Passive joint end play at L4-5 and L5-S1 was decreased bilaterally.

Magnetic resonance imaging, done approximately 20 months earlier, showed evidence of degenerative disc changes at L5-S1 with a right-central disc herniation, with the central portion likely compressing the right S1 nerve root and an extruded disc fragment abutting the bottom of the L5 pedicle. There were reactive changes in both L5 and S1 and a trace retrolisthesis of L5 relative to S1. There was no appreciable facet arthropathy and the rest of her lumbar MRI was normal. Her treatment was built upon a diagnosis of a sequestered disc.

She was treated during 2 visits with a Category III protocol Sacro-Occipital Technique [9] blocking technique, for approximately 10-15 minutes each time, as described above; cryotherapy for approximately 10-15 minutes each time; and Active Isolated Stretching and Strengthening, [10] primarily targeting the pelvic, lumbar, and thigh muscles. Core strengthening exercises were included during both visits, focusing on posterior pelvic tilt movements, along with abdominal hollowing exercises. These exercises and cryotherapy were also prescribed to the patient as a home exercise plan; however, despite being compliant with instructions, she reported no decrease in pain and ultimately opted for surgery.

Discussion

The patients described above had similar complaints and examination findings (Table 3). Their care was similar; though Category III blocking may differ from one patient to another in the exact angles that the blocks are placed at, and AIS treatments may differ in how much effort is directed at specific muscles. Both patients initially reported an increase in symptoms upon active pelvic tilt maneuver, but while one patient recovered the other went on to surgery.

The principal author's working hypothesis, based upon the anatomy of the lower lumbar spine, has been that patients whose symptoms resolve or lessen could have adhesions or scar tissue from previous injury, or other limitations of connective tissue. This line of thought was derived from discussions of the Shoulder Depressor test in chiropractic orthopedic textbooks by Evans and Cipriano. [11,12] Evans [11] states that inflammation from trauma can contribute to scar tissue formation around the dura mater and nerve roots, and within joint capsules; Cipriano [12] specifically mentions the dural sleeves around the nerve roots. Under normal circumstances, nerve roots are free to move up to half an inch within the intervertebral canals; but scar tissue may "tether" or constrict such movement. [11] If such movement is impeded, the nerve root becomes stretched, which may cause pain. [11,12] Additionally, epidural fibrosis could be a factor for those patients who have previously had back surgery. [13] For patients in this category, repeated performance of the pelvic tilt as an exercise could help rehabilitate the affected tissues. The principal author's working hypothesis for patients whose symptoms increase or do not improve has been that they could be experiencing neurologic impingement or encroachment to a degree that would require surgical intervention. There is little evidence to confirm or dispute the working hypothesis, and more research is needed in this area.

In any case, the pelvic tilt maneuver may be used as a convenient monitoring tool. Painful provocation may resolve as the patient improves. Persistent painful responses suggest another course of action is needed including but not limited to referral.

The patient cases above are part of a minority; most patients with low back pain experience decreased pain when titling the pelvis posteriorly. [4] Exactly why that is remains unclear, though there is evidence that low back pain patients for whom the posterior pelvic tilt is

palliative tend to have lower levels of pain and disability. [4] There has been limited research of the pelvic tilt maneuver. Levine [14] demonstrated that patients can voluntarily flatten the lumbar lordosis in a standing position by performing a pelvic tilt. Gracovetsky [3] advocated the posterior pelvic tilt position as a way to relieve compressive forces in the spine in various activities, including lifting. Suputtitada [15] recommended a sitting version as exercise for relief of low back pain in pregnancy and Gürşen [16] recommended it after caesarean section childbirth, along with other exercises and Kinesio Taping. Shin [17] included anterior-posterior pelvic tilting as one exercise of several in a rehabilitation program. When used as an exercise, posterior tilting of the pelvis is of fairly low intensity; it may not use the abdominal muscles at a level that would strengthen them [18,19] but it does activate them to a greater degree than abdominal hollowing. [18,20] Schoenfeld [21] demonstrated that, during performance of a "plank" exercise, upper abdominal muscle activity could be increased by adding in posterior pelvic tilting. It may be relevant that patients with LBP tend to stand with a sight anterior pelvic tilt, [22,23] and one study found that a larger lumbar lordosis angle in those for whom flexion provoked pain. [23]

Limitations

In general, single cases cannot be assumed to represent the general population. There is a limit to what can be known about each of the individuals involved in these cases and the factors related to their responses (or lack of response) to the care provided. However, the 2 individuals included in this report are generally representative of a number of others seen by the principal author in many years of monitoring pelvic tilt responses.

