THE AAO
JOURNAL
A Publication of the American Academy of Osteopathy

TRADITION SHAPES THE FUTURE • VOLUME 11 NUMBER 2 SUMMER 2001

2001 CME Calendar

July 21-22
Postural Relief of Common Chronic Pain
Chicago Marriott Downtown
Chicago, IL
Hours: 16 Category 1A

August 23-26
OMT Update at WDW®
Contemporary Hotel
Buena Vista, FL
Hours: 23 Category 1A

September 13-16
Introduction to OMT/HVLA
Nugget Hotel
Reno, NV
Hours: 23 Category 1A

The Still Technique: A Manipulative Method of Andrew Taylor Still, MD
Nugget Hotel
Reno, NV
Hours: 23 Category 1A

October 20
AAO's One-day course on OB/Gyn
San Diego, CA
Hours: 8 Category 1A

October 21-25
AOA Convention (AAO Program)
"Building and Sustaining a Healthy Body Through Nutrition, Exercise, and Posture"
San Diego, CA

November 9-11
Prolotherapy – Below the Diaphragm
UNECOM in Biddeford, ME
Hours: 20 Category 1A

30-Dec 2
Visceral Manipulation/Abdominal
Martin House
Indianapolis, IN
Hours: 24 Category 1A

2002 CME Calendar

January 20-23
Introduction to OMT/Muscle Energy
Walter Ehrenfeucher, DO, FAAO
Program Chairperson
Florida (Location TBD)
Hours 23 Category 1A

February 3-10
Cruise CME / Facilitated Positional Release
Eileen DiGiovanna, DO, FAAO
Program Chairperson
Mexican Riviera
Hours: 20 Category 1A

March 17-20
Visceral Manipulation/ Emotional/Trauma with Jean-Pierre Barral, DO, MROF
Kenneth Lossing, DO
Program Chairperson
Norfolk, VA
Hours: 32 Category 1A

March 21-24
2002 Annual Convocation
Michael P. Rowane,DO,
Program Chairperson
Norfolk, VA
Hours: 24-33 possible Category 1A

April 20-21
Fulford's Percussion Technique(Basic)
Richard Koss, DO, Program Chairperson
Renton, WA
Hours: 14 Category 1A

May 3-5
Prolotherapy / Above the Diaphragm
Mark Cantieri, DO, FAAO
Program Chairperson
UNECOM in Biddeford, ME
Hours: 20 Category 1A

May 31-June 2
Greenman's Exercise Prescription featuring Philip Greenman, DO, FAAO
Brad Sandler, DO
Program Chairperson
Indianapolis, IN
Hours: 20 Category 1A

July 26-28
Visceral /Structural Integrated
Kenneth Lossing, DO
Program Chairperson
Indianapolis, IN
Hours: 24 Category 1A

August 15-18
OMT Update at WDW®
Ann Habenicht, DO, FAAO
Program Chairperson
Lake Buena Vista, FL
Hours: 23 Category 1A

September 20-22
Myofascial Release
Judith O'Connell, DO, FAAO
Program Chairperson
Indianapolis, IN
Hours: 20 Category 1A

October 6
One-day Course on ENT Problems
Ann Habenicht, DO, FAAO
Program Chairperson
Las Vegas, NV
Hours: 8 Category 1A

October 7-11
AOA Convention (AAO Program)
George Pasquarello, DO
Program Chairperson
Las Vegas, NV

November 8-10
Prolotherapy: Below the Diaphragm
Mark Cantieri, DO, FAAO
Program Chairperson
UNECOM in Biddeford, ME
Hours: 20 Category 1A

December 6-8
Introduction to OMT/Counterstrain
John Glover, DO, Program Chairperson
Mesa, Arizona
Hours: 20 Category 1A

For more information, contact:
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Third-class postage paid at Carmel, IN. Postmaster: Send address changes to American Academy of Osteopathy 3500 DePauw Blvd., Suite 1080, Indianapolis, IN., 46268

THE AAO
JOURNAL
A Publication of the American Academy of Osteopathy

TRADITION SHAPES THE FUTURE

The mission of the American Academy of Osteopathy is to teach, advocate, advance, explore, and research the science and art of osteopathic medicine, emphasizing osteopathic principles, philosophy, palpatory diagnosis and osteopathic manipulative treatment in total health care.

Editorial Section

Peer-Reviewed Section

Instructions to Authors

The American Academy of Osteopathy (AAO) Journal is a peer-reviewed publication for disseminating information on the science and art of osteopathic manipulative medicine. It is directed toward osteopathic physicians, students, interns and residents and particularly toward those physicians with a special interest in osteopathic manipulative treatment.

The AAO Journal welcomes contributions in the following categories:

Original Contributions
Clinical or applied research, or basic science research related to clinical practice.

Case Reports
Unusual clinical presentations, newly recognized situations or rarely reported features.

Clinical Practice
Articles about practical applications for general practitioners or specialists.

Special Communications
Items related to the art of practice, such as poems, essays and stories.

Letters to the Editor
Comments on articles published in *The AAO Journal* or new information on clinical topics. Letters must be signed by the author(s). No letters will be published anonymously, or under pseudonyms or pen names.

Professional News of promotions, awards, appointments and other similar professional activities.

Book Reviews
Reviews of publications related to osteopathic manipulative medicine and to manipulative medicine in general.

Note
Contributions are accepted from members of the AOA, faculty members in osteopathic medical colleges, osteopathic residents and interns and students of osteopathic colleges. Contributions by others are accepted on an individual basis.

Submission
Submit all papers to Anthony G. Chila, DO, FAAO, Editor-in-Chief, Ohio University, College of Osteopathic Medicine (OUCOM), Grosvenor Hall, Athens, OH 45701.

Editorial Review
Papers submitted to *The AAO Journal* may be submitted for review by the Editorial Board. Notification of acceptance or rejection usually is given within three months after receipt of the paper; publication follows as soon as possible thereafter, depending upon the backlog of papers. Some papers may be rejected because of duplication of subject matter or the need to establish priorities on the use of limited space.

Requirements for manuscript submission:

Manuscript
1. Type all text, references and tabular material using upper and lower case, double-spaced with one-inch margins. Number all pages consecutively.

2. Submit original plus three copies. Retain one copy for your files.

3. Check that all references, tables and figures are cited in the text and in numerical order.

4. Include a cover letter that gives the author's full name and address, telephone number, institution from which work initiated and academic title or position.

5. Manuscripts must be published with the correct name(s) of the author(s). No manuscripts will be published anonymously, or under pseudonyms or pen names.

6. For human or animal experimental investigations, include proof that the project was approved by an appropriate institutional review board, or when no such board is in place, that the manner in which informed consent was obtained from human subjects.

7. Describe the basic study design; define all statistical methods used; list measurement instruments, methods, and tools used for independent and dependent variables.

8. In the "Materials and Methods" section, identify all interventions that are used which do not comply with approved or standard usage.

Computer Disks
We encourage and welcome computer disks containing the material submitted in hard copy form. Though we prefer Macintosh 3-1/2" disks, MS-DOS formats using either 3-1/2" or 5-1/4" discs are equally acceptable.

Abstract
Provide a 150-word abstract that summarizes the main points of the paper and it's conclusions.

Illustrations
1. Be sure that illustrations submitted are clearly labeled.

2. Photos should be submitted as 5" x 7" glossy black and white prints with high contrast. On the back of each, clearly indicate the top of the photo. Use a photocopy to indicate the placement of arrows and other markers on the photos. If color is necessary, submit clearly labeled 35 mm slides with the tops marked on the frames. All illustrations will be returned to the authors of published manuscripts.

3. Include a caption for each figure.

Permissions
Obtain written permission from the publisher and author to use previously published illustrations and submit these letters with the manuscript. You also must obtain written permission from patients to use their photos if there is a possibility that they might be identified. In the case of children, permission must be obtained from a parent or guardian.

References
1. References are required for all material derived from the work of others. Cite all references in numerical order in the text. If there are references used as general source material, but from which no specific information was taken, list them in alphabetical order following the numbered journals.

2. For journals, include the names of all authors, complete title of the article, name of the journal, volume number, date and inclusive page numbers. For books, include the name(s) of the editor(s), name and location of publisher and year of publication. Give page numbers for exact quotations.

Editorial Processing
All accepted articles are subject to copy editing. Authors are responsible for all statements, including changes made by the manuscript editor. No material may be reprinted from *The AAO Journal* without the written permission of the editor and the author(s).

From the Editor

by Anthony G. Chila, DO, FAAO

Increasing expectations for the AAOJ

In this issue, we continue publication of Scientific Papers/Theses submitted for Fellowship Status in the AAO (conferred in 2000).

David C. Eland, DO, FAAO prepared *A Model for (Focused) Osteopathic Evaluation of 'Iliacus' Function and Dysfunction*. In his very detailed coverage of the subject, the author engaged in a great deal of original study as well as a comprehensive review of history and research related to the topic. This paper is published in its entirety for convenience to the reader.

The purpose of specifying original contribution in preparation of FAAO Scientific Papers/Theses is to encourage comment and dialog for the enhancement of osteopathic philosophy, science and art. Letter to the Editor offers thoughtful response to the nature of the primary respiratory mechanism discussed by R. Paul Lee, DO, FAAO (Vol. 11, No. 1, 2001). Charles H. Cummings, DO, FAAFP provides elaboration of the tensegrity model as it might be useful throughout the entire neuro-musculo-skeletal-fascial system.

Message from the President inaugurates the term in office of John C. Glover, DO. *Message from the Executive Director* addresses ongoing professional concerns and efforts in developing osteopathic clinical research. The efforts of the AAO Louisa Burns Osteopathic Research Committee are certainly very pertinent and timely.

From the Archives discusses the adjustment of muscular lesions circa 1922. The source is *A Textbook of the Principles of Osteopathy*. This was the 5th edition of the text written by G.D. Hulett, BS, DO. This edition was revised at the request of the House of Delegates, American Osteopathic Association, and the Associated Colleges of Osteopathy. The volume was copyrighted in 1922 by the A.T. Still Research Institute. The preface was written by Louisa Burns, Dean of the Institute. Dr. Burns noted the inclusion of work done by Dr. C.M.T. Hulett in 1915, and the cooperation of the Professors of Principles of Osteopathy in the osteopathic colleges.

Dig On acknowledges the importance of osteopathic philosophy and practice in the care of chronic arthritic conditions. The thought expressed by Dr. M.A. Lane in his 1918 text Dr. A.T. Still, Founder of Osteopathy, was not only a tribute to the Old Doctor, but an anticipation of problems which we still face today. The thoughtful reader might well pair Dr. Lane's thought with a recent supplement to *JAOA* (Vol. 101, No.4) which discusses diagnosis and treatment of common arthritic conditions.

During the recent AAO Convocation Program at Colorado Springs, CO, I had the opportunity to discuss the future of *The AAOJ* with Stephen J. Noone, CAE and Diana L. Finley, Managing Editor. Listing of the journal in the *Index Medicus* is a Long-Range Plan goal. The present format of *The AAOJ* can be described as "blended" since messages from the President and Executive Director are included. It was suggested that these messages, in future, might be better directed through other venues. We agreed that we will review our formatting for consistency and plan for modification which will establish greater journalistic "purity". At the present time, *The AAOJ* regularly publishes original papers, case studies and special communications. The continued use of the columns *Dig On* and *From the Archives* is thought to be acceptable.

Tradition Shapes the Future

Message from the President

by John C. Glover, DO

My year of service to the Academy and to the osteopathic profession will be dedicated to further the integration of osteopathic principles and osteopathic manipulative medicine (OMM) into our educational process. I have had the good fortune to be involved with teaching in the osteopathic profession for the past fifteen years. This has included doing an OPP undergraduate fellowship, teaching at several osteopathic schools and serving as faculty in a family medicine residency.

Each of us has our own reason for why we applied to osteopathic medical school. They vary from first hand knowledge of the profession through family ties or being treated by an osteopathic physician, to feeling an attraction to the philosophy. My osteopathic training began in Lewisburg at the West Virginia School of Osteopathic Medicine. At that time, I assumed that everyone in my class came to school because he or she wanted to become an osteopathic physician. To me, this meant some understanding of Dr. Still's philosophy and the desire to learn how to use our hands for diagnosis and treatment. To find out that there were people who didn't care about osteopathic medicine or philosophy was a surprise. But, to realize that I held a minority opinion was a shock.

Initially, the Undergraduate American Academy of Osteopathy provided me with the opportunity to develop my skills as an osteopathic physician and meet students of similar mind. My first contact with the American Academy of Osteopathy (AAO) came as a first year student when I attended the AAO Convocation in Colorado Springs. This meeting provided the opportunity for me to experience what it meant to be an osteopathic physician. AAO members had been drawn to the profession for many of the same reasons that attracted me. I have not missed an AAO Convocation since. This meeting has energized and nurtured me throughout my training and continues to do so.

Convocation has given me the opportunity to visit with many physicians who trained around the time I was born. (That is about half way between the start and the end of the last century) It was not uncommon for a professor to demonstrate a technique in front of a class without most of the students having a clear view and then expecting them to practice the technique. Through trial and error, working together in small groups, students figured out what was presented. When they went out on rotations they were expected to be able to give an osteopathic treatment. Attending physicians wrote orders for OMT, supervised the use of OMT in patient care and provided teaching of OMM when needed. Since then, the educational process for medical training has improved in many ways. Some of the improvement is due to technological advances such as videotape, closed circuit television and other electronic advances. Other improvements are related to the application of good educational principles to teach OMM. Unfortunately, along with our technological advances, students of today seldom are expected to provide any OMT, are not supervised when OMT is given, and rarely can find an attending to teach them how to integrate OMM into patient management.

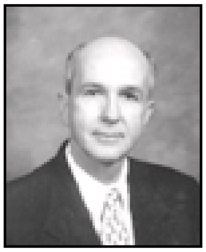
There needs to be a unified process, involving all aspects of the profession, if the profession is going to get back on track to integrate osteopathic principles into the management of patients. The AOA's unity campaign can provide valuable leadership to help coordinate the integration. There needs to be coordination between the schools, the AOA and the postgraduate training programs. In the schools the coordination needs to be with the American Association of Colleges of Osteopathic Medicine and its Educational Council on Osteopathic Principles. The AOA needs to help coordinate the efforts of the committees that develop standards for training and certification.

Internships and residencies must identify and develop specific bodies of information, based on anatomy, physiology, osteopathic principles and research. Utilization of OMT in patient management needs to be required and not suggested, if appropriate. Demonstration of an understanding of the integration of OMM into all areas of medicine needs to be tested on residency certification exams. Proficiency in using the hands for diagnosis and treatment also needs to be a standard part of residency testing. The osteopathic profession has an opportunity to be able to add to the medical knowledge by integrating osteopathic principles and utilizing OMT in patient care.

Please join me throughout this year in helping to increase the educational effort for the improvement of the integration of OMM within the Academy and the whole osteopathic profession. I hope that this may enliven the whole profession again with its unique contributions that osteopathy has made to the practice of medicine.❐

Message from the Executive Director

by Stephen J. Noone, CAE



Advancing Research

I have been frustrated with this profession's seeming inability to muster sufficient resources to complete the necessary clinical osteopathic research to document the benefits of osteopathic manipulative treatment in the care of patients. When I review the nine years of executive director's messages contributed to this journal, the need for research on OMT has been a recurring theme. As far back as 1984, when I began service as executive director of Indiana's state osteopathic association, members named the lack of OMT research as a primary reason for denial of reimbursement cited by third party payors.

There is hope, however, since the profession is moving forward to create a center for osteopathic research. An independent review committee has issued a request for proposals from the nation's colleges of osteopathic medicine to host the center. The American Osteopathic Association, the American Association of Colleges of Osteopathic Medicine and the American Osteopathic Foundation have pledged more than $1 million over the next three years to establish this research center.

In his thought-provoking article in the March issue of the *Journal of the American Osteopathic Association*, Norman Gevitz, PhD described the profession's historical inattention to clinical research and offered reasoned suggestions for the future. He commented on the osteopathic medical profession's initiative to develop an electronic SOAP note for the purposes of creating "a mechanism for collecting clinical practice data from large numbers of office-based practitioners throughout the profession, including uniquely osteopathic findings." The AAO's Louisa Burns Osteopathic Research Committee originally developed this project and continues to supply time, talent and financial resources to advance the initiative as it winds it way through the many challenges encountered along the way. Dr. Gevitz writes:

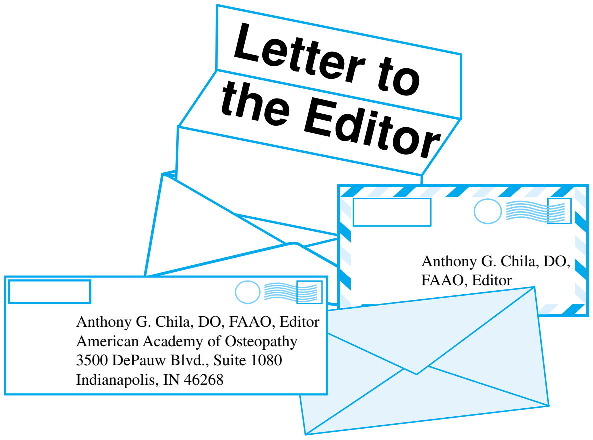
> "This data would certainly be interesting and potentially useful for some purposes, including the development of practice guidelines. Obviously, such data-gathering and entry must be rigorously and continuously inspected for completeness and accuracy. I hope this effort moves cautiously, as difficult methodological issues still need to be resolved. For example, I believe any recording of distinctly osteopathic findings on SOAP notes would be of limited if of any value for purposes of scientific research and peer-reviewed publication if they do not undergo interexaminer reliability or are not objectively measured through instrumentation. Therefore, before the osteopathic profession heavily invests in and implements this ambitious project, it should obtain assurances from experienced and distinguished external researchers that the data collected can be satisfactorily used for the research purposes intended by its advocates."

