

"High-Tech" for "Higher Touch?" Exemplars & Research



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Overview Today

Higher Tech - Higher Touch



Documenting: Palpatory Diagnosis, OMT, Post-OMT Change,
 Intra- & Inter- Examiner Reproducibility

Potential Impact: Perspective & Interpretation; Teaching;
 Learning; Research; Literature

Advancing Our Science & Art

DOcumenting Palpation & OMT



Inter-Examiner Reliability:
www.FIMM-Online.com
 (Workshops Tomorrow)

Several Important Objective

Measures of Palpation
 Pressure & Duration
 Useful in Teaching,
 Replicating &
 Documenting Procedures

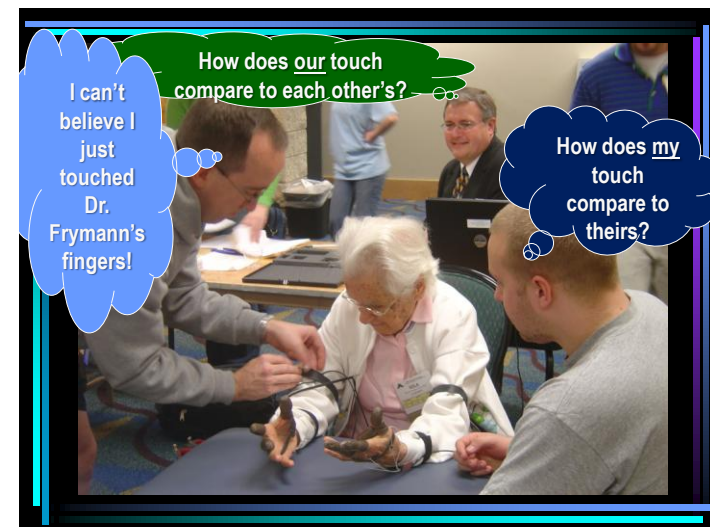
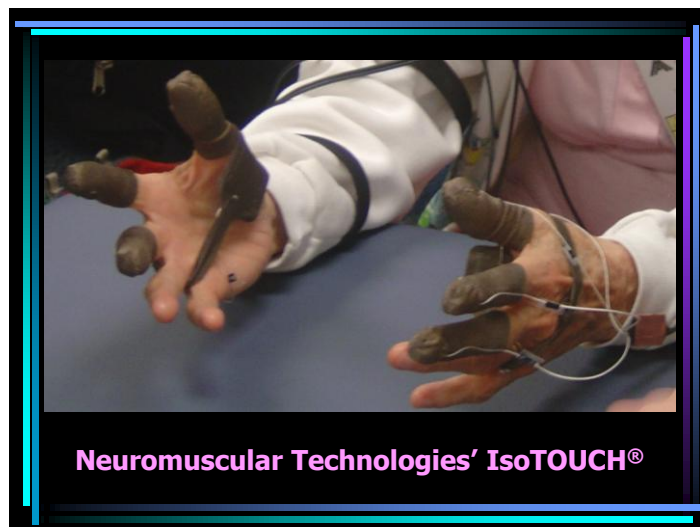
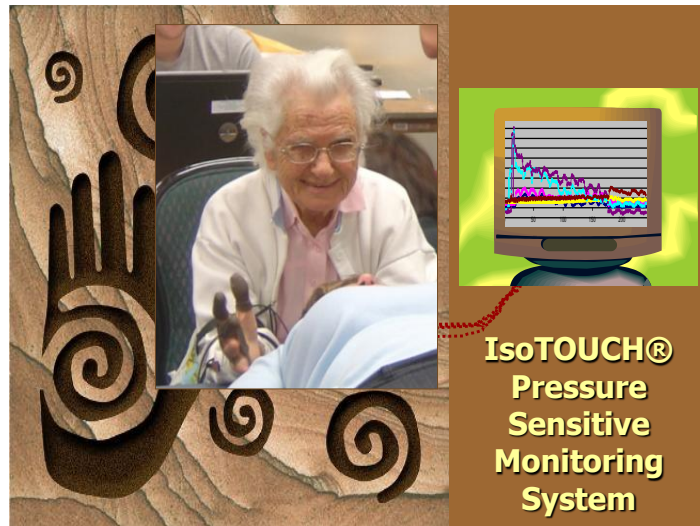
- Pressure / Force
- Duration & Frequency
- Direction
- Intra- & Inter- Examiner Reproducibility/Reliability