In some ways this report simply evokes the mystery of why some patients improve from chiropractic care and others, seemingly similar, do not. The authors do not claim to definitively answer the question, but they do offer another tool that may help. One of our objectives is that other practitioners may use the pelvic tilt maneuver and investigate further.

Conclusions

Two patients with low back and right lower extremity pain of similar presentation experienced markedly different outcomes following a similar treatment protocol. The authors found the posterior pelvic tilt test to be helpful in monitoring patient response. Higher level study would be required to make any comment regarding the utility of posterior pelvic tilt as a diagnostic or prognostic test.

Consent

Written informed consent was obtained from the patients for publication of this report. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

SJM developed the examination method, conceived of the project, collected data, and contributed to manuscript preparation. BSR organized the information and drafted the bulk of the manuscript.

Acknowledgments

Thank you to Dr. Ronald Evans for extensive suggestions for reorganization of the original version of the manuscript, and to Dr. Kathryn Hoiriis for additional literature search and for publication advice. There were no sources of funding.

References

1. Liebenson C, Oslance J: **Outcomes assessment in the small private practice**. In: Rehabilitation of the spine - a practitioner's manual. 1st ed. Edited by Liebenson C. Baltimore: Williams & Wilkins; 1996.

2. McKenzie RA. **The lumbar spine: mechanical diagnosis and therapy**. Auckland, New Zealand: Spinal Publications; 1981.

3. Gracovetsky S, Kary M, Pitchen I, Levy S, Ben Said R. **The importance of pelvic tilt in reducing compressive stress in the spine during flexion-extension exercises**. *Spine*. 1989; 14(4):412-6.

4. Minicozzi SJ, Russell BS, Ray KJ, Shen A, Owens EF. **Low back pain response to pelvic tilt position: an observational study of chiropractic patients**. J Chiropr Med 2016; 15: 27-34

5. Wilke HJ, Neef P, Caimi M, Hoogland T, Claes LE. **New in vivo measurements of pressures in the intervertebral disc in daily life**. *Spine*. 1999;24(8):755-62.

6. Ianuzzi A, Pickar JG, Khalsa PS. **Relationships between joint motion and facet joint capsule strain during cat and human lumbar spinal motions**. *J Manipulative Physiol Ther*. 2011;34(7):420-31.

7. Sawa AGU, Crawford NR. **The use of surface strain data and a neural networks solution method to determine lumbar facet joint loads during in vitro spine testing.** *J Biomech*. 2008;41(12):2647-53.

8. Little JS, Khalsa PS. **Human lumbar spine creep during cyclic and static flexion: creep rate, biomechanics, and facet joint capsule strain**. *Ann Biomed Eng*. 2005 Mar;33(3):391-401.

9. DeJarnette, MB. **Sacro Occipital Technique, 1984**. Nebraska City, Nebraska: privately published; 1984.

10. Mattes A. **Active Isolated Stretching: The Mattes Method**. 2000: 119-29.

11. Coskun E, Süzer T, Topuz O, Zencir M, Pakdemirli E, Tahta K. **Relationships between epidural fibrosis, pain, disability, and psychological factors after lumbar disc surgery**. *Eur Spine J*. 2000 Jun;9(3):218-23.

12. Evans R. **Illustrated orthopedic physical assessment**. 3rd ed. Maryland Heights, Missouri: Mosby; 2008.

13. Cipriano JJ. **Photographic manual of regional orthopaedic and neurologic tests**. 5th ed. Philadelphia: Lippincott, Williams & Wilkins; 2010.

14. Levine D, Whittle MW. **The effects of pelvic movement on lumbar lordosis in the standing position**. *J Orthop Sports Phys Ther*. 1996; 24(3): 130-5.

15. Suputtitada A, Wacharapreechanont T, Chaisayan P. **Effect of the "sitting pelvic tilt exercise" during the third trimester in primigravidas on back pain**. *J Med Assoc Thai*. 2002 Jun;85 Suppl 1:S170-9.