While Dr. Gevitz makes a valid point in suggesting *external* review of the LBORC's electronic data-gathering mechanism, I believe that the naysayers will only use his recommendations to further impede the study and explanation of our own *internal* premises and practices. I also fear that many "experienced and distinguished external researchers" may lack sufficient understanding of osteopathic philosophy and osteopathic medicine, a deficiency which may further delay the completion of important research projects. As one example, consider how long from design to publication it took for the AOA to deliver its study on low back pain. Some also believe that the "experienced and distinguished principal investigator" (an MD) conducting that study for the osteopathic medical profession failed to design an appropriate research protocol which would most efficiently measure the results of OMT.

How much longer can we wait for scientific proof of what many DOs already know, i.e. integration of OMT in patient care is beneficial? Will the impediments to research on OMT ever go away? Will federal agencies and foundations support osteopathic research? How does the profession meet the current demand for double-blind research when investigators find it difficult to create "placebo OMT?"

I encourage all Academy members to consider participation in the LBORC's electronic outpatient SOAP note project. This initiative is not in competition with the

continued on page 14



Dear Editor:

I want to give credit to Dr. Lee for his article re: the nature of the primary respiratory mechanism (Lee, *The primary respiratory mechanism beyond the craniospinal axis, The AAO Journal*, Vol.11 No.1, 2001). Osteopathic physicians study this palpable motion and use it to therapeutically manipulate and improve function of the human organism, but after almost 70 years since Dr. Sutherland first published his discovery of cranial mobility, the nature of the CRI is still unknown. Some in our profession are content to bestow the primary respiratory mechanism a mysterious or almost supernatural status, and feel that the origin of the CRI cannot be explained further. However, that attitude is anti-scientific and not only leads many others to doubt the validity of this type of manipulative treatment, but may be counter-productive in further integrating the cranial concept within modern medical practice.

The CRI is a palpable motion that can be identified at the head as well as throughout the entire body. Sutherland and most other authors since have implied that the CRI originates in the central nervous system, but that is not proven. Dr. Lee uses the tensegrity concept to describe the tension/integrity of different parts of the structure including the bones, the membranes including the fascia and reciprocal tension membranes of the craniospinal compartment, and even the proteins of the cellular membranes and extracellular matrix. While it is true that different parts of the structure demonstrate tensegrity, this misinterprets the concept of tensegrity, which unifies tension/integrity throughout the entire system. For example, the cables of any bridge may be composed of individual tensegrity structures, but the beauty of a suspension bridge is that those individual components are integrated together so that the resulting SYSTEM has tremendous support. Likewise, in the human body, it is clear not only that many individual components are composed of icosahedra, but it must be emphasized that the individual parts are integrated together to result in a SYSTEM that transcends these individual components. As such, the motion that we palpate at the head and through the body may originate not only within the central nervous system, but is a manifestation of the tension/integrity throughout the entire neuro/musculoskeletal/fascial system.

A tensegrity model for this fluctuating "tide" that we palpate and treat in cranial osteopathy has previously been hypothesized.[1] The biochemical and biophysical forces at the cellular and extracellular levels as described in Dr. Lee's paper are not inconsistent with this model but I do not feel that his mention of the tensegrity concept goes far enough. The emphasized feature of the tensegrity model is that there may be many forces beyond the central nervous system influencing the integrated structure that we palpate.

That may influence not only how we interpret what we palpate but also how we use that information to therapeutic benefit. With the tensegrity model, we are oriented to the biologic organism not as individual yet connected components, but as a SYSTEM. With further research, I feel that the tensegrity model will be one of the most valuable concepts in osteopathic medicine and how we understand the musculoskeletal system.

Dr. Lee quotes A.T. Still: "the osteopath must remember that his ***first*** lesson is anatomy, his ***last*** lesson is anatomy, and ***all*** his lessons are anatomy." I must respectfully differ. The information gathered in studying anatomy may be misinterpreted if we do not integrate that information within the perspective of biochemistry, biophysics, and biomechanics. Our profession must continually integrate new scientific findings in all fields with our established therapeutic methods. Dr. Lee has nicely integrated some of this information. However, there is no doubt that we are still a long way from developing a unified model to completely and scientifically explain the motion that we palpate and the therapeutic changes on the system that we are able to achieve with our hands.

Sincerely,
Charles H. Cummings, DO, FAAFP
Tiverton, RI

1. Cummings CH, A Tensegrity model for osteopathy in the cranial field, *The AAO Journal*, Vol. 4, No. 2, Summer 1994.❐

The Law of Pause and Effect

You know about the law of cause and effect. But have you considered the results of inaction? What's the effect of an inappropriate pause? Take, for example, your last will and testament. What happens if you delay the process of planning your estate and finalizing your will?

First, a protracted pause guarantees that state law will dictate the disposition of your estate. A court-appointed executor will handle the probate of your estate. A stranger may be selected to care for your minor children. Bequests to organizations like the American Academy of Osteopathy will not be made.

Second, forever pausing to complete your will may cause loved ones unnecessary turmoil after you're gone. They will be grieving, and it will only add to their suffering to face the uncertainties and complications involving your estate. They will be left to the mercy of the court regarding timing and decision-making. They may have to stand by and see your estate disbursed in ways they know you would not approve. Family arguments may erupt.

Third, chronic pausing may needlessly reduce the size of your estate. Court costs and other settlement fees can be expensive. Assets may be prematurely sold resulting in unnecessary loss. The estate may also shrink through estate taxes that could have been avoided or lessened with earlier planning.

The best time to avoid the "law" of pause and effect regarding estate planning is to act now. Initiate the cause by contacting an estate-planning attorney today. Schedule an appointment and then get ready to make the most of your meeting.

AAO's Executive Director Steve Noone may be able to assist you in preparing for your visit with your attorney. Please feel free either to call him at (317) 879-1881, or complete and mail the form below.❐

(Please complete and return this reply form.)

Dear Friends at the American Academy of Osteopathy :

_____ Please send me literature about making a will.

_____ I have provided for the Academy in my will or other estate-planning document.

_____ Please send information about the Academy.

Name:____

Address:____

City:_____________ State:__________ Zip:________

Phone:______________________________

Mail this form to: American Academy of Osteopathy, 3500 DePauw Blvd., Suite 1080, Indianapolis, IN 46268.

Dig On!

by Anthony G. Chila, DO, FAAO

In the contemporary medical arena, common arthritic conditions are frequently encountered, and a multiplicity of approaches appears to suggest that no easy course of management can always be provided. In a recent supplement to *JAOA* (Vol. 101, No. 4) diagnosis and treatment are considered.

Editor Linda S. Brecher, DO noted that "Arthritis is a term that is used to describe more than 100 different rheumatic diseases. Arthritis is one of the most prevalent chronic conditions among adults in the United States affecting more than 15 percent of the population overall and more than 20 percent of the adult population. The impact of arthritis on functional ability is great. It is the leading cause of disability." The supplement provides reviews of osteoarthritis, a nonsurgical approach to low back pain, a practical approach to fibromyalgia, and osteopathic treatment considerations for rheumatic diseases.

In 1918, shortly after the passing of A.T. Still, M.A. Lane discussed Dr. *A.T. Still, Founder of Osteopathy* (The Osteopathic Publishing Co., Chicago). Dr. Lane was professor of pathology in the American School of Osteopathy at Kirksville, and director of the postgraduate laboratory there for clinical diagnosis. The publishers of the text selected him as the author because of his international reputation for original researches in pure biological science, and his dedication to original research in osteopathy and the scientific teaching of the osteopaths of the future. Chapter VI of the text reflects Dr. Lane's thought on the value of osteopathy in rheumatic diseases.

> *"Osteopathy in the group of so-called rheumatic diseases*
>
> Rheumatism is a disease as old as history, and in ancient times men resorted to mineral springs for the relief of the pains, the twinges, the swellings, the soreness, the sudden sharp stabs, the acute disabling inflammation, the chronic pain and deformity – all of which were lumped together in the ancient medical mind and labeled in gross rheumatismus. Perhaps under no one name have so many widely divergent and radically different disorders been classified as under this old term rheumatism.
>
> *Nearly all pains once called rheumatic*
>
> Until yesterday one may say, "rheumatismæ was perhaps the most mysterious of diseases that tortured with strong pain or only just annoyed its victim. For in this many-headed disease all degrees of symptoms were recorded, from the smallest, most insignificant "pain" in the end of the toe or finger, which came and vanished so quickly that the individual could not be certain it was there at all, to long drawn out chronic torture that inflamed, enlarged and deformed the joints of the body with such racking and exhausting pain that one might well wonder how the victim could remain sane in mind.
>
> "Rheumatism," as this panorama of pain was called from of old, was studied in modern times by the best physiologists, bacteriologists and pathologists in the world without result. It was believed to be due to some chemical disturbance or unbalance in the body in which uric acid, or lactic acid, or some other acid, was not destroyed in the body, or was poorly eliminated, as is the known case with uric acid in gout. But this theory was long ago abandoned. It was believed to be due to diet, but no proof of this belief was ever brought forward. It was more recently believed to be due to the growth in the body of a microscopic germ, called by the man who believed he had found it, micrococcus rheumaticus. But bacteriologists in general were never convinced that this particular germ was the cause of rheumatism. The mystery of rheumatism promised never to be solved, and so it was that the old name lingered, and the doctors continue to prescribe anodynes, that is, drugs that dulled pain – opiates – not because the anodynes could cure or were believed to cure rheumatism, but because so-called rheumatism was accompanied by pain of any kind. Dosing the "rheumatic" patient with anodynes – or pain killers – helped to kill the patient, to ruin the heart, to make the sufferer suffer more. And so the use of anodynes in rheumatism came to be regarded as dangerous, and the wise doctor, for the patient's own good preferred to allow the rheumatic person to suffer rather than to risk killing him with drugs.
>
> But the mystery of rheumatism has been recently and finally cleared up by the discovery – which has been for several years dawning on the scientific mind – that what has been called rheumatism is not one single disease, that is, a disease due to one unvarying cause, but a

great number of symptoms caused by several different causes, the one thing common to all being the various kinds of pain. Until very recently we used to classify rheumatism into several kinds – inflammatory rheumatism (rheumatism accompanied by inflammation); rheumatoid arthritis (which was an inflammation of the joints milder than articular rheumatism or "like" rheumatic joints); articular rheumatism (in which the joints were swollen and the pain intense); muscular rheumatism (when the pain was in the muscles); neuralgic rheumatism (in which the pain was dull, chronic and distinctly of the toothache variety); rheumatic neuralgia (in which the pain was like that of the no less mysterious neuralgia, mixed with rheumatic signs); neuritis (which resembled rheumatism but was different in some ways); sciatica (pain in the great sciatic region); lumbago (pain in the lumbar region of the back); certain symptoms of the heart (called rheumatism of the heart); similarly of the stomach, and so on, without end.

Only a short time ago, it was believed that rheumatism was caused by the entrance into the body of some mysterious germ through the tonsils; and forthwith it became the fashion for people to have their tonsils removed (by a rather bloody and distressing if simple surgical operation). But even this last stand on the old ignorant basis has now been abandoned, and it has been seen that while of the troubles that was labeled rheumatism can and does come in by way of the tonsil, removing uninfected tonsils is a rather crude, hit-and-miss way of preventing disease; is rather, an excellent method of inviting other and worse disasters by taking away the natural fortifications of the body against invading organisms of many kinds.

How, then, let us ask, has the mystery been cleared up, and if there is no such thing in reality as rheumatism, what is the nature of the many different things that produce in the body the various aches and pains, swellings and tortures, twinches and "touches" that have been all along thrown together and labeled rheumatism from time out of mind?

When due to anatomical maladjustments

The osteopathic practitioner of five or ten or twenty years experience will understand much of the mystery when he thinks in retrospect of the persistent "rheumatisms" he has cured – occasionally with a single treatment. Well does such an osteopathic practitioner know, and well has he known for years, that an enormously large proportion of the "rheumatism" going the rounds of the human race was and is anything but mysterious, at least in its cause; for every such a practitioner has seen many cases of "rheumatism" – cases that would be labeled such by all the doctors in the world – which were caused by a ridiculously simple slip or misplacement or strain in some joint or tissue, the results of which were not always so simple as the cause. Such cases vary from long continued – nearly incessant – pain in a hand, a foot, an entire arm or leg, in both arms or legs, in the breast, in the entire lower part – from such a pain, we say, to intermittent stabbings and shootings of pain, which, like the true old "rheumatics" come and go with the weather and without it. But give the required adjustment, and such rheumatism is gone for good.

It is quite impossible to say what percentage of "rheumatisms" are caused by just such lesions. It is likewise impossible to say how many cases of neuritis, in which the entire upper body, the trunk, or large areas of it, are due, if not to bony lesions in the back, then to hardened and tense muscles along the spine, for the osteopath is familiar with such cases also, and has removed the ill permanently by loosening up the joint-binding tissues of the spine.

Here, then, is one great source of many of the pain-complexes known in the past as rheumatism – anatomical disturbances often minute in their nature. Let us illustrate."

Among the illustrations provided by Dr. Lane are: Intercostal Neuralgia, Brachial Neuritis, Bursitis, Disabled Foot Arch, Sciatica from a Slipped Pelvis, Infectious Processes, Inflammatory "Rheumatism", "Rheu-matic" Heart, Pus Pockets, Intestinal Autointoxication, Gonorrheal Arthritis, Rheumatoid Arthritis. The concluding comments by Dr. Lane are very applicable to the concerns of today.

"In conclusion one may say the 'rheumatic pains', when directly traceable to some comparatively prominent or comparatively obscure tissue disturbance, either in the spine or elsewhere, are reasonably certain to be cured by osteopathic adjustment of the lesions. A large percentage of 'rheumatism' is directly caused by these anatomical displacements, tensions, or maladjustments, and for all of these osteopathy is the only and at the same time the perfect remedy. In other forms of so-called rheumatism, when the pains are due to the presence of germs in the body, osteopathy may still be relied upon as one of the most important factors in the relief and cure of these infections, especially when the germs or their poisons have rendered the tissues of the spine tense or hard. And osteopathic treatment in general may be depended upon as one of the most salutary measures in maintaining a state of body well calculated to be resistent to the several germs that cause the swellings and pains formerly called rheumatism, as also to other germs and to germ diseases in general.❐

Adjustment of Muscular Lesions

A Textbook of the Principles of Osteopathy, G. D. Hulett, BS, DO, Fifth Edition, Chapter XXX, pages 136-141

In most cases of a chronic nature and in practically all acute cases muscular lesions are quite manifest. It is not necessary at this time to discuss the question as to whether that lesion is primary or secondary; the fact that it exists calls for discussion as to the methods of producing relaxation. For whether the lesion be primary or secondary its removal is seldom if ever contraindicated. Note first that one or more of several purposes may be had in view of the relaxation.

Relaxation for Diagnosis

One of the objects in such relaxation is that of diagnosis. In a large number of cases the muscular lesion is the most apparent one, which fact has given rise to much hasty reasoning with the conclusion that no additional factors were present. The writer was once told when he was a student in school, that when he "got into the field" he would find little beside muscular lesions. He is compelled to testify that the informant has proved himself a false prophet; if care be taken in analysis of conditions few acute or chronic cases can be found present unassociated with deeper than muscular lesion. Indeed it is not unsafe to assert that in most cases the muscular contracture is direct evidence of a deeper lesion. The difficulty of detection may be much more marked than the realness of the lesion. The fact that a deeper lesion is usually associated makes it necessary, or at least in many instances helpful, to effect a superficial relaxation in order to detect the deeper condition. Note the case of a contractured cervical region. In such the osteopath may not be able to determine the condition of the cervical vertebrae until the obscuring muscle contracture is removed. It is often difficult, further, to detect the relative position of the posterior part of a rib at its junction with the transverse process of the vertebrae until the associated contracture is overcome.

A floating kidney as a lesion is often obscured by contracture of the quadratus lumborum and abdominal muscles. Not only for diagnosis of further lesion is removal of contraction and contracture necessary, but also for determination of the organ involved and the nature of the involvement, in other words, for diagnosis of the disease itself. Note the fact that in hepatic colic from the passage of a gallstone, muscle contraction is so intense and painful that a palliative relaxation becomes imperative for definite diagnosis of the gallstone condition; similarly an obstruction to the bowel produces secondary abdominal tenseness sufficient to prohibit palpation; the rectal and vaginal sphincters may be so constricted as to hinder local examination of the position and condition of the uterus. In all such cases the osteopath often finds it necessary to resort to the removal of the secondary obscuring lesions before he is able to make a satisfactory diagnosis of the disease.

Relaxation as Preliminary to Treatment

A second object is as a preliminary to further treatment. Dr. Still invariably allowed his fingers or palms to "sink in" the tissues for a moment previous to the movement for adjustment of a cervical vertebra; in this "sinking in" relaxation occurs which reduces the vasomotor mechanism to the part involved. Relaxation of the pressure. In long standing cases of hip dislocation where a crude new articulation has been formed with a consequent adjustment – shortening and lengthening – of muscle and ligament, it is impossible to immediately reduce the dislocation, and recourse must be had to a series of treatments designed to relax and otherwise change structural conditions which are secondary to the original dislocation. In bowel occlusion from impaction of feces, relaxation of the abdominal wall is essential to a further direct manipulation of the impacted area.

Relaxation of Primary Lesions

Finally, relaxation is used as a treatment primary in itself. A muscle contracture whether primarily or secondarily produced exerts pressure on tissues within itself, (e.g., sensory nerve terminals) or disturbs structures to which it is attached. As instance of the former note the conditions of congestion produced in the respiratory canal by virtue of contractures irritating afferent nerves which carry impulses to the segment of the spinal cord governing the baso-motor mechanism to the part involved. Relaxation of the muscle tissue in such a case removes the primary cause of the congestion. By the tension upon the associated vertebra or rib, displacement of the latter further adds to the difficulty and hence is additional cause; in this case the relaxation permits of a return of the displaced structures to their natural relationship. Further instances are relaxation of suprahyoid muscles which interfere with venous return from various cephalic structures, thus relieving congestion; pressure on the bowel wall in a spasmodic contraction of the muscular coats which relaxes the tissue and overcomes the cramp which so distresses.