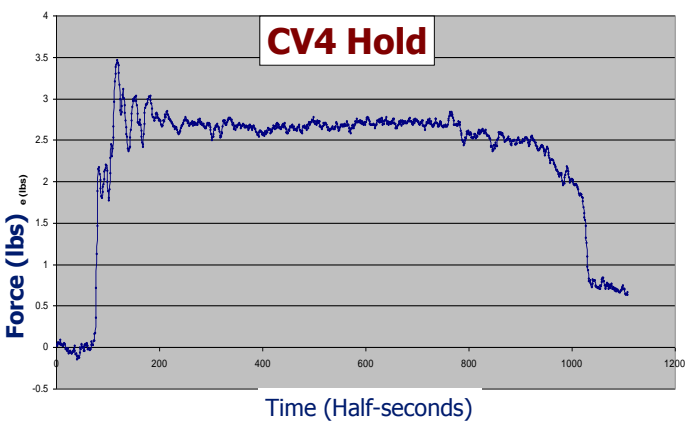
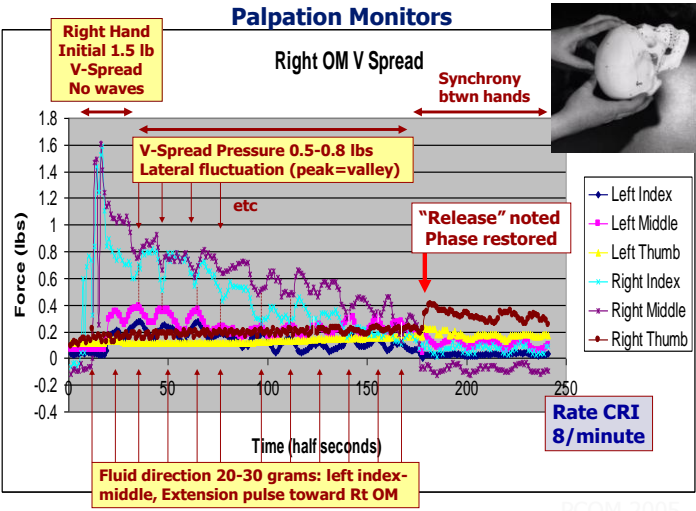
Research Tool

1. Pressure Sensitive Pad Monitor System (IsoTOUCH®)
2. Tissue Texture Response Durometer & Hysteresis (Spineliner® & Ankle Torsion Monitor®)
3. Accelerometer
4. Transcranial Doppler / Rheoencephalography Software Potential