16. Gürşen C, İnanoğlu D, Kaya S, Akbayrak T, Baltacı G. **Effects of exercise and Kinesio taping on abdominal recovery in women with cesarean section: a pilot randomized controlled trial**. *Arch Gynecol Obstet*. 2016;293(3):557-65. doi: 10.1007/s00404-015-3862-3.

17. Shin CH, Kim M, Park GD. **Impact of post-manipulation corrective core exercises on the spinal deformation and lumbar strength in golfers: a case study**. *J Phys Ther Sci*. 2015 Sep;27(9):3027-30. doi: 10.1589/jpts.27.3027.

18. Vezina MJ, Hubley-Kozey CL. **Muscle activation in therapeutic exercises to improve trunk stability**. *Arch Phys Med Rehabil*. 2000; 81:1370–9

19. Hubley-Kozey CL, Vezina MJ. **Muscle activation during exercises to improve trunk stability in men with low back pain**. *Arch Phys Med Rehabil*. 2002; 83(8):1100-8.

20. Drysdale CL, Earl JE, Hertel J. **Surface electromyographic activity of the abdominal muscles during pelvic-tilt and abdominal-hollowing exercises**. *J Athl Train*. 2004; 39(1): 32-6.

21. Schoenfeld BJ, Contreras B, Tiryaki-Sonmez G, Willardson JM, Fontana F. **An electromyographic comparison of a modified version of the plank with a long lever**

and posterior tilt versus the traditional plank exercise. *Sports Biomech*. 2014;13(3):296-306. doi: 10.1080/14763141.2014.942355.

22. Laird RA, Gilbert G, Kent P, Keating JL. **Comparing lumbo-pelvic kinematics in people with and without back pain: a systematic review and meta-analysis**. *BMC Musculoskelet Disord*. 2014;15:229.

23. Day JW, Smidt GL, Lehmann T. **Effect of pelvic tilt on standing posture**. *Phys Ther*. 1984;64(4):510–516.

Editorial Review

Posterior, Lateral, and Anterior Hip Pain Due to Musculoskeletal Origin: A Narrative Literature Review of History, Physical Examination, and Diagnostic Imaging

Patrick J. Battaglia, DC, Kevin D'Angelo, DC, and Norman W. Kettner, DC, DACBR

J Chiropr Med 2016;15:281-293

JACO Editorial Reviewer: Casey Okamoto, DC

Published: March 2019
Journal of the Academy of Chiropractic Orthopedists
March 2019, Volume 16, Issue 1

Authors' Abstract:

Objective: The purpose of this study was to present a narrative review of the literature of musculoskeletal causes of adult hip pain, with special attention to history, physical examination, and diagnostic imaging.

Methods: A narrative review of the English medical literature was performed by using the search terms "hip pain" AND "anterior," "lateral," and "posterior." Additionally, specific entities of hip pain or pain referral sources to the hip were searched for. We used the PubMed search engine through January 15, 2016.

Results: Musculoskeletal sources of adult hip pain can be divided into posterior, lateral, and anterior categories. For posterior hip pain, select considerations include lumbar spine and femoroacetabular joint referral, sacroiliac joint pathology, piriformis syndrome, and proximal hamstring tendinopathy. Gluteal tendinopathy and iliotibial band thickening are the most common causes of lateral hip pain. Anterior hip pain is further divided into causes that are intra-articular (ie, labral tear, osteoarthritis, osteonecrosis) and extra-articular (ie, snapping hip and inguinal disruption [athletic pubalgia]). Entrapment neuropathies and myofascial pain should also be considered in each compartment. A limited number of historical features and physical examination tests for evaluation of adult hip pain are supported by the literature and are discussed in this article. Depending on the clinical differential, the gamut of diagnostic imaging modalities recommended for accurate diagnosis include plain film radiography, computed tomography, magnetic resonance imaging, skeletal scintigraphy, and ultrasonography.

Conclusions: The evaluation of adult hip pain is challenging. Clinicians should consider posterior, lateral, and anterior sources of pain while keeping in mind that these may overlap.