Methods

With regard to the methods employed in producing relaxation several are in vogue by different osteopaths. Among them mention may be made of the most important. The removal of the cause constitutes in all cases the fundamental method. Owing to the tendency on the part of students to overlook the fact it seems necessary to emphasize that a contracted muscle remains in that state only by virtue of a continuously acting stimulus. A muscle in a state of rigor may remain in that state indefinitely, or until correct circulation removes the abnormal fluids from around its cells. One of the inherent properties of muscle tissue is the ability to respond to a stimulus by a contraction. It is no less an inherent property of that tissue to relax as soon as the stimulus is removed.

In muscular rigor, the removal of the cause of edema, the restoration of normal circulation and normal alkalinity of the fluids, the restoration of normal innervation, permit the injured cells to return to normal conditions, unless the rigor has persisted so long as to cause definite overgrowth of connective tissues and atrophy of muscle cells, the condition of contracture in the common significance of that term.

With a certain proportion of students and inexperienced osteopaths the first consideration on meeting with a case presenting contracture is the application of methods direct to the muscle designed to produce relaxation. This is fundamentally erroneous. The first consideration should be the determination of the nature and source of the constantly acting stimulus. The second consideration should be the application of measures to remove that stimulus. If a muscle is contracted through simple exposure to a change of temperature, the primary treatment is the negative one of removing the patient from the influence of the changing temperature. If the contraction or contracture is caused by a direct irritation to the motor nerve through pressure from a deep bony or ligamentous lesion, the essential treatment consists in opening up the space, which transmits the nerve. A contractured condition of the anterior muscles of the thigh caused by impingement upon the anterior crural is logically and surely overcome by the adjustment of the subluxated hip, pelvic, or lumbar structures causing the impingement. Note that the direct work upon the muscle in any of these cases will be getting at the difficulty from the wrong side and can only indirectly and in most cases temporarily reduce the contracture.

Pressure

Admitting the logic of the above considerations, it yet remains a fact that specific methods, other than those directly concerned in the way indicated above, may be employed as a matter of expediency. Pressure with quiet and slight rotation of the tissues, usually more in a direction at right angles to that of the fibres than otherwise, is employed in numerous cases. This method secures normal condition of the muscle by acting upon its fluids. Venous blood is forced out, and arterial blood returns; edematous fluids are carried away; alkalinity is brought to normal by the blood flow, the tension due to turgor diminishes, and the muscle resumes its normal metabolism.

As examples of cases in which the pressure and manipulation method is efficacious are the following: in headache the suboccipital region is often found quite tense, in which case gradual but deep pressure, a "sinking in" as Dr. Still calls it, forces the tissue to relax and often yields immediate relief. In case of the passage of a gallstone along the duct the irritation is so intense as to cause direct connection along the duct, the abdominal wall overlying it, and the spinal region from which it is innervated, in which case pressure is used both along the spine and the course of the duct. In croup and diphtheria the rapid inflammation and associated toxic condition cause rapid and intense contraction and congestion of the suprahyoid muscles, which will in most cases rapidly, though perhaps temporarily, yield to the pressure and manipulation.

Stretching

Stretching the muscle is a method that is employed by many osteopaths for the purpose of producing relaxation. It is doubtful whether such a method usually results satisfactorily. Theoretically there is much to be said against the process. The process of stretching a muscle is one method of increasing the irritability of the muscle. Lombard is authority for the statement that "the irritability of muscles is likewise increased by moderate stretching and destroyed if it be excessive." Hence it would certainly seem illogical to attempt relaxation by increasing its irritability. Neither would it be the part of wisdom to destroy the irritability by excessive stretching. A muscle in the condition of contracture will be stimulated to still greater contraction by throwing it out of tension and yet there seems to be no question that in a certain percentage of cases the process does result favorably and the explanation is sought. The stretching of a muscle, thus increasing its tension, corresponds in a way to the exaggeration in case of an osseous lesion, and in that case there is secured the benefit of recoil. In addition reference is again made to the fact that muscle contracture is not identical with muscle contraction, and in the process of stretching, the congested material and waste products are more or less forcibly expressed from the contractured tissue, though no relaxing effect might be gotten on a simple contraction. In all cases when attempting relaxation by this method a simple rule of guidance is usually sufficient. Separate the origin and insertion of the muscle. In case the scaleni muscles are found contractured on the left side, bending the head to the right with the shoulder a fixed point separates the attachments and hence produces stretching. Hyperextension of the thigh stretches the anterior femoral muscles, while extreme flexion of the thigh on the abdomen puts tension on the posterior muscles of the limb. Pulling the middle portion of a muscle in a direction transverse to the course of its fibers produces tension of the muscle although the absolute distance between the two attachments of the muscle actually may have been lessened, as in the case of an upward and outward manipulation of the spinal muscles in the region of the lower thoracic.

Approximation

Another method less subject to abuse is that of approximation of the origin and insertion. In this method the attached structures are forced toward each other. That this method is efficacious as a temporary expedient few will deny. Just as the tension can be removed from a rope attached to posts by bending the posts toward each other, so to an appreciable extent can the tension be taken from a muscle by forcing nearer together the points of attachment. Further, this method seems to be a most natural one, and one resorted to involuntarily in many cases. Note the characteristic position assumed by a victim of peritonitis in which the superficial abdominal tissues are intensely tightened. The patient lies supine with the limbs flexed at the hip and the head and shoulders raised, the total effect on the musculature of the abdomen being an approximation of the origin and insertion of most of the muscles concerned. A further instance indicating the value of this method is the flexing of the head dorsally upon the neck in a case of suboccipital contrac-

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tion; or the flexion of the arm at the elbow for the purpose of relaxing the biceps preliminary to the reduction of a dislocated shoulder.

It is seldom that any one of these several methods is used alone and it is in comparatively few cases that it is possible or advisable to avoid using two or more of them. For instance in the case of a contractured scalenus muscle a common method is first to bend the head away from the side of the contracture, which stretches the muscle, then to rotate it back, which approximates the origin and insertion, and at the same time to exert pressure directly upon the muscle fibres. In this case three of the methods are employed and it is altogether likely that during the course of the movement the deeper structures are opened up, impingement taken off the nerve which supplied the muscle, and hence the irritation removed and a fourth method employed. The point was emphasized in the case of the method by pressure that the application should be gradual. It is equally true of the other methods, and not only with reference to the application but the removal of contact should be gradual for if the removal be sudden there results an abrupt change. Abrupt change, whether from a lower to a higher or from a higher to a lower level, constitutes a stimulus, and a stimulus means further contraction. Another caution of some considerable value has reference to the relative temperature of the hand of the physician. If the manipulation is made upon the tissues it is necessary for best results that the temperature of the part and of the physician's hand should be approximately the same. Especially is it advisable if the physician has cold hands to warm them before beginning the treatment, otherwise the shock produced by the difference in temperature will be a distinct added stimulus for further contraction, a result not at all to be desired.❐

Message from the Executive Director
continued from page 7

profession's efforts to create a research center. It could be immensely helpful in generating significant patient data as well as supporting smaller and/or pilot research projects from which investigators can launch larger studies. Please let me know if you are interested in participating and I will put you in touch with the LBORC leadership.

[1]Gevitz, N. Researched and demonstrated: inquiry and infrastructure at osteopathic institutions. *JAOA* 2001;101:174-179.

Errata:

In my executive director's message published in the spring 2001 issue of *The AAO Journal*, I referenced but failed to name directly the second German osteopathic journal. Editor Roger Seider, MD, DO appropriately pointed out that I should have identified *Stillpoint: Deutsches Journal für Osteopathie*, a publication of the Deutsche Akademie für Osteopathische Medizin in Hamm. I apologize to our DAOM colleagues for the omission.❐

A Model for (Focused) Osteopathic Evaluation of 'Iliacus' Function and Dysfunction

by David C. Eland, DO, FAAO

Editor's Note: *Submitted in partial fulfillment of requirements for Fellowship in the American Academy of Osteopathy. Dr. Eland was conferred status as Fellow in 2000.*

I. Introduction

'Iliacus' function and dysfunction play a significant role in sacro-pelvic function and ambulatory activity. There is a great deal of information available on the relationship of the low back, pelvis, and lower extremity in health and disease. Back problems alone, have been ranked high among reasons for physician office visits; they are second only to visits for upper respiratory infections; upwards of 90 percent of adults experience back pain at some time in their lives. (Wipf & Deyo, 1995). The most frequent cause of disability in individuals 45 and younger is low back pain (Bigos, 1994). Dysfunction of the low back, pelvis, and hips impacts quality of life issues and ambulation, i.e. falls, for the senior population. Dance and athletic injuries associated with related structures – hip, hamstring, groin, knee, and ankle, to name a few – also suggest the need to for continued exploration of regional biomechanics and improved understanding in these related regions. Diagnostically, there are myriad tests specific to the various aspects of function and dysfunction for these regions. Therapeutically, there are as many or more therapeutic interventions. (Magee, 1997, Hoppenfeld, 1976, Mosby, 1999)

It might be asked: Why give so much attention to Iliacus evaluation and treatment? Isn't there more than adequate diagnostic and therapeutic information currently available? Hip flexion and extension are key factors influencing upright activity such as running and walking. The hip flexors play a pivotal role in much of our upright activity. Little information is available in the literature about the Iliacus muscle, let alone about the iliacus complex. Therefore the evaluation of the relationships of the innominate, its joints, musculature and fascial-ligamentous structures, particularly hip extension in normal function and hip flexor contracture in dysfunction deserves detailed attention.

It could be argued that there is only a small difference between the approach to the Iliacus and the generally accepted approach to the iliopsoas. As in other aspects of osteopathic evaluation and management, small differences can be quite significant. The difference between an experienced clinician's ability to define a slight compression resistance, in addition to the primary diagnosis of that rib's resistance to inhalation that a relatively naive clinician might make, could be the difference between a full resolution or a partial resolution of the rib dysfunction. The small difference in direction or vector of force between the same two clinicians, given a diagnosis upon which they agree completely, could also result in a difference in efficacy of treatment. Similarly, more definite knowledge of the role and importance of the 'iliacus complex'[1] can provide the additional information for evaluation and treatment of patients and for performance enhancement in athletics and dance. This will lead to improved patient outcomes.

The term iliacus complex was developed for research purposes to describe the elements that resist hip extension, including the single-joint hip flexor elements that cross the hip →

[1]For the purposes of brevity, the 'Iliacus complex' and the 'Iliacus test' are named for the major single joint muscle involved in hip joint flexion and resistance to hip extension, the iliacus. It should be recognized that the iliofemoral ligament is a significant contributor to limitation of hip extension range of motion, as well. The fascias associated with these structures also play a significant role. Other single joint musculature that cross the hip joint, such as the pectineus, likely play a lesser role in hip extension resistance, but should not be ignored. These anatomic relationships will be addressed in more detail in the Anatomy section. The terms, Iliacus test and Iliacus complex, should therefore, be thought of as a descriptor of these various anatomically related and interdependent structures, not as a descriptor solely of the iliacus muscle itself. These terms are not in use in the general literature. When an individual structure, such as the iliacus muscle, is being addressed its name will be used specifically. These descriptors are used to differentiate the focus of inquiry in this thesis from that generally associated with hip flexion, i.e. the psoas.

joint. (See Figure 1) During the course of my thesis this complex will be shown to be a key element in function and dysfunction. Exploration of this subject requires review of the evolution of my inquiry into the iliacus complex. It also requires examination of the structure/function relationships, current research, osteopathic history, and allopathic history related to the iliacus complex. Finally, current diagnostic and treatment options need to be reviewed.

II. History of the Development of the 'Iliacus test'

The general medical literature has not regarded the Iliacus muscle as a discreet muscle in its functional sense or with regard to its diagnostic and therapeutic significance. The Iliacus test has evolved from evaluation of the iliacus complex stretch capacity. This 'iliacus' focus has emerged from use of the osteopathic principles

Gluteal and Hip Regions

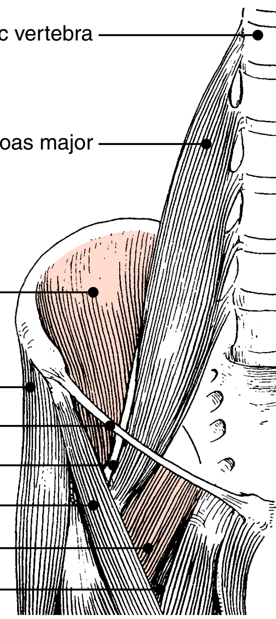

Figure 1: *Hip & Gluteal Region – (adapted from Hollingshead, 5th Ed., 1997, p.331) The 'Iliacus complex' is depicted in the larger context of multiple joint muscles. The superficial muscular 'Iliacus complex' components are depicted in red. The enveloping fascia and deeper structures must be inferred.*

based upon 1) the interrelated nature of structure and function, 2) localization, 3) body unity - which underlies compensatory and healing processes, and 4) the application of knowledge of biomechanical fulcrums and levers. (The importance of each principle will be explored through the course of this paper.) Clinical need combined with knowledge of these osteopathic principles, review of the anatomy (structure) and assessment of motion characteristics (function) of the lower half of the body, particularly the sacroiliac joint led to the development of the 'Iliacus test'. Knowledge of the dysfunctions common to the sacroiliac joint (torsions, innominate rotations, etc.) helped determine the need to fix the innominate in place, i.e. prevent rotation during hip extension. All joints proximal to the hip joint, including the sacroiliac joints and pubic symphysis, needed to be taken out of the hip extension compensation equation. (Psoas contracture, if present, could still be as a major factor. This is an argument for the multi-joint/regional effects of fascial elements, for example.)

The approach developed has been helpful in diagnosing patients with low back pain and dysfunction, hamstring strain, and lower extremity strain and dysfunction. It has been as valuable for evaluation of athletes and dancers with the goal of performance enhancement. Individuals with these complaints and performance needs have benefited from the addition of the Iliacus test to their diagnostic sequence. This test has enabled the examiner to more accurately assess specific range of motion deficits and decipher key elements of sacro-pelvic dysfunction. The new information has led to the recognition of the primary nature of Iliacus contracture/dysfunction in some recurrent patterns of this sacro-pelvic dysfunction. This has, in turn, allowed the addition of specific therapeutic interventions that would not otherwise have been considered.

III. Structure/Function Relationships

The Iliacus muscle, iliofemoral ligament, associated joints, and fascial structures are key elements in need of examination. The Iliacus muscle has been approached historically as an integral part of the iliopsoas muscle. The iliopsoas muscle has been identified as a key component in low back complaints, postural function and dysfunction, gait and athletic endeavors, i.e. any endeavor requiring controlled and modulated hip flexion and extension. The iliofemoral ligament has been identified as a key element in passive support of upright posture. Little has been published in recent years to define the unique contribution of the Iliacus or iliofemoral component's contribution to pain complaints/dysfunction or this complex's contribution to optimizing lower extremity, pelvic and axial skeletal function independent of the psoas. It is valuable, at this point, to review the various aspects of the structure/function relationship separately. As such, this section will be divided into seven sections: history; sacroiliac and pubic considerations; hip joint; musculature; gait/ambulation; phylogeny; and summary.

A. History

Michele, in his book, *Iliopsoas - Development of Anomalies in Man* (1962) refers to early work by Basmajian and draws the conclusion: "... to properly present the action of the iliopsoas, each component should be studied independently and given independent values as to the directional force and momentum. One muscle is monoarticular, the other unipennate and multipolar, possessing a powerful bending action at the neck of the femur" (p.121) (Also, See Figure 1). Unfortunately, the author does not proceed to consider the Iliacus in any true independent manner after drawing his conclusion. Later, while addressing the etiologies of exaggerated lumbar lordosis the author does acknowledge likely involvement of the iliopsoas in this dysfunctional postural process, but does not suggest a primary role for the Iliacus component.

B. Sacroiliac & Pubic Considerations

The tendency to ignore or discount independent Iliacus contribution to function and dysfunction is, in large part, a function of the widespread belief, outside manipulative medicine circles, that there is no significant sacroiliac motion; The general feeling has been that there may be some there, but it has no clinical relevance. For example, Turek's *Orthopaedics* (1984) defines sacroiliac strain and subluxation, but summarizes by saying "the existence of which is doubted by many." (p.1657). *Gray's Anatomy* (30th American Edition; 1984) states only that it is 'a synovial joint that permits little movement'. p.360. Kapandji (1974) weighs in after describing sacroiliac motion as nutation and counternutation by saying: "There is more a tendency to movement than actual movement since extremely powerful ligaments preclude any movement from the start." (p.70) The current *British Gray's Anatomy* (Williams, 1995, p.677) acknowledges as much as 56mm of motion for the sacral promontory in reference to the ilium. Intra pelvic motion was addressed during the proceedings of the 24th Annual Osteopathic Research Conference (Wells, 1980): "Although the significance of the Intrapelvic mobility in the birth process and its probable role in low back pain have long been noted, functional interpretation of the motion characteristics in the pelvis must await a more intensive investigation." (p.280) These various authorities, even when recognizing sacroiliac motion, do not address the potential significance of innominate →

rotation in function and dysfunction. Theirs is a scientific empiric approach, not clinical. However, anatomy does support the clinical approach.