JACO Editorial Summary:

- The article was written by authors from the Department of Radiology, Logan University, Chesterfield, MO, as well as Canadian Memorial Chiropractic College, North York, ON, Canada.
- The purpose of the study was to present a narrative review of the literature of musculoskeletal causes of adult hip pain and provide differential considerations for posterior, lateral, and anterior hip pain in the adult patient.
- The investigative researchers conducted a PubMed search for randomized controlled trials, cohort and case-control studies, case series, and both systematic and narrative reviews regarding common etiologies of musculoskeletal hip pain in adults. Additional searches were conducted for physical examination and diagnostic imaging of the hip. In total, 116 papers were included in the narrative review.
- Classifying hip pain by region (anterior, posterior, or lateral) can implicate certain sources of nociception while ruling out others, narrowing the differential. Such an approach may improve the diagnostic yield of a physical exam.
- In the case of posterior hip pain, it is recommended that the lumbar spine and sacroiliac joint be ruled out as potential sources of nociception. This can be accomplished with McKenzie assessment and sacroiliac joint cluster testing respectively.
- Osteoarthritis (OA) of the femoroacetabular joint (FAJ) may frequently cause posterior hip pain. This contrasts with the popular belief that OA of the FAJ causes mostly anterior hip pain in a “C” sign distribution.
- Myofascial trigger points in the hip girdle and low back musculature may mimic intraarticular hip pathology by referring to the posterolateral or anterolateral hip, medial thigh, or lateral thigh.
- When the history and exam alone are insufficient to form a diagnosis, imaging may be warranted. The differential formulated by classifying a condition into posterior, lateral, or anterior hip pain will inform the clinician’s choice of imaging.

Summary: Diagnosis of hip pain necessitates a thorough history and physical examination to identify not only intraarticular hip pathology, but also neuropathies, myofascial contributors, and somatic referral from the lumbar spine and sacroiliac joints. Classifying a pain condition according to location (posterior, lateral, or anterior hip) may be useful in narrowing the list of differentials, guiding the physical exam, and informing the selection of imaging technique.

Editorial Review

Clinical-anatomic Mapping of the Tarsal Tunnel with Regard to Baxter's Neuropathy in Recalcitrant Heel Pain Syndrome: Part 1

Simone Moroni, Marit Zwierzina, Vasco Starke, Bernhard Moriggl, Ferruccio Montesi, Marko Konschake

Surgical and Radiologic Anatomy October 2018

JACO Editorial Reviewer: Nathan Hinkeldey, D.C., D.A.C.R.B.

Published: March 2019
Journal of the Academy of Chiropractic Orthopedists
March 2019, Volume 16, Issue 1

Authors' Abstract:

Purpose: Neuropathy of the Baxter nerve (BN) seems to be the first cause of the heel pain syndrome (HPS) of neurological origin.

Methods: 41 alcohol–glycerol embalmed feet were dissected. We documented the pattern of the branches of the tibial nerve (TN) and describe all relevant osteofibrous structures. Measurements for the TN branches were related to the Dellon–McKinnon malleolar-calcaneal line also called DM line (DML) for the proximal TT and the Heimkes Triangle for the distal TT. Additionally, we performed an ultrasound-guided injection procedure of the BN and provide an algorithm for clinical usage.

Results: The division of the TN was 16.4 mm proximal to the DML. The BN branches off 20 mm above the DML center or 30 mm distally to it. In most of the cases, the medial calcaneal branch (MCB) originated from the TN proximal to the bifurcation. Possible entrapment spots for the medial and lateral plantar nerve (MPN, LPN), the BN and the MCB are found within a circle of 5 mm radius with a probability of 80%, 83%, and 84%, respectively. In ten out of ten feet, the US-guided injection was precisely allocated around the BN.

Conclusions: Our detailed mapping of the TN branches and their osteofibrous tubes at the TT might be of importance for foot and ankle surgeons during minimally invasive procedures in HPS such as ultrasound-guided ankle and foot decompression surgery (UGAFDS).

JACO Editorial Summary:

- The purpose of the article was to describe detailed anatomical variation in Tibial Nerve at the Tarsal Tunnel. Topographical accuracy of the Tibial Nerve within the Tarsal Tunnel was 73-94%.
- The tibial nerve and its branches have been implicated as causes in heel pain syndromes, specifically, neuropathy of Baxter's nerve has a prevalence of 15-20%.
- Variation of branching was consistent with 32/40 specimens branching from the Lateral Peroneal Nerve, from the Tibial Nerve proximal to the bifurcation in 4/40 specimens, and within the bifurcation in 4/40 specimens.
- Accuracy of injection site of Baxter's nerve was also tested. In 10/10 cases, researchers could inject Baxter's Nerve.
- Implications of this research include improving diagnostic accuracy with Tinel's sign. The sign elicits pain due to nervous sprouting from chronic compression and consequent axonal demyelination.
- Authors have demonstrated half of the asymptomatic, non-diabetic average population, older than 45 years, have abnormal electro diagnosis in the distal tarsal tunnel.
- Prevalence of atrophy of the abductor hallucis muscle is supposed to be an indirect diagnostic proof for Baxter's neuropathy in MRI and this has been observed in 6% of the general asymptomatic population.

Summary:

This article was written for the purpose of identifying anatomical variation of the Tibial Nerve within the Tarsal Tunnel which can have implications for surgeons who perform minimally invasive surgery for heel pain syndromes. For the manual therapist implications would include potential improvement in performing Tinel's Sign. In addition, the paper adds differential diagnosis options to patients with heel pain syndromes.

Editorial Review

The Effect of Bracing and Balance Training on Ankle Sprain Incidence Among Athletes: A Systematic Review with Meta-Analysis

Rachel Bellows, PT, DPT, OCS, Christopher Kevin Wong, PT, PhD, OCS
International Journal of Sports Physical Therapy,13(3), 379-388.

JACO Editorial Reviewer: Alec Schielke, DC

Published: March 2019
Journal of the Academy of Chiropractic Orthopedists
March 2019, Volume 16, Issue 1

Authors' Abstract:

Background: Ankle sprains are common musculoskeletal injuries in the athletic population that have been addressed with prevention strategies that include bracing and balance training. Many authors have examined ankle sprain incidence after bracing or balance training in athletes at different levels of competition and in various sports. No systematic review has analyzed the results of both interventions.

Purpose: The purpose of this review was to compare the effect of balance training and bracing in reducing the incidence and relative risk of ankle sprains in competitive athletes, with or without prior injury, across different sports.

Design: Systematic review, with meta-analysis

Methods: A literature search of four databases was conducted for randomized control trials that reported ankle sprain incidence published from 2005 through 2016. Included articles studied high school, college, or professional level athletes with or without a history of a prior sprain, who received bracing or balance training as an intervention compared to a non-intervention control group. Methodological study quality was assessed by two reviewers using the PEDro scale, with scores ≥5 considered
moderate quality. Group incidence and relative risk were determined to assess the preventative effect of bracing or balance training compared to control.

Results: From 1832 total citations, 71 full-text articles were reviewed, and eight articles were included in the study. Methodological quality of the available evidence contained in the systematic review was moderate. Five studied the effect of balance training, two studied the effect of bracing, and one studied the effect of bracing and balance training compared to the control condition. In all eight studies, athletes in the control condition did not receive any

intervention. Athletes who wore braces had fewer ankle sprains (p=0.0037) and reduced their risk of sprains by 64% (RR=0.36) compared to controls, based on analysis of 3,581 subjects. Athletes performing balance training had fewer ankle sprains (p=0.0057) and reduced their risk by 46% (RR=0.54) compared to controls, based on analysis of 3,577 subjects.

Conclusion: The findings of the current systematic review and meta-analysis support the use of bracing and balance training to reduce the incidence and relative risk of ankle sprains in athletic populations. Clinicians can utilize this information to educate their patients on wearing a brace or performing balance training exercises to decrease the risk of an ankle sprain.

Level of evidence: Level 1A???

Keywords: Athlete, ankle sprain, balance training, bracing, incidence, prevention

JACO Editorial Summary:

- This review was performed at Stanford Health Care, Ortho-Sport Physical Therapy in Redwood City, CA where the corresponding author is from.
- Prior to this review, bracing and balance exercises were individually examined in regard to ankle sprain incidence, but not the results of both interventions. Ankle sprains are common a musculoskeletal injury with prolonged recovery times ranging from 6 weeks to 1 year which can sometimes be a recurring issue resulting is subsequent ankle sprains. Thus, understanding appropriate prophylactic intervention is vital as a clinician and a patient.
- The purpose of this review was to compare the effect that balance training and bracing may have on reducing the incidence and relative risk of ankle sprains in athletes, with or without prior ankle sprain.
- This review encompassed English language publications from 2005-2016 from four different major databases initially returning over 1,832 articles. However, following exclusion/inclusion criteria there were eight remaining studies included, resulting in 7,195 subject athletes.
- It is noteworthy that: lateral, medial and high ankle sprains during athletic participation were included; balance training was not consistent across studies and could include proprioceptive training, static or dynamic exercises, with or without perturbations, and with eyes open or closed; that taping was not considered bracing in this review; and that in one study, self-reporting of prior ankle sprain by athletes did occur.