The three joints that unite the bony pelvis form a complete ring along the pelvic brim. (See Figure 2) In the upright position the roughly triangular sacrum is wedged between the ilia. Kapandji describes the ilia as levers with their fulcra at the sacroiliac (SI) joint. The posterior sacroiliac ligaments provide the 'mechanical resistance' for the lever (See Figure 3) and the 'power' of levers meet at the pubic symphysis which absorbs the lever's 'approximating force' under normal circumstances. The author concludes: "One can thus understand the complete interdependence of the various elements of the pelvic brim." (Kapandji, 1974, p.56) The author does acknowledge the alternating nature of superior/inferior shearing 'force' at the pubic symphysis during walking and alludes to similar shearing type force at the sacroiliac, as well. Kapandji's description of nutation and counternutation assumes a relatively stationary pair of innominates with the sacral base moving anterior and inferior while the apex moves in the opposite direction during nutation and counternutation producing the sacral base posterior superior motion while the apex moves opposite to that. (p.64). If one instead assumes the sacrum to be relatively stationary, the same description for nutation/counternutation supports the idea of innominate motion. Given the mobility acknowledged for the pubic symphysis, it is reasonable to thus conclude that a single innominate may move relative to its joint with the sacrum. By deduction, this provides support for the theses and clinical observations of the osteopathic profession suggesting there is rotational motion of the innominate about the SI joint. Probably of more relevance to the 'iliacus complex', is Kapandji's comments relative to extension of the hips. "When the hips are extended the traction of the hip flexor muscles causes the pelvis to tilt anteriorly...and leads to a movement of counternutation." (p.70) In osteopathic terms he is saying tension on the hip flexor muscles produces anterior rotation of the innominates. Deductive reasoning suggests imbalance in the traction exerted by the hip flexors of the right side as compared to the left, as would be the case with a unilateral 'iliacus contracture' on the right, would produce anterior rotation of the right innominate. (See Figure 3)

Innominate rotation is readily acknowledged in manipulative circles (Mitchel, Moran, Pruzzo, 1979, p.55; Ward, 1997, p.683-684; Greenman, 1996, p.330; DiGiovanna, 1997, pp.203-204), but often times is treated

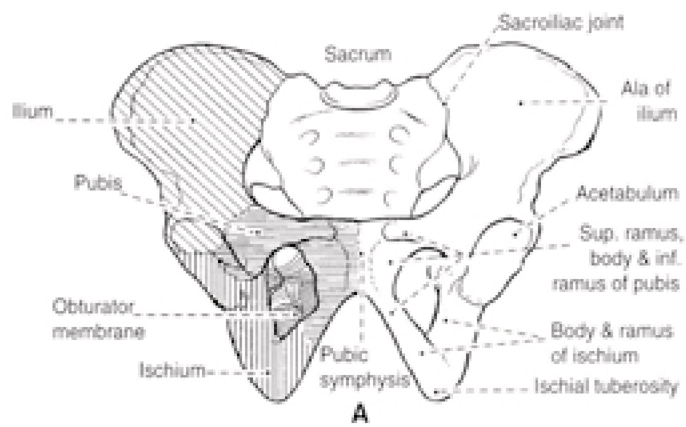

Figure 2: *Bony Pelvis (adapted from Hollingshead, 5th Ed., 1997, p.308) This figure depicts the complete bony ring around the brim of the pelvis.*

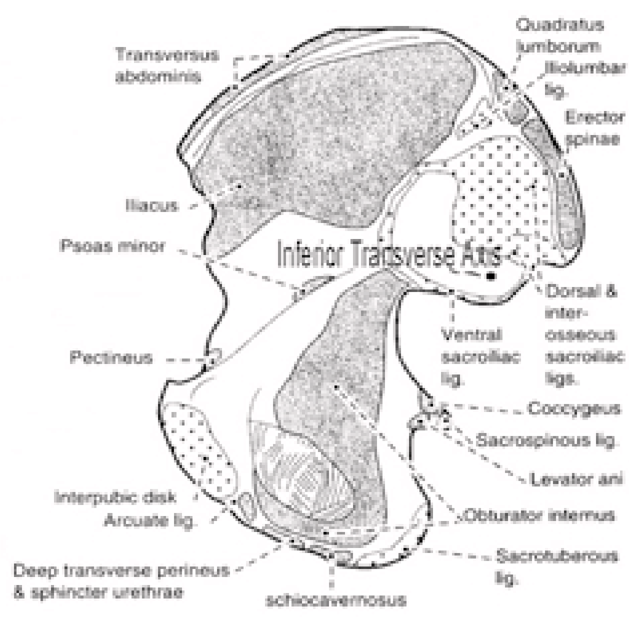

Figure 3: *The Right Coxal Bone – (adapted from Hollingshead, 5th Ed., 1997, p.310; inferior transverse axis position added by this author)*
– The extensive attachments of the sacroiliac ligaments are depicted here.
– The extensive origin of the iliacus and its relationship to the inferior transverse axis give a clear indication of the influence of an iliacus contracture upon anterior innominate rotation.

as an isolated finding to be treated as such. [The muscle energy treatment sequence suggests otherwise.[2]] 'Treat it and that should be the end of that' is the conclusion that may be drawn from the review of isolated techniques from these resources for evaluation and treatment of the innominate; that is, if the larger context of local and regional interrelationships is not recognized from a more general reading of these texts.

The osteopathic resources noted in the preceding paragraph also provide definition, diagnostic criteria, and therapeutic maneuvers for backward torsions of the sacrum[3]. This clinical phenomenon, especially when recurrent, may be secondary to the anterior innominate and its source in Iliacus contracture.

Contracture of the iliacus complex is a significant contributor to chronic or recurrent anterior rotation of the ipsilateral innominate (and ipsilateral backward torsion) is supported by clinical findings and functional anatomy noted in the preceding material. This pattern recognition is the result of ten years of private practice experience. It is implicit in the writings of many osteopathic physicians as well. (see Lippincott/Sutherland, 1990; Pratt, 1952; etc - to be explored later in this paper). The anatomic line of reasoning will be developed further, based upon hip joint structure and function and the myotatic or functional unit (for lower extremity flexion)[4].

C. Hip Joint

This is a ball and socket joint. Functionally, the ligaments of the hip joint all tighten with extension of the ball of the femur in the socket of the innominate, the acetabulum. For detailed evaluation of the extension elements, understanding the anatomy and function of the iliofemoral ligament is crucial (See Figure 4). The iliofemoral ligament is the strongest ligament in the body (Rosse, p.327). The medial iliofemoral ligament is vertical and is the element that most strongly resists extension. It and the other ligaments promote the close-packing of this joint as the limits of extension are approached in any given individual. Close-packing the hip joint compresses the ball of the femur into the socket of the innominate. The long lever of the femur acts with considerable force applied to the iliofemoral ligament[5], especially the medial portion. Given the strength of the ligamentous resistance to extension and the close-packed nature of the joint, excessive extension forces are going to be transferred to the sacroiliac joint posteriorly which in turn leads to recruitment of the iliopsoas. This provides one potentially powerful lever for anterior rotation of the ipsilateral innominate. See Appendix 1 for more anatomic detail.

D. Musculature

It necessary to turn our attention to the musculature, at this point. Travell sets forth a useful organizing principle, based upon the work of Janda and Lewit - the myotatic or functional unit. For lower extremity flexion this includes: (Greenman, p. 452; Travell, 1992, pp. 94-95)

If we add the muscle fiber type to the biomechanical information presented thus far, we can make further deductions about the pivotal nature of the Iliacus in pelvic function and →

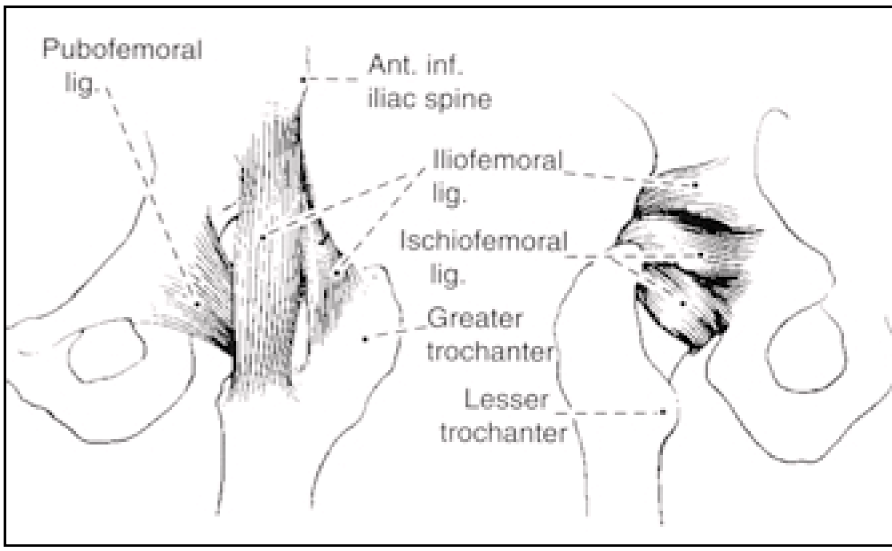

***Figure 4:** Ligaments of the Hip – (adapted from Hollingshead, 5th Ed., 1997, p. 327) Iliofemoral Ligament: As its tension increases, the powerful vertical portion (medial iliofemoral ligment) strongly resists hip extension.*

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[2]David Johnson, DO, FAAO participated in the original work group formalizing the muscle energy model. He presented the sequence to the students at Ohio University College of Osteopathic Medicine during his tenure there. Treatment sequence: 1) Long leg restrictors, 2) Pubic symphysis, 3) Innominate Upslip, 4) Lumbars, particularly L5, 5) Sacrum, 6) Innominate, 7) Iliopsoas. We have found this sequence to be of particular value for the beginning students, as a general guide in their sequencing of evaluation and treatment of the lower half of the body.

[3]*Foundations for Osteopathic Medicine*, p.620 and *Glossary of Osteopathic Terminology*, p.1137.

[4]Travell defines Myotatic Unit: "A group of angonist and antagonist muscles, which function together as a unit because they share common spinal reflex responses. The agonist muscles may act together in series, or in parallel." p.4, vol. 2.

[5]If this were not 'the strongest of all ligaments' we would see traumatic rupture and displacement in adults and children. Turek (p.1252, 1258) makes no reference to such events and confines discussion to congenital dislocations and dislocations secondary to muscle imbalances, paralytic or spastic, associated with myelomeningocele or cerebral palsy.

Iliacus would be described as a 'postural or tonic muscles'. Predominantly 'slow twitch' muscles, like the Iliacus, do not fatigue readily and react to functional disturbance by hypertonicity, shortening and tightening. In the pelvis and lower extremity they include the following major *flexors*-iliopsoas, rectus femoris and major *extensors*- the hamstrings. Predominantly 'fast twitch' muscles produce considerable power, but fatigue quickly and react to functional disturbance by weakening and inhibition. These are the 'phasic' muscles. In the pelvis and lower extremity they include one of the major *extensors*- the gluteus maximus.

1. Synergists (See Figure 5):
   iliopsoas
   rectus femoris
   pectineus
   assisted by: sartorius
   tensor fasciae lata
   gracilis
   adductors - longus, brevis, middle part of magnus

2. Antagonists (See Figure 6):
   gluteus maximus
   hamstring muscles
   posterior part of the adductor magnus

(See Appendix 1 for a detailed description of these muscles based upon the *British Gray's Anatomy*, Williams, 1995)[6]

In order to appreciate the implications of these facts, the biomechanical relationships need to be evaluated in a standard standing position. The major 'tonic' extensors are the hamstring muscles (See Figure 6). The hamstrings proximal attachments are almost directly below the axis of rotation in the standing position. Given this proximal attachment to the ischium and the relationship to the axis of rotation for the innominate (inferior transverse axis for motion of the ilia upon the sacrum; Mitchell, 1958, p.75), there is no mechanical advantage to resist hypertonicity of the Iliacus which is the major single joint 'tonic' flexor of the hip[7]. The direction of pull for the hamstring fibers is directly toward the inferior trans-

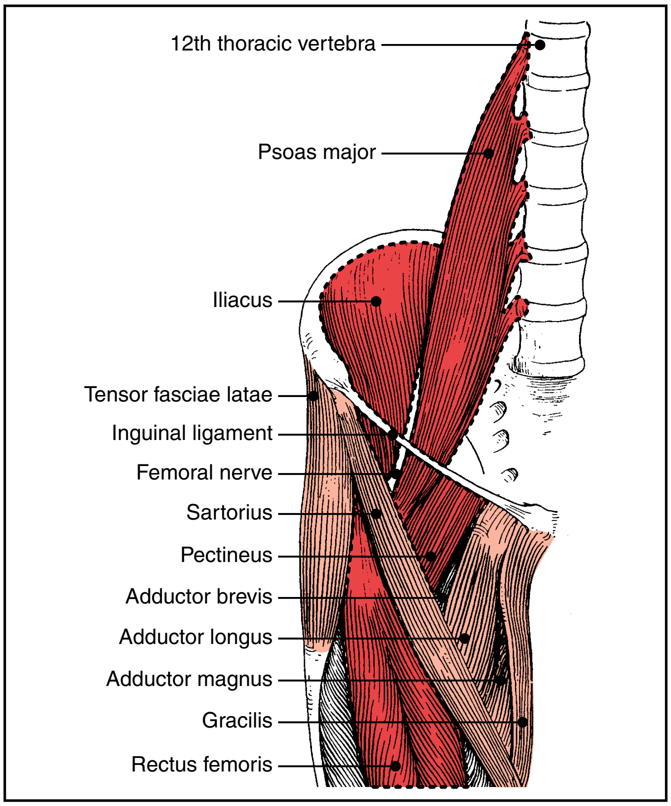


Figure 5: *Synergist Muscles for Hip Flexion – (adapted from Hollingshead, 5th Ed., 1997, p. 331)*

= hip flexion synergists

= assisting muscles

= The iliopsoas and rectus femoris are the tonic muscles in the group with primary hip flexion function.

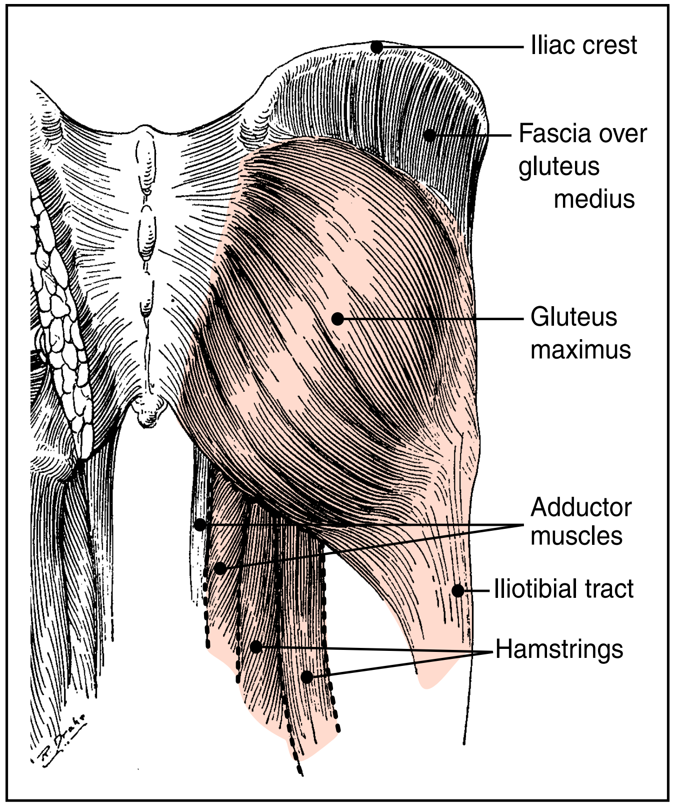


Figure 6: *Antagonist Muscles for Hip Flexion – (adapted from Hollingshead, 5th Ed., 1997, p. 321)*

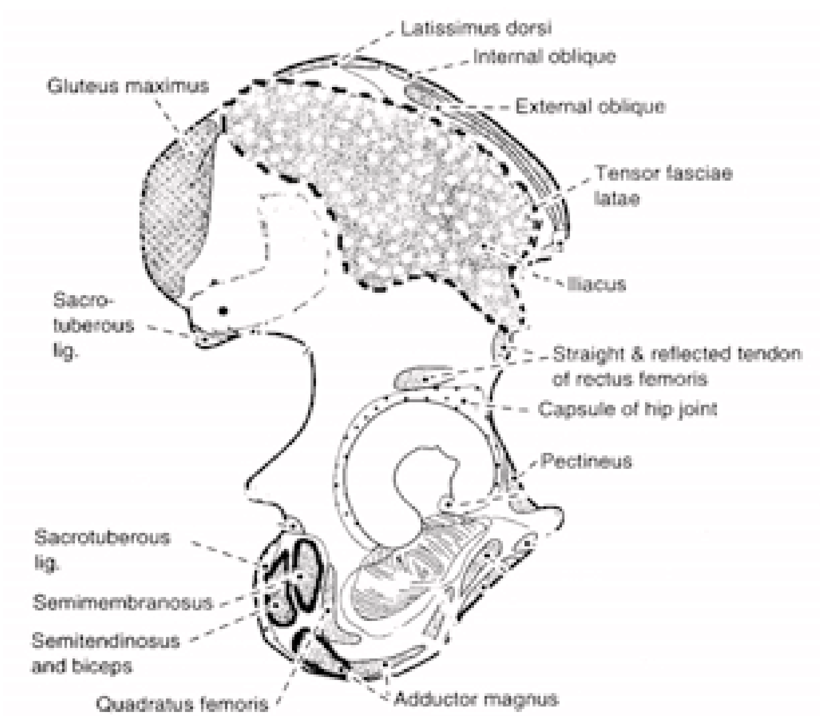
= The hip flexion antagonists are the gluteus maximus, hamstrings and posterior part of adductor magnus.

= The hamstrings and adductors are the tonic muscles in the group

[6]The appendix is organized around the concept of the myotatic or functional unit described above. Excerpts from *British Gray's Anatomy* were selected to bring clarity to the relationships. It's text provides the detail that flushes out the observations that follow in this section.

verse axis, i.e. along a radial line extending from the axis. This relationship provides no basis for these muscles to exert a sustained posterior rotational force on the innominate (See Figure 7). However, increased pelvic tilt, with associated rotation anterior of both innominates, may be partially responsible for a change in leverage relationship allowing for that sustained posterior rotational force. In the upright position, the pelvic tilt would bring the origin of the hamstrings posterior to the axis of rotation of the innominate. This would provide a mechanical advantage allowing the hamstrings to counterbalance the contractured iliacus complex, since both muscles are 'tonic' type muscles. The gluteus maximus attaching near the PSIS on the lateral surface of the ilium passes inferior and laterally. Part of its force generation becomes a lateral pull on the ilium due to its fiber direction (See Figure 6). It also has a short lever arm from that proximal attachment to the inferior transverse axis (See Figure 7). The gluteus maximus is a 'phasic muscle', thus it is not designed for sustained contraction.

The Iliacus is a 'tonic' muscle and has a shorter course (See Figure 5). It has a fulcrum that helps multiply mechanical advantage as it crosses the iliopubic (iliopectineal) eminence to attach upon the lesser trochanter. Given the nature of each of these muscles and the biomechanical environment described, neither the gluteus maximus nor the hamstrings are going to be effective in opposition to the Iliacus in other than normal functional circumstances. Thus, the consequence of Iliacus contracture will be anterior rotation of the innominate to the limits allowed by the SI joint and compensatory flexion of the femur on the hip.



Lateral View of Right Innominate with Superimposed Sacroiliac Joint & Iliacus (From the Medial Aspect – dashed lines)

Figure 7: *Lever arms Relative to the Inferior Transverse Axis (ITA) – (adapted from Hollingshead, 5th Ed., 1997, p. 310)*
In the upright (standing position the tonic hip extensors) dark outlines) – hamstrings) are not in a position to resist anterior rotation of the innominate. Any pull they exert is essentially in line with the ITA. This does not allow creation of an effective leverage arm from the ITA to their origins for active posterior rotation. There may even be a slight anterior rotation leverage.

On the other hand, the extensive origin of the iliacus does create a lever arm with respect tothe ITA in standing position and contraction of the iliacus is not in nearly as direct a line with the ITA. Given a fixed femur, it [the iliacus muscle] can readily rotate the innominate anterior with contraction. The limiting factor is the sacroiliac ligaments which offer passive resistance at their end range, but with the fixed femur the ligaments and fascial elements also have the potential to participate in anterior innominate rotation at their end range.

E. Gait/Ambulation

Anterior rotation of the innominate occurs normally during the swing phase and heel strike due to factors other than the Iliacus[8], according to Mitchell (p.76). Norkin's assessment is representative of the exercise physiology literature . There is mention of pelvic drop in the frontal plane, forward and backward rotation of the pelvis, but no mention of accompanying innominate rotation.[9] (Norkin, 1992, pp.459-464). Osteopathic clinical experience is on Mitchell's side.

The normal response during →

[7]The psoas can only influence the innominate through its attachment to the lesser trochanter. This is ineffective due to the extensive flexion possible across the hip joint.

[8]The iliacus plays a role in the anterior rotation of the innominate. The work of Andersson designating the iliacus as the 'switch muscle' suggests it is contracting during the swing phase.

ambulation is to attempt to maintain stride length. With the decreased hip extension associated with Iliacus contracture (or spasm) and its lack of end range resilience, anterior rotation of the innominate (the next most proximal joint from the hip) is a logical and common response. Increased rotation of the pelvis, as a whole, is also common (especially with bilateral Iliacus contracture), as is increased lumbar lordosis. Each of these compensations helps the body normalize the gait.

The extensive origin of the Iliacus upon the ilium can only reinforce the anterior rotation of the innominate. Yet, the iliopsoas and other hip flexors represent the only flexible mechanism of compensation the body has for excessive extension stress, which can be part of uncompensated gait. Repetitive extension stress can produce inflammation that would produce fibrotic thickening of the iliofemoral ligament. This would occur most likely over years of time. The short-term response is more likely that of Iliacus spasm with subsequent contracture which may then be followed by iliofemoral ligament fibrosis. Clinical experience corroborates this theory. Younger patients with fewer years of trauma for which their bodies must compensate, have tight, more tense, congested, somewhat boggy Iliacus upon palpation medial to the ASIS (anterior superior iliac spine). Patients with a few more years of trauma accumulation or with one severe trauma have tight tense fibrotic, sometimes tender, Iliacus with a more restricted range of motion.

F. Phylogeny

If we return to the biomechanics of standing, comparison of the above biomechanical relationships with those for a quadruped stance, makes it clear that the leverage imbalance does not exists in quadruped. Because the femur is flexed 90 degrees in relationship to the pelvis, the ischial attachments of the hamstrings are not in a direct line of pull with the axis of rotation of the innominate about the sacrum. There are therefore similar lever systems in action for the hip flexors and the hip extensors in the quadruped with tonic muscles controlling action in both directions (See Figure 7 - rotate it ninety degrees clockwise). Thus, it seems the problem of Iliacus contracture is one of the small prices we pay for the upright stance.

G. Summary

Anatomy lends itself to reductionist thinking. This section has addressed the relationships of various muscles, joints and ligaments, but the goal is to bring them back together into a meaningful whole. A focus on hip extension is not meant to diminish the importance of other lumbar, pelvic or lower extremity motions in function and dysfunction. Nor is it meant to diminish the importance of the fascial continuity. That subject has been and will be the source of many theses and ruminations.

There is a logical structural/functional mechanism for inclusion of iliacus complex concerns in evaluation and treatment of low back, pelvic and lower extremity complaints. This mechanism includes chronic recurrent anterior innominate rotation, backward sacral torsions and apparent short lower extremities. Typical allopathic treatments for these entities and for hip flexion contracture do not take Iliacus contracture into account and are thus, not as successful as they might otherwise be.

IV. Research Related to the Iliacus Complex

Early controversy with regard to the iliopsoas revolved around whether it was an internal or external rotator of the hip. There was no argument about its hip flexor function. There was some thought about the two parts of the muscle. Basmajian summarized the consensus of thought of the EMG (electromyography) researchers of the 1950s: "Although the actions of psoas may possibly differ from those of Iliacus, our experience with other two-headed muscles suggests that it is unlikely insofar as actions of iliopsoas at the hip are concerned." (Basmajian, 1958) He was careful to limit his comments to the hip joint. If Basmajian had been an osteopathic physician, he might have explored the implication for the ipsilateral sacroiliac joint. He did not, nor did other allopathic physicians over the years. The assumption that prevailed in the medical literature, and still does to a certain degree, was that the sacroiliac joint allowed no medically significant motion. This was an acknowledgment of 'a slight amount of movement' of a gliding and rotary nature in anatomy texts such as Morris' *Human Anatomy* (Anson, 1966). Osteopathic physicians recognize the various motions of which the sacroiliac is capable. The influence of the 'iliacus complex' upon anterior innominate rotation, in particular, was explored in the structure function section.

From a functional perspective, Basmajian and DeLuca came to several conclusions about the iliopsoas: "Iliopsoas - both of its parts - appears to be an active postural and stabilizing muscle of the hip joint as well as a flexor." (p.313) They analyzed the walking cycle. They found the Iliacus to be continuously active with biphasic peaks during swing phase and midstance. The psoas was noted to be triphasic with an additional peak half way through the cycle. (p.380) Since that time, little directly related to the Iliacus has been reported, that is, until recent years.

[9]Most studies are based upon videotape analysis of gait. This would not allow appreciation of innominate function during the gait cycle.

Evidence has been gathered for increased proprioceptive flow from sensorimotor stimulation (walking in balance shoes) during walking. The study of Bullock-Saxton (1993) demonstrated facilitation of activation of gluteus maximus and medius. Surface EMG electrodes were utilized and no other muscles were tested. Given the antagonist nature of gluteus maximus and iliopsoas, there were likely influences on the iliopsoas by the proprioceptive stimulation. Were they inhibitory? Would increased gluteus maximus activity (and possibly increased hamstring activity) inhibit the continuous activity noted by Basmajian during walking, and if so, how? Answers tot these types of questions are now possible with the fine-wire electromyography now available.

Recent evidence, cited in three separate studies published in 1995 and 1997 by a team of Swedish researchers, has shown independent Iliacus activity by this fine wire electromyography. Andersson (1995) found that the Iliacus was selectively recruited with standing contralateral leg extension. The balance requirements with this activity would first affect the pelvis, not the lumbar spine. It seems logical the nervous system would attempt compensation in the most efficient local manner, ipsilateral Iliacus recruitment. Given the findings, it is easier to reason backwards than it might have been to deduce this selective recruitment response. The researchers also found maximal ipsilateral abduction showed significantly higher levels of activation of the Iliacus when compared to the psoas. This, again, seems to speak to local pelvic control when possible. In contrast, the psoas was selectively activated during sitting with a straight back and showed significantly higher activation than the Iliacus in static ipsilateral lateral flexion in a lateral supine position. Each of these findings confirms the body's efficient management and local control capacity. The majority of positions and actions showed coactivation of both muscles or inactivity of both muscles. Most activities that require pelvic response also require lumbar and thoracolumbar response. Thus the information from this study seems to confirm that proposition. In their conclusion, the authors allude to the importance of the Iliacus in rehabilitation and sports, but do not elaborate.

Andersson (1997) evaluated walking and running and found the Iliacus to be the main 'switch muscle' - relating times of the activation periods to the start of hip flexion- during low speed walking. The iliacus was key to reversing direction. This has implications for any individual recovering from an injury that affects gait. The importance of this will be explored in the clinical history section.

In another 1997 study, Andersson studied abdominal and hip flexor activation during hip flexion, trunk flexion, spontaneous sit-ups and leg lifts. The Iliacus and sartorius were noted to perform a static function needed to prevent a backward tilting of the pelvis during trunk flexion sit-ups. With static leg lifts there was more activation of these muscles with increased elevation of the extremity, e.g. 60 degrees of leg lift showed strong activation, 10 degrees much less so. A change in pelvic tilt was also observed to influence Iliacus and sartorius activation during a 10 degree leg lift. Backward pelvic tilt combined with hypo-lordotic back decreased their activation. Forward pelvic tilt combined with hyper-lordotic back increased sartorius and Iliacus activation. These two sets of findings appear consistent. Sixty degrees of leg lift comes close to approximating the relationship of the femur and innominate given 10 degrees of leg lift with concomitant forward pelvic tilt. In both cases there is increased Iliacus and sartorius activation. This may have implications for the individual with a chronic forward pelvic tilt and hyperlordosis in the upright stance. During quiet standing and during the gait cycle these individuals may have higher levels of EMG activity for the Iliacus and sartorius, which in turn has implications for contracture of these muscles and for anterior innominate rotation. It is important, when drawing conclusions from these kinds of studies, to avoid an overly reductionist approach. Therefore, the local and regional fascias must be considered. Contracture would not be limited to the Iliacus and sartorius, but would encompass the whole anterior aspect of the lower extremity fascial sheath. The continuity with the pelvic fascias, especially into the pelvic diaphragm could be significant, as could the continuity into the abdominal fascias and the fascias associated and in continuity with the quadratus lumborum.

Another interesting finding in this paper was that the hip flexors (only Iliacus and sartorius were monitored) "were always engaged to higher degree with bent than with straight legs, in all forms of sit-up tasks." (p. 121) This expresses the same femoral/innominate relationship as was noted with leg lifts, but this time with a dynamic activity and resistance from the opposite end of the body. It flies in the face of the common wisdom that suggests bent knee sit-ups eliminate involvement of hip flexors. As will be noted later, the hip flexors are tonic muscles which as a general rule tend to be hypertonic in dysfunction and need to be stretched, not strengthened. This would argue against bent knee sit-ups as a part of reconditioning for any complaint with hip flexor involvement.

As can be seen, the scientific literature specific to the Iliacus muscle is fairly limited. With evolving methods of investigation, such as the fine-wire electromyography, more is likely to be seen in the near future. I have recently completed a simple range of

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motion study comparing test approaches for hip extension. The statistical analysis reveals significant differences between tests, Iliacus and Thomas, in a normal population. The norm for Iliacus test motion is 3.2-8.0 degrees of hip extension with a mean of 5.6 degrees. Those results have been submitted to *The Journal of the American Osteopathic Association.*

V. Osteopathic Clinical History of the Iliacus

The functional and structural aspects that are implicit in the writing and clinical practice of a sampling of osteopathic physicians, specifically as they relate to the iliacus complex, will be the historical focus in this portion of the thesis. It is valuable, at this point, to examine the historical evaluation and treatment of similar problems in order to compare and contrast findings, paradigms and treatment.

A. Warren A. Pratt, DO

Dr. Pratt undertook the study of pelvic imbalance with Angus G. Cathie, DO with a focus upon lift therapy. He reported his belief that the difference between medical lift therapy and osteopathic lift therapy was the recognition by osteopathic physicians of the need for associated manipulative evaluation and treatment for effective long-term results. Findings and experience were reported in the Academy of Applied Osteopathy Yearbook under the title of 'The Diagnosis and Treatment of Postural Abnormalities'. Pratt's report on the mechanism of the syndrome included reference to the iliopsoas group. "Pronation of the feet with internal rotation of the legs and thighs, causing the lesser trochanters of the femurs to assume a posterior position, increasing the tension of the lliopsoas group of muscles, causing increased forward and downward tilting of the pelvis (flexion of the sacrum), increasing the sacrolumbar angle and the anterior arching of the lumbar spine, with shearing stress placed on the lower lumbar arthrodial joints." (pp. 37-38) His description was more extensive, but this section encompasses the components he felt were key to the decompensated process. He described the 'sacrolumbar lesion' and its mechanics in detail relating them to 'pelvic twist', not 'pelvic tilt' associated with short lower extremity and lift therapy. Pratt describes a difference between seated and supine findings as being attributable to unloading of the quadratus lumborum, sacrospinalis and psoas muscle groups with supine positioning. Seated, the right PSIS and iliac crest are high with respect to the left. Supine, the left ASIS and iliac crest are high in relation to the right. His conclusion was that this combination of findings indicate a 'pelvic twist' or 'right latexion sacrolumbar lesion' (current terminology would name this a neutral 5th lumbar somatic dysfunction- sidebent left, rotated right. Both pelvic findings described are consistent with an anterior rotated innominate. A strong case could be made for a tight or contractured Iliacus as the source of these findings, as well. In a seated position the femur is flexed upon the innominate; a tight Iliacus will not pull the innominate forward. In the change to supine the tension on the Iliacus becomes manifest, pulling the right innominate anterior and downward. Pratt's description of the preferred method of correction of the 'sacrolumbar lesion' was that for a lumbar roll each direction. He also described exercises to be done to complement the manipulation, one of which seemed like it could have some influence on the 'iliacus complex'.[10]

Dr. Pratt was not fully satisfied with the long term results for his patients. Further study led to communications with Carl Kettler, DO and the exploration and definition of the 'lumbopelvic torsion syndrome'. (Pratt, 1952) "This work of Dr. Kettler appears to have provided the key to a better solution of the problem of lumbopelvic posturo-mechanics." (p.97) Pratt's descriptions of palpatory findings do not use the terminology of innominate rotation about the inferior transverse axis of the sacrum He describes a more ventral innominate on the involved side and an associated short leg. The other terminology is not as clearly interpreted. My experience is that the more ventral ASIS and innominate show a resistance to the anterior-posterior compression which goes hand in hand with an anterior rotated innominate and/or backward torsion on the involved side.

David Patriquin, DO reviewed the Pratt article with a group of us at OUCOM Medicine several years ago. He had a familiarity with the Kettler technique or, more precisely, Pratt's variation on it. It is very useful in select patients with 'iliacus complex' tensions and very tight sacroiliac joints. Given the patient response to this technique, it seems reasonable to believe that Drs. Pratt and Kettler had an appreciation for the single joint hip flexor involvement, the iliacus complex in lumbopelvic dysfunction. This technique does a good job of preventing anterior rotation of the innominate during straightening of the lower extremity. Thus, focusing upon a sacral fulcrum while it stretches the hip flexor tissues. See Appendix 3 –

[10]"The third exercise reduces the lumbosacral angle and extends the sacrum. The patient now extends the legs, still maintaining chest elevation. The heels are forced down, dorsiflexing the foot. This causes contraction of the leg muscles and fixes the heads of the femurs. Contraction of the gluteal muscles with the femoral heads fixed causes the pelvis to rotate at the fixed acetabular points and elevates the pubes in relation to the sacral base, extending the sacrum." p. 41 Pronation Syndrome, Pratt. This would have the effect of rotating the pelvis as a whole posterior, thus increasing the distance between origin and insertion for 'iliacus complex' tissues.

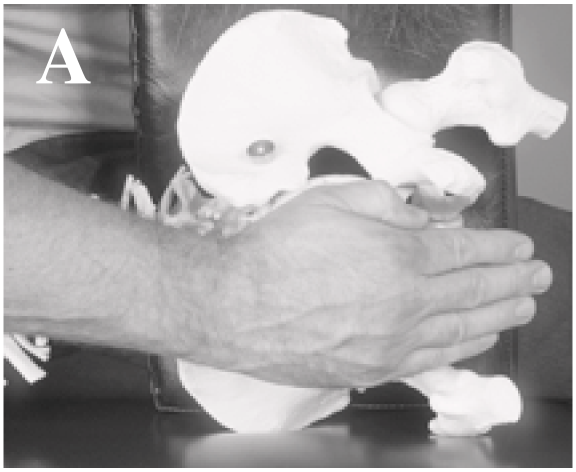

Figure 8a: *Kettler Technique – Part I*
A) Thenar placement along the sacral margin
B) Cushioned chest pressure against the ASIS;
C) Combined chest to thenar pressure vector with gentle knee pressure posterior;
D) Patient initiates lower extremity straightening (continuous active process);
E) Gentle posterior pressure on the knee is maintained until completion of the active straightening of the lower extremity is complete.