- The effect of balance training and bracing compared to no-treatment control was assessed with ankle sprain incidence per season/year and relative risk.

- In general, athletes with or without a prior sprain with bracing or balance training intervention established reduced incidence and relative risk of ankle sprains compared to no-treatment controls. Following statistical analysis, the results established that for both interventions there was a significantly lower incidence of ankle sprains and a reduced risk of a sprain by 64% with bracing and 46% with balance training.

- Subgroup limitations of this review include inability to demonstrate whether bracing or balance training was more effective, whether there were different effects among different levels of competition, and whether or not predisposition of previous ankle sprains had any effect on outcome

- The authors did point out that due to restriction of ankle joint mechanics inherent to bracing, other lower extremity injuries may occur secondarily as reported in other studies, but further discussion was beyond the scope of this review.

Summary:

Although it is inconclusive which ankle intervention, bracing or balance exercises, is superior, this review demonstrated that there is moderate quality evidence supporting both interventions decrease the incidence and the relative risk of ankle sprains in athletes. Along with other appropriate diagnostic, treatment and management procedures for ankle sprains, clinicians may consider one, if not both intervention as part of their rehabilitation protocols, while also considering the potential unintended consequences of prolonged ankle bracing.

Editorial Review

Does the Gillet Test Assess Sacroiliac Motion or Asymmetric One-legged Stance Strategies?

Robert Cooperstein, MA, DC and Felisha Truong, BSc
J Can Chiropr Assoc. 2018 Aug; 62(2): 85–97

JACO Editorial Reviewer: John S. Stites DC, DACBR, DACO

Published: March 2019
Journal of the Academy of Chiropractic Orthopedists
March 2019, Volume 16, Issue 1

Authors' Abstract:

Objective

The purpose of this study was to quantify the extent to which apparent movements of the posterior superior iliac spine and sacral base areas Gillet sacroiliac motion testing were related to (a) degree of hip flexion and (b) the examiner's palpatory pressure.

Methods

A preliminary exploratory study quantified relative PSIS/S2 displacements in 10 sacroiliac joints among 5 asymptomatic subjects at 10° increments of hip flexion from 0–90°. A comprehensive follow-up asymptomatic study quantified PSIS/S2 displacements at 0° vs. 30° vs. 90° hip flexion, and for light vs. firm pressure at 30° hip flexion. Displacements measured in pixels on digital photographs were transformed to mm. Mean differences for the various test conditions were evaluated for statistical significance using paired t-testing and Wilcoxon signed rank test.

Results

With light pressure, the left PSIS moved caudal for hip flexion ≤30° during right-legged stance, whereas the right PSIS moved cephalad relative to the sacral base. For hip flexion =90°, both PSISs moved cephalad. The use of firm palpatory pressure abolished the initial caudal movement

of the left PSIS, as well as differences in the amount of cephalad PSIS movement at 30° vs. 90° hip flexion.

Conclusions

The results are consistent with there being left-right differences in gluteus medius and biceps femoris activation among asymptomatic individuals that result in different balancing strategies during one-legged stance. This may create the appearance of relative PSIS/SB displacement, even though the results of Gillet testing can be wholly or partially explained by pelvic obliquity owing to muscle function asymmetry. This study questions the validity of the upright Gillet test for sacroiliac motion.