Therapeutics and Figures 8a and 8b for technique details.

B. William Garner Sutherland, DO (See Appendix 3, IV)

It seems clear that Dr. Sutherland recognized and treated the important elements of the 'iliacus complex'. The section under 'postural lesions' in H. A. Lippincott, DO's description of Sutherland techniques, specifically the correction of an anterior rotation of the innominate (listed under 'postural lesions'), describes a direct technique capable of mobilizing the innominate while addressing the anterior pelvic fascias. This is a standing technique (see figure 9). The physician holds the involved ischial tuberosity in one hand and the ipsilateral iliac crest in the other. The in-

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Figure 8b: *Kettler Technique – Part 2*

A) Contact the anterior leg to create resistance to lower extremity straightening as the patient begins that action. Let the patient overcome the continuing resistance.

B) Maintain resistance as the patient continues to lower extremity motion.

C) The resistance continues to completion of the straightening motion.

Figure 9: *Sutherland's Approach to 'Postural Lesions' – (adapted from Sutherland, 1990, p.256) Since the patient is active in this approach, there is likely a reflex inhibition of the hip flexors as the patient activates the hip extensors.*

Correction of Anterior Rotation of the Innominate: Operator rotates the ilium posteriorly on the sacrum.

nominate is rotated toward 'the position of correction, (into the barrier). As the weight bearing leg straightens, a stretch is produced through the anterior soft tissues of the involved lower extremity equivalent to the amount of posterior positioning obtained during the leg flexion phase. This is an elegant way to allow the patient's tissue to determine how much should be accomplished during the procedure. It is a characteristic example of Dr. Sutherland's approach to diagnosis, treatment and his belief in the human mechanism's inherent wisdom.

C. John Morgan

One current resource was brought to the author's attention by Anthony Chila, DO. It suggests a variation on Dr. Sutherland's approach to treatment and acknowledges Still and Ida Rolf as resources for evolution of thought in this regard. John Morgan presented the 'iliacus Mio-facial Release technique' in the *European Journal of Osteopathy* in the Summer 1989 issue (Morgan, 1989). He focused on the myofascial elements with their rich supply of afferent receptors. The technique uses inhibition and patient cooperation to accomplish the stretch (see Figure 10). A patient is supine with the involved hip flexed. The physician wraps his/her hand over the ASIS carrying the fingerpads into contact with the Iliacus myofascial elements. The physician maintains this contact as the patient slides the heel of the involved leg towards the other foot. The extension at the knee and hip increases the tension against the palpating fingers and affects a stretch. The technique is repeated several times. Some discomfort is likely during the course of the treatment. This technique seems to work somewhere in a realm inclusive of ligamentous-articular release and trigger point treatment. Dr. Sutherland's approach has the advantage of engaging the whole in-

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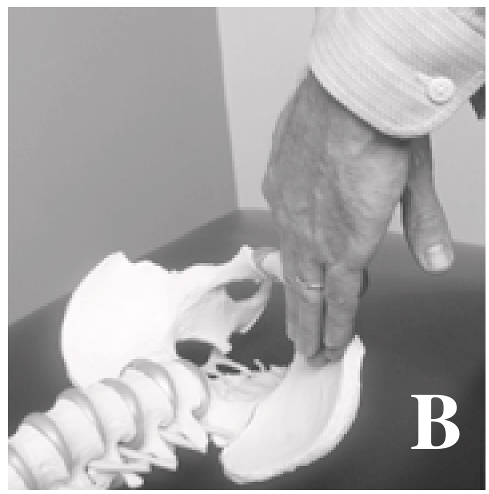
Figure 10: *Iliacus Inhibition Stretch-Innominate Free*
Again, this involves active patient participation and control of rate of return to neutral from the hip flexed position.

A) The hip is flexed with the patient in a supine resting position;



B) Physician hand placement

C) The patient initiates and completes return of the hip to neutral, thus bringing tension into the iliacus tissues under the physician's fingers which serve as a fulcrum.

nominate in the process of correction. I have taken the liberty of combining the two in a manner to be described in the treatment section.

VI. Current Allopathic Approaches to Diagnosis: The Thomas Test (See Figure 11)

The Thomas test, which does not utilize the principle of localization, has been the standard for evaluation of hip extension. (Magee 1997; Van Duesen 1997; Kendall 1993; Travell, 1992; Mitchell, Moran, Pruzzo, 1979). This test is the basis for the AMA Guide to Physical Impairment's assessment of hip flexion contracture related disability (AMA, 1993). The description in Appendix 2 incorporates the essentials for this test from the resources noted. It seems clear that the test is designed to address psoas contribution[11] to diminished hip extension (a variation of the test also identifies and differentiates rectus femoris involvement- Travell, vol. 2, p.98).

Multiple joints participate in this test - lumbar, lumbosacral, bilateral sacroiliac, pubic symphysis, and both hip joints. All muscles ligaments and fascias associated with these joints potentially participate, as well. Any somatic dysfunction of any of these joints and tissues could influence the test results. This test thus allows a regional approximation for hip extension and promotes related regional somewhat nonspecific treatment. There is general agreement on the need to control pelvic motion during hip range of motion measurements for improved reproducibility (VanDuesen, 1997, p. 65; Ashton, 1978; Gajdosik, 1993). However, given the nature of this multiple joint and tissue test, the considerable variability in reported hip extension norms using the Thomas test is understandable. Norms range from 9 degrees of extension to 50 degrees. (Van Duesen, p.66). Ekstrand (1982; p.174) found intra-tester variation of 4 degrees.

VII. An Osteopathic Approach to Diagnosis: The Iliacus Test

(See Figure 12)

The key element that differentiates this test from the Thomas test is prevention of innominate rotation during hip extension.[12] This prevents joint restriction other than that across the hip from influencing the range of motion test results and makes the test much more specific. Prone and supine

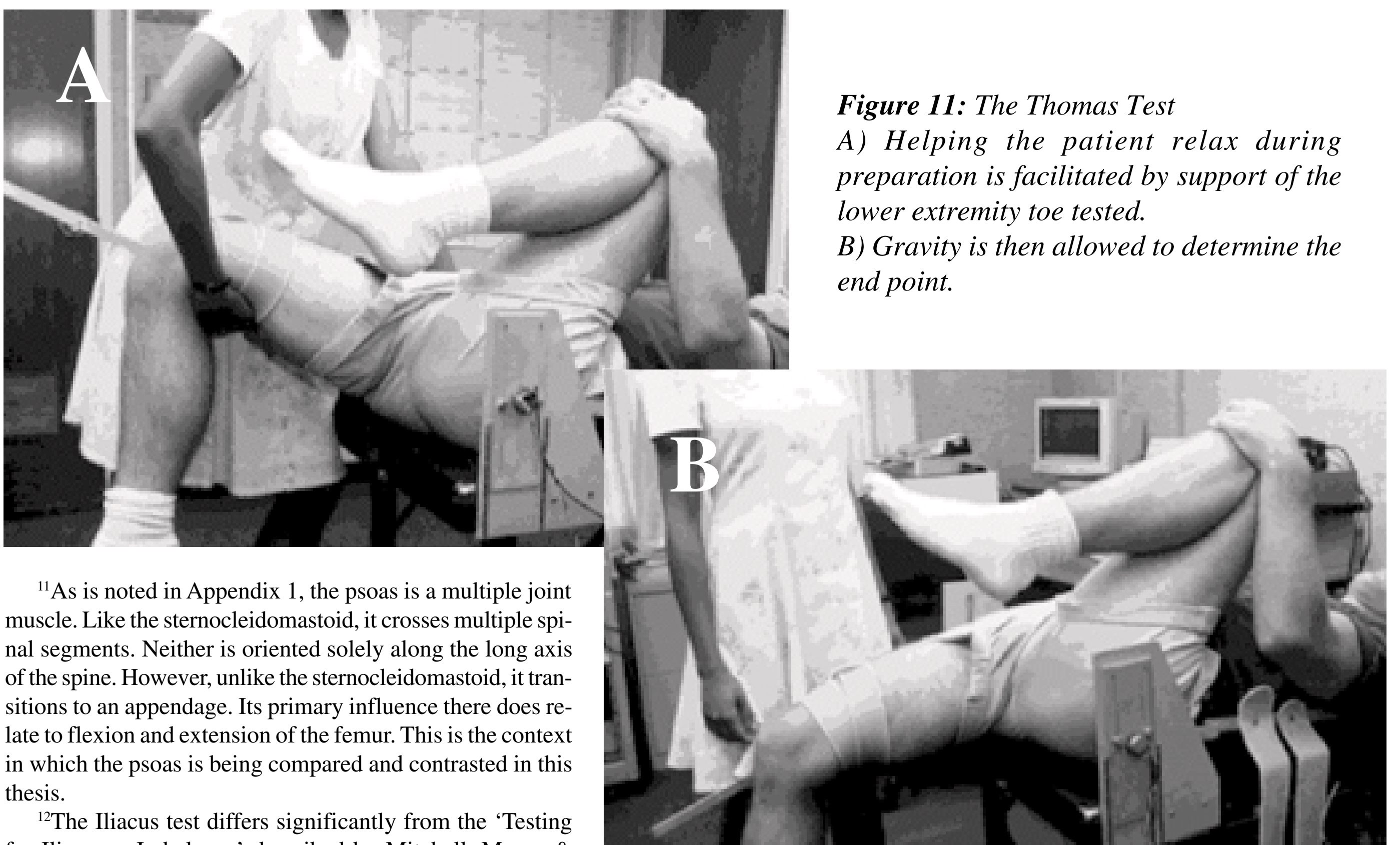


Figure 11: *The Thomas Test*
A) Helping the patient relax during preparation is facilitated by support of the lower extremity toe tested.
B) Gravity is then allowed to determine the end point.

[11]As is noted in Appendix 1, the psoas is a multiple joint muscle. Like the sternocleidomastoid, it crosses multiple spinal segments. Neither is oriented solely along the long axis of the spine. However, unlike the sternocleidomastoid, it transitions to an appendage. Its primary influence there does relate to flexion and extension of the femur. This is the context in which the psoas is being compared and contrasted in this thesis.

[12]The Iliacus test differs significantly from the 'Testing for Iliopsoas Imbalance' described by Mitchell, Moran & Pruzzo, 1979 (p. 165-166), in that the innominate is not directly prevented from compensatory anterior rotation during the maneuver described therein. The Iliacus test described in Appendix 2 is distinct in this significant detail. Research comparing these two approaches (*JAOA*, Eland, submitted 11/4/99) confirms this by showing a significantly diminished range of motion for the iliacus test compared to the above, which is essentially the Thomas test. If the Iliacus test differed only slightly from the Thomas test there would be no significant difference noted in the testing protocol.

Figure 12: *The 'Iliacus' Test & Stretch: A) Contact with the ASIS generates a cephalad vector of force. Leaning through a straight elbow makes it easy to use body weight to maintain force while preventing innominate rotation during lower extremity extension (B).*

patient positions both offer opportunities to fix the innominate in place. Prone positioning required sufficient upper body strength to lift the patient's lower extremity while applying anterior pressure upon the ischial tuberosity. Because of this, supine patient positioning ultimately provides the most efficient approach during the motion test for physicians of different sizes. A complete description of the clinical supine 'Iliacus test' can be found in Appendix 2.[13]

VIII. Thomas Test & Iliacus test-Paired Clinical Information

Two factors provide information to differentiate Iliacus and psoas contributions to hip flexion restriction (see Figure 13):

A. The sense of arching into the lumbar or thoracolumbar region that accompanies inadequate fixation of the innominate with the Iliacus test is the same sense transmitted via a tight psoas. When adequate innominate fixation is present during the Ili-

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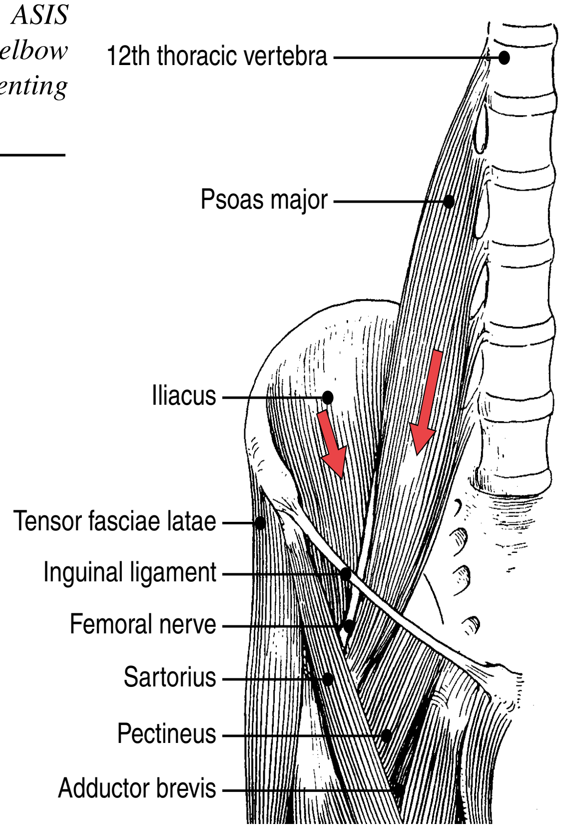

Figure 13: *Iliacus & Psoas – (adapted from Hollingshead, 5th Ed., 1997, p. 331) The multiple joint nature of the psoas can be clearly seen as opposed to the single joint influence from the iliacus. Therefore, there is the opportunity for compensation for psoas tensions through the joints proximal to the hip joint, which is not the case for the iliacus.*

The vector of pull for the two muscles can be seen to be clearly different as well. The psoas is pulling from medially and cephalad; the iliacus from cephalad and lateral.

The psoas is influenced directly by the axial skeleton; the iliacus only indirectly via fascial continuity with the quadratus lumborum.

[13]The Iliacus test can be done from a modified Thomas positioning as was done for the recently completed comparison test (submitted to *JAOA*, Eland 11/4/99). However, for clinical purposes it is more practical to use the variation described in Appendix 2.

acus test the arching sense occurs before end range is palpated, if the psoas is the dominant factor in hip flexion contracture.

B. During the Iliacus test the innominate is fixed in position via the contact with the ipsilateral ASIS. This effectively fixes the origin of the iliacus. This is not the case for the origins of the psoas. Therefore, during the Iliacus test compensations for a tight psoas can occur through the sacroiliac and lumbar joints. Its influence on end range resistance is thus diminished leaving the iliacus complex as the primary influence on end range resistance during the Iliacus test, even if significant psoas tightness is present. If the psoas is sufficiently tight to limit end range during the Iliacus test no appreciable influence from fixing the ASIS in place will be noted and thus no appreciable difference will be seen between the Iliacus and Thomas tests.

These two factors lead to a clinically valuable comparison using the two tests. Used together they can differentiate Iliacus contribution from the psoas contribution, as follows:

If the Thomas and Iliacus tests are done with the result that the same amount of restriction is noted in both tests, you have psoas contracture as great or greater than Iliacus.

If both tests are done, but the Iliacus shows more restriction, Iliacus contracture is the dominant element.

IX. Clinical Presentations Suggestive of Iliacus Dysfunction

Typical patient presentation for 'iliopsoas problems' as described in relatively current allopathic and osteopathic literature:

A. Travell & Simons

Travell and Simons (1992) describe the patient with an iliopsoas problem as follows: "Patients with active arid latent iliopsoas trigger points (TrPs) tend to walk with a stooped posture, have a forward tilt of the pelvis, and exhibit hyperlordosis of the lumbar spine. . . (These patients must extend their head and neck to see where they are going" (vol. 2, p. 97).

"Patients with active TrPs that shorten the iliopsoas muscle significantly are likely to stand with the weight on the uninvolved limb and the foot of the involved limb forward with the knee bent slightly to lessen psoas tension. They are also likely to stand with the torso leaning slightly toward the involved side." (vol. 2, p. 97)

B. Kappler

Kappler (1973), on the other hand identified a different pattern associated with the psoas: "The sequence of events up to this point is as follows: The psoas muscle contracts. The upper lumbar area becomes fixed in flexion, maintaining the psoas mechanism. The lumbosacral area is the site of accumulation of stress and becomes painful. As the condition becomes chronic or recurrent, the instability of the lumbosacral area increases. The pain may lateralize. The patient assumes a typical posture at this point, with flexion of the lumbar spine and pelvic side shift or lateral deviation of the pelvis. Inspection with the patient standing will show the lumbar anteroposterior curve to be flat or even forward bent, with the patient flexed forward and unable to straighten up properly." (p.58-59)

C. Comparisons

Kappler's structural analysis of psoas involvement in low back pain leads to a conclusion that a survey for trigger points does not seem to elicit. 'Stooped posture' is as close as the Travell description comes to acknowledging the proximal psoas involvement. In the chapter 'Thoracolumbar Paraspinal Muscles', the authors acknowledge "Active TrPs in the deep paraspinal muscles cause guarded movements and restrict side bending, rotation, and <u>hyperextension</u> of the trunk." [Emphasis added] (p.644, vol. l) Interestingly all treatments depicted place the patient in a flexed position using vapocoolant spray and flexion to influence the 'deep paraspinal muscles.' This does not fit the pattern that would be expected to address thoracolumbar flexion when hyperextension is restricted as was noted in the quotation. It suggests a lack of recognition by Travell of the importance of the upper psoas in thoracolumbar and low back complaints, as presented by Kappler.

On the other hand, Kappler's analysis relies upon scientific information available in the early 70s: "Simkins stated that the action of the three muscles of the psoas group can be considered as a unit" (p.58) This was prior to the time that clear information was readily available elucidating independent Iliacus function and influence in postural and active mechanics of movement. Thus his focus is understandably upon psoas concerns without exploration of possible Iliacus contribution as a predisposing factor or perpetuating factor in low-back complaints. Dr. Kappler's recent contribution to *Foundations for Osteopathic Medicine* (Ward, 1997) in the chapter – 'Rest and Recovery' seems to imply recognition of the iliacus complex's role in limiting hip hyperextension. The exercise is called 'hip hyperextensions (psoas resets)' (p.1054). The hands under the ASIS in a prone position can be an effective way to help prevent anterior rotation of the innominate during lower extremity extension exercises.

Kappler speaks of a flat anteroposterior lumbar curve. Travell describes hyperlordosis of the spine. It is quite likely that each is describing a different dysfunctional pattern involving the iliopsoas. From my understanding of the iliopsoas it seems one primarily describes upper psoas involvement (Kappler), the other describes primary Iliacus (and possibly lower psoas) involvement (Travell). Today's vantage point suggests that both perspectives hold an important element of truth. Patients with a low back or pelvic complaint tend to have thoracolumbar involvement. A backward torsion of the sacrum with ipsilateral Iliacus tension or contracture has associated flattened lumbar lordosis. The two A-P findings may coincide with upper lumbar flexion (Kappler) and lower lumbar extension (Travell). An acute psoas spasm superimposed on bilateral Iliacus contracture is not an uncommon finding and does bring Kappler and Travell's findings together in one patient.

Travell claims iliopsoas TrPs are activated secondarily to TrPs in other muscles of the functional unit. (vol. 2, p.96) The iliopsoas provides 'protective splinting for the other muscles of its functional unit'. (vol. 2, p.104) If this is true, the iliopsoas TrPs can remain active after the others have resolved and predispose to recurrent problems in the others. This would be particularly true of the Iliacus TrPs.

It seems unlikely that Travel and Simon appreciated the mechanical implications of Iliacus contracture and its influence upon pelvic tilt. Their description deals with the observable consequences.

'Failed' low back syndrome is another clinical presentation in which the iliacus complex is relevant. Ingber (1989) used the dry-needling approach to the treatment trigger points in 'failed' low back syndrome. Although the trigger points treated did influence the 'iliacus complex', the exercises used in conjunction allowed innominate rotation and did not have an optimal effect on the 'iliacus complex'. Mechanical implications were made clear in the structure/function section.

X. Therapeutics

Clinical experience has demonstrated that the 'Iliacus test' identifies hip flexion restrictions not otherwise revealed. Patients that have had competent evaluation (physical medicine/rehabilitation, orthopedic, family medicine, physical therapy or chiropractic) have been referred with ongoing complaints. Each of these disciplines develops particular biases or perspectives that has not led to the identification of the significant involvement of the 'iliacus complex'. Thus, treatment has not focused on this element. Treatment has included physical therapy modalities, manipulation, medication, exercise of various forms, rest or denial that there is a problem. Many of these people have benefited from addition of 'iliacus' treatment within the context of a osteopathic diagnostic and treatment regimen.

A. Case History

A case in point may help may further clarify the importance of the Iliacus perspective for evaluation and treatment. A 39-year-old member of the faculty of the school of dance at a local university presented with a complaint of low back pain of many years duration. When she sat down she had to partially support herself with her hands as she moved from standing to sitting. Coming back up from supine was 'impossible'. The right sacroiliac was identified as the primary site of pain. There was no radiation of symptoms into the lower extremity. She had previously been told of an 'ileocecal valve' problem, but otherwise had no gastrointestinal or genitourinary symptoms. She had previously had other forms of treatment including Rolfing and Palottis exercise training (which focuses upon core body strength and flexibility). Cursory examination in the standing position revealed a significantly increased lumbar lordosis. Ranges of motion were exemplary with good balance in gross ranges of motion. Prone evaluation of hip extension (without fixing the innominate in place) revealed a range of motion any physician would hope to find in a patient. There was a sense of elasticity approaching end range that was gratifying, too. The lower thoracic region showed inelastic resistance to extension. In supine position the 'Iliacus test' revealed both right and left 'iliacus complexes' to allow motion far below what would be expected given the prone test and her dance history. The right was, by far, the tighter of the two and there was accompanying right innominate rotation anterior. The end range tissue feel was one of fibrosis and inelasticity, as well. Deductive reasoning suggested that the low back pain was secondary to lumbosacral overcompensation and overuse due to increased pelvic tilt whose primary source was contracture of bilateral iliacus complexes with the right predominating. Three or four treatments with the 'iliacus' as the focus and instruction in home stretching have significantly reduced this individual's low back pain. The stretches focused upon the iliacus complex, but recognized the need for lower thoracic and thoracolumbar extension capacity, as well. She could feel the increasing stress when she missed her daily stretches, but had not had a flair up that has required further office visits in 6-8 months. This patient demonstrated a part of a pattern common to most patients with Iliacus dysfunction, i.e. the iliacus complex inelasticity, the anterior innominate rotation and extension resistance in the lower thoracic. Often an ipsilateral backward torsion and apparent short leg accompany these findings with a neutral or non-neutral lower thoracic somatic dysfunction showing rotation in the ipsilateral direction.

The ipsilateral backward torsion is often a major part of the reason for an office visit in the acute setting. The underlying anterior innominate rota-

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tion and Iliacus contracture are not the source of acute pain. It is the inability to stand up straight due to the backward torsion. A chronically rotated innominate has the sacral base on the same side in a mildly backward compensated position. The local tissues are already somewhat stressed and congested. It does not take too much additional local stress to initiate the guarding that can lock in the sacroiliac joint and prevent the little give that had been present in the chronic pattern.

The short lower extremity is secondary to hip flexion. It seems to contradict the common osteopathic wisdom that dictates a functional long lower extremity when an anterior innominate is present. This is one area where the regional anterior fascial tensions associated with an Iliacus contracture are obviously manifest. The combined anterior lower extremity tensions effectively flex the hip enough to offset any increased length due to innominate rotation.

B. Treatment Descriptions

Appendix 3 provides descriptions of treatment techniques described historically[14], as well as several current techniques[15] –this includes several of those developed and/or modified, based upon osteopathic principles, for use in clinical practice and the Iliacus research done at OUCOM.

Each of these techniques has an innominate-fixation based or a fascially based approach to localization of the 'iliacus complex' for treatment. The Kettler technique, Sutherland approach, and the innominate fixed – Iliacus inhibition stretch all use an innominate fixation in combination with a direct approach to treatment. Morgan's fascial approach complements the innominate fixed modification. Each seems to address a slightly different aspect of Iliacus restriction – the innominate fixed approach addressing iliacus complex origins on the innominate, while the Morgan approach addresses the ventral fascial continuity of the iliacus complex.

XI. Approach to Treatment Decisions

Janda (1991) has delineated types of muscular tone. This description provides one basis for a logical decision process regarding choice of treatment approaches for iliacus complex dysfunction for a given patient. "Increased muscle tone can occur as a result of:

1. Dysfunction of the limbic system.
2. Impaired function at the segmental (interneuronal) level.
3. Impaired coordination of muscle contraction (trigger points; functional methods?)
4. Response to pain irritation.
5. Overuse (which is generally combined with changed elasticity of the muscle and usually described as muscle tightness).

All but the fifth type have so far been referred to diagnostically as 'spasm' (p.137)

Janda links 'tension myositis' to increased muscle tone as a result of 'dysfunction of the limbic system'.(1) It is not immediately apparent that this applies to the iliacus complex, except in it's interactions with the pelvic diaphragm which Janda mentions as one of the muscles he has associates with this type of spasm.

'Increased tone due to dysfunction at the segmental spinal level'(2) is exhibited by antagorlists of a myotatic unit. He considers this rare, but the source of some cases of fibromyalgia. The hip flexion myotatic unit could well be involved in this kind of spasm. As such, the sensorimotor stimulation, such as that described by Bullock-Saxton (1993), would probably be the first place to start.

If there is acute spasm with significant pain with palpation of the Iliacus and/or pain with attempted hip extension, this fits Janda's description of 'impaired coordination of muscle coordination' (3) and/or 'response to pain irritation' (4). Jones (1995, p.87) Strain-Counterstrain or functional methods (Johnston, 1994, Section IV) is an effective first step for these individuals. In some cases, a gentle Iliacus inhibition approach has been useful, the intent being relief of tissue congestion and flushing of proinflammatory elements. In the intermediate stage a more aggressive Iliacus inhibition approach with home two-person Iliacus stretch and/or inhibition has proven helpful. All of this is within the larger context of evaluation and treatment of other identified somatic dysfunction. Fascial/ligamentous unwinding is of great value in 'connecting the dots'[16], i.e. recognizing the collective strain and need for an organized regional or multiregional response.

A patient with a fibrotic feeling, tight, inelastic end feel fits Janda's description of 'overuse'(5). "The tight muscle is generally not spontaneously painful, but is tender on pal-

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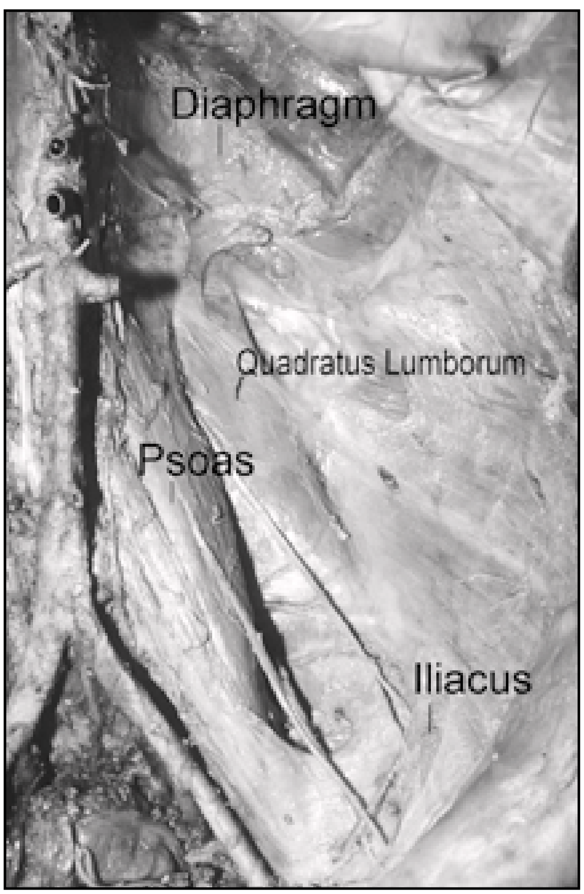
[14]The 'Kettler technique and Sutherland's Approach to 'Postural Lesions' (anterior innominate rotation)

[15] Iliacus Inhibition - innominate free (Morgan), Iliacus Inhibition - innominate fixed, and the 'Iliacus' Stretch and the innominate fixed - iliacus inhibition stretch all use an innominate fixation in combination with a direct approach to treatment. Morgan's fascial approach complements the innominate fixed modification. Each seems to address a slightly different aspect of iliacus restriction - the innominate fixed approach addressing iliacus complex origins on the innominate, while the Morgan approach addresses the ventral fascial continuity of the Iliacus complex.

[16]Dr. Chila is fond of this analogy and describes it as a link between the approaches to treatment of discreet, locally palpated somatic dysfunction and fascial/ligamentous unwinding of the type he has developed.

pation." (p.137) This patient will tolerate and benefit from relatively aggressive, direct stretch as is done with the supine two-person Iliacus stretch. The Kettler technique can be very useful, if there is associated sacroiliac restriction.

Most people have a need for a combination approach. It is, however, valuable to attempt a taxonomy of muscle spasm as Janda has done. His bias is toward the neuro-musculature. It is the primary source of ongoing dysfunction. As osteopathic physicians, who inherited Still's legacy of open-minded inquiry, we have to agree that this neuromuscular element is likely to be part of the story. There is also the fascia that does not know the limits of a muscle, but has a continuity that must be explored. This continuity was explored in a fascial dissection in the summer of 1997 at OUCOM (see Figure 14). An unending sheet from the dome of the diaphragm along the posterior abdominal wall, enveloping the iliopsoas and diving into the anterior portion of the fascial cylinder of the lower extremity is what is seen. This tissue rich in afferent nerves, vasculature and lymphatics deserves at least as much attention as the neuromuscular element. The evolution of the approach to treatment described so far has its roots in the fascia as much as the musculature - which, being discreet, is much more easily described than the fascia.



XII. Conclusion

Quiet balanced stance and a rhythmic elegant gait are a joy to experience or observe. Imbalanced awkward posture and halting agonizing steps are painful to endure or behold. The low back, pelvis, and lower extremities contribute significantly to both experiences. The interrelationships that prevent the experience of unimpeded motion, particularly as it relates to hip flexion and extension are both crucial elements in posture and gait. The iliacus complex has been shown to be a major factor in this equation. The legacy of osteopathic thought and practice is the foundation for exploration of the iliacus complex. Research into this complex, or at least aspects of it, were presented. Structural and functional aspects support the conclusions drawn. Finally, some of the implications of iliacus complex dysfunction for evaluation and treatment relative to posture; gait and expressive movement have been explored.

The Iliacus muscle is a powerful 'tonic' muscle that basically crosses only one joint. Once stressed, its hypertonic reaction can, and often does, lead to contracture and fibrosis. The associated inflammatory process can inflame the associated bursa and lead to iliofemoral ligament thickening. The consequences of either are stress into the sacroiliac joint in the form of anterior innominate rotation, as well as ipsilateral functional short lower extremity and recurrent backward torsion of the sacrum.

This is not an exhaustive list of consequences. It is intended to emphasize the need to evaluate the 'iliacus complex' regularly as part of any routine osteopathic structural examination.

Greenman and Lewit hypothesize that "the establishment and maintenance of length and strength of the hip flexors and extensors might well prevent degenerative hip joint disease." (Greenman, 1996, p.456) The implications go beyond the hip when considering the 'iliacus complex' in this context. Fascial continuity demands this. This task is ongoing.

The recently completed study of iliacus complex influence upon range of motion in 'normal' subjects provides a range of motion norm to compare with that in symptomatic individuals. The next step will be to compare these results with those obtained from individuals with simple low back pain. Imbalance in dancers and athletes is of interest and will be explored in a similar manner →

looking toward performance enhancement and injury prevention. Identification and treatment of this complex's function is not a panacea. It is of significant value as a part of any comprehensive osteopathic evaluation.

Appendix I. Anatomy

Most of the quotations come from *British Gray's Anatomy* (Williams, 1995). The quotations will be cited with the abbreviation - BG - for this reference, followed by the page(s).

A. Hip Joint: *(See Figure 4)*

I. Iliofemoral ligament: "Triangular and very strong, it is anterior and intimately blended with the capsule, its apex is attached between the anterior inferior iliac spine and acetabular rim, its base to the intertrochanter line: it is often referred to as the Y-shaped ligament. Fuss and Bacher (1991) distinguish a weaker central section, referred to as the greater iliofemoral ligament, with thicker, more dense margins, the lateral and medial iliofemoral ligaments. The oblique lateral ligament attaches to a tubercle at the superolateral end of the intertrochanteric line; the vertical medial ligament reaches the inferomedial end." (BG, p.684-685)

Motion: "When the thigh is flexed or extended, the femoral head 'spins' in the acetabulum on an approximately transverse axis." (BG, p.687) "extension beyond the vertical is limited (perhaps l0-20 degrees). . .movements are augmented by adjustments of the spinal column and pelvis, flexion of the knee and concomitant medial or lateral hip rotation." (BG, p.688) - "The iliofemoral is the strongest of all ligaments and is progressively tightened when the femur extends to the line of the trunk. The pubofemoral and ischiofemoral ligaments also tighten and, as the joint approaches close-packing, resistance to an extending torque rapidly increases."(BG, p.688)

"In manipulation of the sacroiliac joints the surgeon takes advantage of the tautness of the iliofemoral and ischiofemoral ligaments in hip extension. So strong are they that forcible hyperextension with forward pressure on the iliac crest produces sacroiliac movement." (BG, p.688) This allopathic confirmation of sacroiliac movement also provides support the hypothesis that other forces (trauma) acting through the hip joint to produce extension could have a nontherapeutic result, i.e. anterior innominate rotation dysfunction.

For the purpose of focus upon the Iliacus (with its fellow synergists) and its importance in lower extremity, pelvic, and lumbosacral function, the antagonists will be addressed first.

B. Hip Extensors (Antagonists): *(See Figure 6)*

1. Multiple Joint Muscles

(Gluteus maximus, Hamstrings: biceps femoris- long head, semitendinosus, semimembranosus)

a. Gluteus maximus:

Description: This muscle has both single and multiple joint components (just as the Iliacus does); however, the elements with the best mechanical advantage to affect hip extension come from the sacrum and erector spinae aponeurosis.

"It arise from the posterior gluteal line of the ilium, and the rough area of bone, including the crest, immediately above and behind it, from the aponeurosis of erector spinae, from the dorsal surface of the lower part of the sacrum and the side of the coccyx, from the sacrotuberous ligament and from the fascia (gluteal aponeurosis) that covers gluteus medius. The fibers descend laterally, the upper and larger part of the muscle, together with the superficial fibers of the lower part, ending in a thick tendinous lamina which passes lateral to the greater trochanter and attaches to the iliotibial tract of the fascia lata. The deeper fibers of the lower part of the muscle are attached to the gluteal tuberosity between vastus lateralis and adductor magnus." (BG, p.875)

Blood Supply: fairly extensive

Nerve Supply: L5, S1, S2

Actions: "Acting from the pelvis, gluteus maximus can extend the flexed thigh and bring it into line with the trunk. Acting from its distal attachment, it may prevent the forward momentum of the trunk from producing flexion at the supporting hip during bipedal gait. The muscle is inactive during standing, swaying forward at the ankle joints, or bending forwards at the hip joints to touch the toes. However, it acts with the hamstrings in raising the trunk after stooping, by rotating the pelvis backwards on the head of the femur. It is intermittently active in the walking cycle and in stair climbing..." (BG, p.876) "Gluteus maximus only becomes active when the thigh is extended against resistance, as in rising from a bending position or climbing." (BG, p.688)

b. Hamstrings (biceps femoris- long head, semitendinosus, semimembranosus):

Description: all three arise from the posterior superior lateral aspect of the ischial tuberosity in close approximation just below the lesser sciatic notch. The semitendinosus and semimembranosus attach distally on the medial tibia. Interestingly, the semitendinosus tendon of insertion unites with those of the gracilus and sartorius to insert into the medial surface of the tibia. This common insertion may help balance any torsional forces introduced into the tibia by the slightly oblique course of the sartorius in walking or other activities.