JACO Editorial Summary:

- Gillet test is purported to assess sacroiliac motion. The test is preformed by the examiner placing a digit on the inferior aspect of the PSIS and the S2 tubercle and having the participant raise their knee to 90 decrees or more hip flexion.
- This study examined the extent of motion relative to the degree of hip flexion and the examiner's palpatory pressure.
- This study was informed by an earlier study that assessed the apparent motion between the PSIS and the sacral base at different degrees while performing the Gillet test. After measuring at increments of 10 degrees it was found that 30 degrees was associated with the greatest caudal motion of the PSIS. There were 5 subjects in that study.
- The current study looked at movement of the PSIS at 30 degrees and 90 degrees hip flexion with lighter vs. firmer palpation.
- Subject were described as a convenience sample of asymptomatic subjects. No demographic information was provided such as age, gender or handedness. 32 subjects were assessed from 0 degrees to 30 degrees, 25 subjects 30 vs. 90 degrees and 27 light vs. heavy pressure 3o degrees flexion.
- Effort was made to reduce bias by using pixelated photos to measure the change in distance with the examiner asked to look away during testing.
- Intra and inter examiner reliability was assessed for evaluating the photos using interclass correlation and showed high reliability.
- When lifting the leg from 0 to 30 degrees the left PSIS moved caudally and the right apparently moved cephalad.
- When lifting the leg to 90 degrees both the left and right PSIS moved cephalad.
- As a side note, a number of p-values are reported as 0.00. Statistical software packages such as SPSS have a rounding algorithm where the output may be p=0.00 but this is inaccurate and implies that there is no possibility of chance being a factor. A better way to report this would be $p<0.01$.
- When considering their findings, the authors surmised that if the Gillet test was purely an evaluation of SI motion then the left SIs with movable and the right hypomobile. This they deemed implausible.

- The authors postulated 4 hypotheses to explain their findings:
    - Asymmetric balancing strategies in left and right one-legged stance
    - Asymmetric hamstring tone
    - A pelvic compression effect
    - A clamping effect

Summary:

The findings of this study suggest that there may be other factors contributing to the findings of a Gillet test other than sacroiliac motion. This brings in to question the validity of the test.

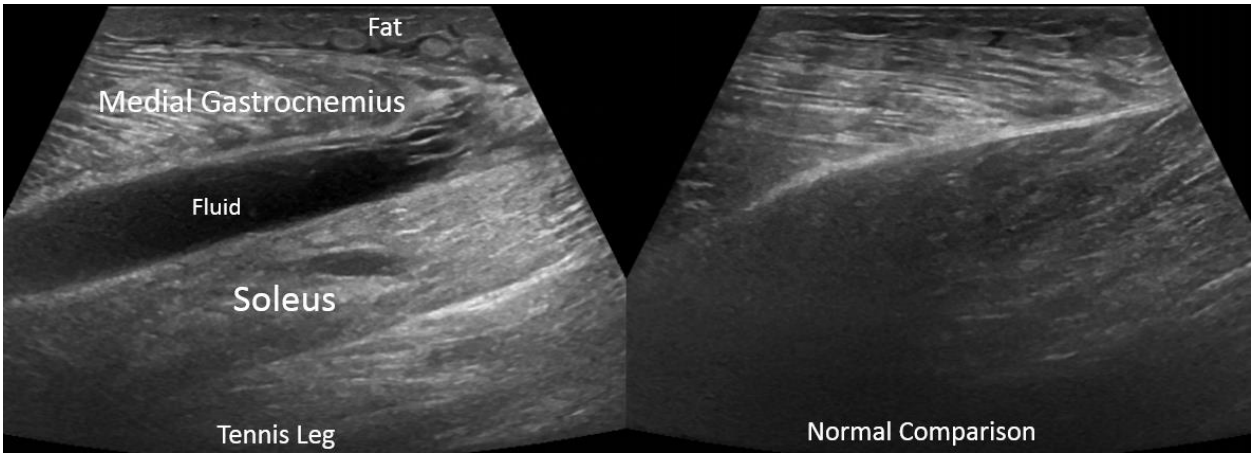
Radiology Corner

Tennis Leg in a Skier

Alicia M. Yochum RN, DC, DACBR, RMSK

Published: March 2019
Journal of the Academy of Chiropractic Orthopedists
March 2019, Volume 16, Issue 1

History: 34 Year old male who fell while skiiing and felt a pop with sharp pain in his medial calf. Swelling and bruising visible on evaluation.



Within the medial calf, the myotendinous junction of the medial head of the gastrocneumis tapers superficial to the soleus muscle. This junction is one of the most common locations for muscluar injury which is called Tennis Leg. Patients with this inujury report trauma or injury and indicate sharp pain at the medial calf which can extend distally along the achilles tendon. A gap can sometimes be palpated in the area of injury.

Pathologically, there is an injruy or partial tearing of the myotendinous juction of the medial gastricneumus. There can also be injury or tearing of the plantaris tendon which lies between the medial gastrocenmius and soleus. Because of the muscular injury, there is a fluid collection that forms between the two muscular bellies which is seen an labled in the figures showing both a normal and abnormal medial calf. Treatment is conservative and self limiting. If injury is severe, compartment syndrome can occur but is very rare.

References:

1. Fundamental of Musculoskeletal Ultrasound. Jacobson J. Elsevier. 2018

Ortho Quiz

by Steven L. Kleinfield DC, FACO

1. The Triangular Fibrocartilage Complex (TFCC) is located in which part of the body:
    a. Ankle
    b. Wrist
    c. Knee
    d. Hip

2. The most common causation for a Triangular Fibrocartilage Complex (TFCC) tear is:
    a. Inversion injury to the ankle
    b. Valgus stress injury to the knee
    c. Traumatic fall resulting in dislocation of the femoral/acetabular joint
    d. Falling on an outstretched hand

3. The most reliable diagnostic way to evaluate for a Triangular Fibrocartilage Complex (TFCC) tear is by:
    a. Manipulation of the extremity
    b. Orthopedic Testing
    c. MRI
    d. X-Ray

4. The main symptom of someone with a Triangular Fibrocartilage Complex (TFCC) tear is:
    a. Pain on the outside of the wrist
    b. Pain on the medial side of the ankle
    c. Pain on the lateral side of the tibio/femoral joint
    d. Pain along the superior/lateral boarder of the femoral/acetabular joint

5. Which orthopedic test is commonly used to help in the diagnosis of a Triangular Fibrocartilage Complex (TFCC) tear:
    a. Fovea Test
    b. Anvil Test
    c. Apley’s Distraction Test
    d. Strunsky’s Test

Current Events

- **Diplomate testing**
  - **Part I Examination Dates: 2019**
    Three hours are alloted to take the Part I online examination during one of the following test window dates:

    Thursday, May 16 – 9:00 AM to 5:00 PM EDT
    Saturday, May 18 – 9:00 AM to 1:00 PM EDT
    Thursday, July 18 – 9:00 AM to 5:00 PM EDT
    Saturday, July 20 – 9:00 AM to 1:00 PM EDT

  - **Part II Examination Dates: 2019**
    The Part II test will be a timed examination consisting of three OSCE modules in a four hour period. The 2019 Part II test window dates are:

    Thursday, Nov 7 – 9:00 AM to 5:00 PM EDT
    Friday, Nov 8 – 9:00 AM to 5:00 PM EDT
    Saturday, Nov 9 – 9:00 AM to 2:00 PM EDT

  - Please contact the Academy as soon as you can with your notice of intent to sit the Academy Board examination.
  - Academy website: http://dcorthoacademy.org/

- Apply for the Lipe Scholarship
  Details at http://www.accoweb.org/lipescholarship.html

- The full hours of the following conventions have been accepted by the Academy as qualifying for re-credentialing.

  - American College of Chiropractic Orthopedists Annual Convention
    2019 Orthopedic Essentials Seminar
    April 25-27, 2019
    Tropicana Las Vegas in Las Vegas, Nevada
    www.accoweb.org/

Answers to Ortho Quiz

1. The Triangular Fibrocartilage Complex (TFCC) is located in which part of the body:

b. Wrist
https://www.rushortho.com/body-part/wrist/triangular-fibrocartilage-complex-tear

2. The most common causation for a Triangular Fibrocartilage Complex (TFCC) tear is:

d. Falling on an outstretched hand
https://www.rushortho.com/body-part/wrist/triangular-fibrocartilage-complex-tear

3. The most reliable diagnostic way to evaluate for a Triangular Fibrocartilage Complex (TFCC) tear is by:

c. MRI
https://www.schreibermd.com/tfcc-tear/

4. The main symptom of someone with a Triangular Fibrocartilage Complex (TFCC) tear is:

a. Pain on the outside of the wrist
https://www.healthline.com/health/tfcc-tear

5. Which orthopedic test is commonly used to help in the diagnosis of a Triangular Fibrocartilage Complex (TFCC) tear:

a. Fovea Test
https://www.healthline.com/health/tfcc-tear#causes-and-risk-factors