(BG, p.879,665)

Blood Supply: extensive

Nerve Supply: L5,S1,S2

Hamstring Actions: "Acting from above, the posterior femoral muscles flex the knee. Acting from below, they extend the hip joint, pulling the trunk upright [if it is already upright they have little mechanical advantage] from a stooping posture against the influence of gravity; the biceps is the most active in this. As is the case with quadriceps femoris, the adductors and gluteus maximus, the hamstrings are quiescent in easy symmetrical standing. However, any action which takes the centre of gravity in front of a transverse axis through the hip joints - for example, forward reaching, forward sway at the ankle joints, or forward bending at the hips – is immediately accompanied by strong contraction of the hamstrings. (This is in marked contrast to gluteus maximus, which contracts only when there is a call for powerful extension at the hip joint.) Usually each of these muscles contracts as a whole, and whether or not movement takes place at hip or knee is determined by other muscles that act as fixators of these joints." (BG, pp.880-881)

2. Single Joint Muscles

(Adductor magnus- posterior part)

1. Adductor magnus: posterior part: accessory extensor (Kapandji, 1974, p.42)

C. Hip Flexors (Synergists):
(See Figure 5)

1. Multiple Joint Muscles

(Gracilis, Tensor fascia lata, Sartorius, Rectus femoris, Psoas)

a. Gracilis: accessory flexor (Kapandji, 1974, p.40)

b. Tensor fascia lata: Kapandji (p.40) lists this muscle as flexor of the hip; British Gray's (p.871) does not even list flexion as one of the muscles actions. Its actions and influence can therefore be ignored for the purposes of this paper.

c. Sartorius, Rectus femoris: two joint muscles; sartorius operates most effectively for flexing the hip with simultaneous knee flexion; rectus femoris can flex the hip and extend the knee simultaneously. Nerve supply: L2 & L3 and L2, L3 & L4 respectively (BG, pp.872-873) Sartorius muscular pull equivalent: 1.8 kg. weight; Rectus femoris muscular pull equivalent: up to 5 kg depending upon amount of knee flexion. (Kapandji, 1974, p.40)

d. Psoas: Description: "It arises: from the anterior surfaces and lower borders of the transverse processes of all the lumbar vertebrae by five digitations, each from the bodies of two adjoining vertebrae and their intervertebral disc." Most superiorly from the lower body of the twelfth thoracic vertebra; most inferiorly from the upper aspect of the fifth lumbar vertebra] tendinous arches connect these digitations on each side (BG, p.868)

The roots of the lumbar plexus enter the muscle directly given that the foramina from which they exit lie anterior to the transverse processes and posterior to the attachments of the digitations. [The clinical significance of this in the context of this paper is in relationship to the innervation of the Iliacus (L2 and L3) and possible influence of psoas spasm.]

Blood Supply: quite extensive

Nerve Supply: "ventral rami of the lumbar spinal nerves LI, L2, and L3."

Action: "It now appears that the psoas major extends the lumbar spine when the individual is standing with normal lumbar lordosis but assists flexion of the lumbar spine when one bends forward." (vol.2, p.93, Travel, 1992); for the assessment of actions from British Gray's see the section on action under Iliacus.

2. Single Joint Muscles (Adductors, Pectineus, Iliacus):

a. Adductors- longus, brevis, middle part of magnus: accessory flexor (Kapandji, 1974, p.40)

b. Pectineus: Description - "a flat quadrangular muscle in the femoral triangle. It arises from the pecten pubis, from the bone in front of it between the iliopectineal eminence and the pubic tubercle, and from the fascia on its anterior surface. The fibers descend posterolaterally to attach along a line from the lesser trochanter to the linea aspera." (BG, p.874) Blood Supply: "Obturator artery; medial circumflex femoral artery; first perforating branch of arteria profunda; deep external pudendal artery; femoral artery"

Nerve Supply: L2 & L3;

Action: "Pectineus adducts the thigh and flexes it on the pelvis."

c. Iliacus: Description: the major mass of this muscle is a single joint muscle; the component that originates from the sacrum could be considered a two joint muscle.

"Iliacus is a triangular sheet of muscle which arises from the superior two-thirds of the concavity of the iliac fossa, the inner lip of the iliac crest, the ventral macro-iliac and iliolumbar ligaments, and the upper surface of the lateral part of the sacrum. In front, it reaches as far as the anterior superior and anterior inferior iliac spines, and receives a few fibres from the upper part of the capsule of the hip joint. Most of its fibers converge into the lateral side of the strong tendon of psoas major, and the muscles then insert together into the lesser trochanter, but some fibres are attached directly to the femur for about 2.5 cm below and in front of the lesser trochanter."

Relation: "its posterior surface with the capsule of the hip joint, from which it is separated by a bursa com- →

mon to it and psoas major."

Blood Supply: " Iliac branch of iliolumbar artery; iliac branches of obturator artery; lateral circumflex femoral artery; arteria profunda femoris."

Nerve Supply: "Branches of the femoral nerve, L2 and 3."

lliopsoas Actions: "Psoas major, acting from above together with Iliacus, flexes the thigh upon the pelvis. Electomyographic studies do not support the common view that psoas major acts as a medial rotator of the hip joint, but activity has been described in lateral rotation, particularly in the young. When psoas major and Iliacus of both sides act from below, they contract powerfully to bend the trunk and pelvis forward against resistance, as in raising the trunk from the recumbent to the sitting posture.

Geometrical reasoning suggests that, with the body erect and the lower limb fixed, contraction of one psoas major might flex the trunk forwards and laterally; however, electromyography does not support such a prediction, but indicates maximum activity when the lumbar curvature is increased. Direct electromyographic recording from the muscle during sympathectomy in the lumbar region suggests that in addition to its role as a hip flexor, psoas major is active in balancing the trunk while sitting (Keagy et al 1966).

In symmetrical standing, iliopsoas might be expected to act from below to maintain the vertebral column upright. This would be in accordance with the principle that a muscle which is so close to a joint centre is likely to have an important postural or stabilizing function (Basmajian and De Luca 1985). Basmajian and Greenlaw (1968) confirmed this by reporting continuous slight to moderate electrical activity during relaxed standing. The fact that there is so little activity in most subjects can be understood by drawing a vertical line through the centre of gravity of the body. Such a line falls behind the transverse axis of the hip joints, which are near their close-packed positions, with spiralization and tautening of the ligaments (especially the iliofemoral) and marked compression and congruence of the articular surfaces. Thus the extending torque exerted by the weight of the trunk is balanced mainly by passive mechanisms." (BG, p.870)

Appendix II: Diagnostics

A. Thomas Testing (of right hip extension) (See Figure 11):

The subject is instructed to inform the examiner if there is discomfort in the back, pelvis or lower extremity at any time during the procedure. The subject is asked to flex the left hip and knee bringing the left knee toward the chest, as far as is comfortable. The subject grasps the left knee with both hands. (This position flattens the lumbar spine against the table and prevents most lumbosacral or pelvic motion.) The patient is instructed to keep the low back against the table during the remainder of the test. Alternatively, the examiner monitors the low back with one hand. The examiner grasps the subject's right lower extremity making contact behind the knee as the support is removed. The subject is then instructed to let the right extremity relax allowing the knee to bend during the range of motion assessment. Gravity is allowed to carry the extremity to an endpoint of hip extension. Goniometric measurement using standard anatomical position as the starting point is used to determine range of hip extension.

B. Clinical Iliacus testing
(See Figure 12)

The patient is in a supine position on the treatment table. Assume the test is to be performed on the right. The physician stands on the patient's right.

1. The patient is instructed to remain supine but slide to the right edge of the table. The physician has the patient stop when the right PSIS is near the edge of the table. (In this way, the pelvis can be fully supported while allowing for hip extension.)

2. The physician grasps the back of the patient's right knee, approaching from the medial side of the knee. The lower extremity is then carried off the edge of the table. The patient is instructed to relax the thigh and leg. The hip joint is still in relative neutral, no flexion or extension.

3. The physician contacts the right ASIS with the palm of the left hand, between the thenar and hypothenar eminences. This allows the palm to mold around the ASIS.

4. The physician applies enough force through this contact to counterbalance the anticipated weight of the lower extremity. The most efficient means for accomplishing this is for the physician to lean his/her body weight on the straight left upper extremity, thus minimizing the need for muscular activity and fatigue on the part of the physician.

5. Gravity is allowed to carry the right lower extremity into extension. The patient is instructed to notify the physician of any arching stress transmitted to the lumbars or thoracolumbar junction. (This helps assure that forces are confined to the pelvis and not transferred via the psoas and associated fascial-ligamentous structures into the origins of these tissues in the lumbar and thoracolumbar regions.) The physician can generally feel and/or see that the force is being transmitted beyond the innominate. This occurrence signifies that the ASIS is not being held superior firmly enough by the supporting hand. At this point the range could be compared with the left side after a similar procedure. However, I find it is more valuable to proceed with assessment of end range compliance as is described in the next step.

6. The physician's right hand can now apply a downward pressure on the patient's right thigh just above the knee. Experience allows a differentiation between gradual elastic approach to the end-range barrier and immediate concrete barrier resistance. This provides additional information important for side to side comparison.

Appendix 3: Therapeutics

A. The 'Kettler' technique - right sacroiliac and iliacus complex dysfunction: (See Figures 8a and 8b) The technique as described and performed by Dr. Patriquin utilizes physician effort and patient cooperation. The patient lays supine. The physician stands on the side opposite to the somatic dysfunction, e.g. the right sacroiliac and iliacus complex.

1. The physician places the thenar eminence of the left hand under the most resistant portion of the patient's right sacral margin.

2. The patient is instructed to flex the right hip and knee letting the knee evert (abduct) as far as possible.

3. The physician leans his/her body weight onto the right ASIS via sternal contact. A dense pillow in between is often advisable.

4. The physician's right hand maintains the eversion (abduction) while the physician maintains compression on the ASIS and the patient straightens the right leg.

5. This sequence is repeated a second time, but with the right hand resisting the leg straightening, only enough to require more lower extremity muscular effort. This technique does a good job of preventing anterior rotation of the innominate during straightening of the lower extremity. Thus, focusing upon a sacral fulcrum while it stretches the hip flexor tissues.

B. Iliacus Inhibition Stretch – Innominate Free (John Morgan; see Figure 10 A and B):

"The patient lies supine with the knees bent to 90 and the operator, who is seated on the patient's left side, grips the ilium just anterior to the anterior/superior iliac spine in such a way as to wrap his fingers downwards and back to hook and anchor the iliac facia. The patient is asked to slowly drag his left heel towards his pelvis, and, at the point of minimum tension, the operator takes a firmer grip on the facia and the patient is instructed to slowly slide his heel towards the foot of the plinth [table} until the knee is fully extended and the foot fully plantar-flexed. During this time the operator has maintained the grip on the iliac facia. The patient is then asked to slowly drag his foot cordaly [cephalad] and the operation is repeated three times for maximum benefit." (p.26)

C. Iliacus Inhibition Stretch – Innominate Fixed: (see Figure 15)

This is a variation that adds a second approach to that described by Morgan. The physician's cephalad palm is used to applied posterior-superior pressure against the involved ASIS. This fixes the innominate in place, preventing any anterior innominate rotation during the leg straightening phase of the procedure. Respiratory cooperation is also used to ease the finger pads into contact with the Iliacus (during expiration). →

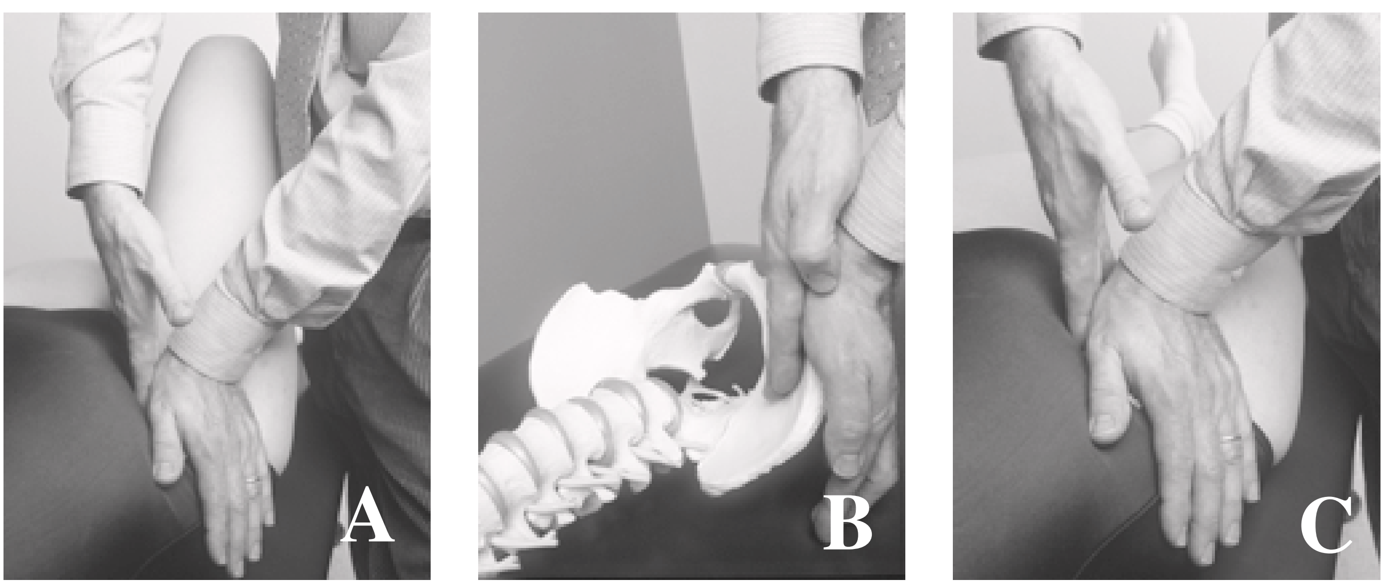


Figure 15: Iliacus Inhibition Stretch – Innominate Fixed: A) shows the pre-stretch position; B) physician hand placement; C) end-stretch positioning. By fixing the innominate the nature of the stretch is changed. The innominate is not allowed to rotate anteriorly as the lower extremity is straightened. Patients acknowledge this stretch feels different and often more comfortable than the stretch without the innominate fixed.

D. Sutherland's Approach to 'Postural Lesions' (anterior innominate rotation; see Figure 9):

"Correction of the postural lesions is made with the patient standing, his hands on a stool which is placed on the table. The leg on the side of lesion is crossed in front of the other one and the foot rests on its outer edge, lateral to the one on which he stands. In this position the weight is transmitted from the spine through the sacrum to the innominate bone which is not directly concerned in the technique. The sacrum is thus stabilized and the lesioned innominate is left suspended [not weight bearing]. The operator, sitting at the side of the patient, holds the tuber ischium in the palm of one hand and the crest of the ilium in the other. The innominate bone is rotated with the hands, anteriorly ...toward the position of correction. (This is 'direct action' technique, so if it is an anterior rotation lesion the bone is held in posterior rotation, ...). The patient flexes the knee, which bears his weight to about 135 degrees, keeping the other leg relaxed [This combination requires a slight flexion of the involved hip and knee. The flexion of the weight bearing leg induces further flexion of the hip and knee and a little more adduction. This further reduces the soft tissue tensions ('iliacus complex') pulling the innominate anterior.], and returns to the erect position while the operator maintains the rotation of the innominate in the direction of correction." [Since the physician continues to maintain the innominate in the direction of correction, further posterior rotation occurs with the same contact force as the soft tissue tension reduces.] (Sutherland, 1990, pp.255-256) This author's comments exploring the biomechanics of the technique described.]

E. 'lliacus' Stretch:
(See Figure 12)
The patient is in a supine position on the treatment table. Assume the stretch is to be performed on the right. The physician stands on the patient's right.

1. The patient is instructed to remain supine but slide to the right edge of the table. The physician has the patient stop when the right PSIS is near the edge of the table. (In this way, the pelvis can be fully supported while allowing for hip extension.)

2. The physician grasps the back of the patient's right knee, approaching from the medial side of the knee. The lower extremity is then carried off the edge of the table. The patient is instructed to relax the thigh and leg. The hip joint is still in relative neutral, no flexion or extension.

3. The physician contacts the right ASIS with the palm of the right hand. Contact is made with the central portion of the palm between the thenar and hypothenar eminences. This allows the palm to mold around the ASIS.

4. The physician applies enough force through this contact to counterbalance the anticipated weight of the lower extremity. The most efficient means for accomplishing this is for the physician to lean his/her body weight on the straight left upper extremity, thus minimizing the need for muscular activity and fatigue on the part of the physician.

5. Gravity is allowed to carry the right lower extremity into extension.

6. The physician's right hand can now apply a downward pressure on the patient's right thigh just above the knee while counterbalancing pressure is applied to the ASIS.

7. The stretch is held twenty to forty seconds and may be repeated after a short rest period in neutral supine position. Muscle energy technique can easily be added to this approach.

This stretch has been successfully taught to patients and their significant others. It is emphasized that lumbosacral pain and strain should never be felt during the stretch. If it is, the stretch is going too far and the ASIS is not being held firmly enough. There are also standing and kneeling variation that can be done by the patient alone.

Illustrations

Figures 1-7 were adapted from Hollingshead's *Textbook of Anatomy,* 5th Ed., 1997, by permission of Lippincott and the editor, Cornelius Rosso, MD., DSc.

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