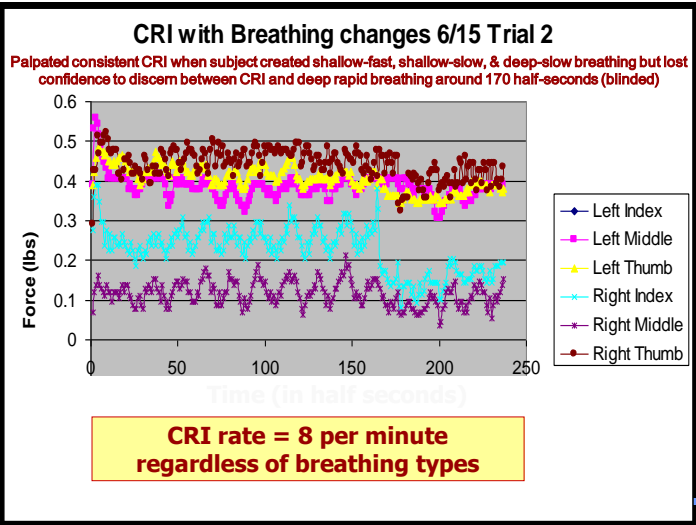
Exemplar or Application

1. Reliability (κ) studies; multicenter research; teaching & learning
2. Cervical Spine diagnosis & treatment – correlation with SD; Ankle sprain & bracing
3. Pedal Pump OMT
4. Cranial Compliance / CSF; Dementia; Multiple Sclerosis





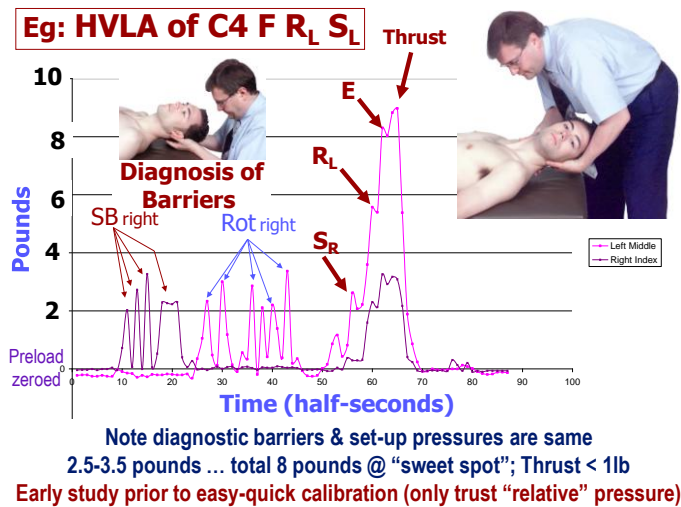
Measure the ranges of pressures and the duration of each of the techniques. Report specifics in methods section to enhance reproducibility.



Pressure Sensor Documentation

Cervical, Cervical, Pelvic

- **Diagnostic Pressures**
 - Tissue Loading (Barrier's "Feather-Edge") & End-Feel
- **Treatment (OMT) Pressures**
 - Tissue Loading (Barrier)
 - Speed, Duration & Force Used
- Agreement Phase in Inter-Examiner Reliability Studies
- Impact on Those Involved



Pressure Used in Direct Cervical Palpation & OMT

Preliminary Study: This Program
 40 subjects randomized

- Cervical Muscle Energy or High Velocity Low Amplitude

+12 subjects treated solely with HVLA for OA somatic dysfunction

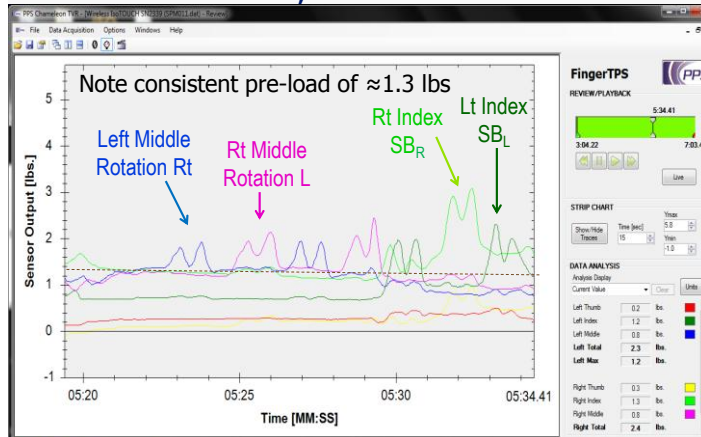
IsoTOUCH® monitoring for representative levels of force used during diagnosis & direct OMT techniques to a single somatic dysfunction

Diagnosis: 1-2 lbs of pressure was used for typical cervicals.

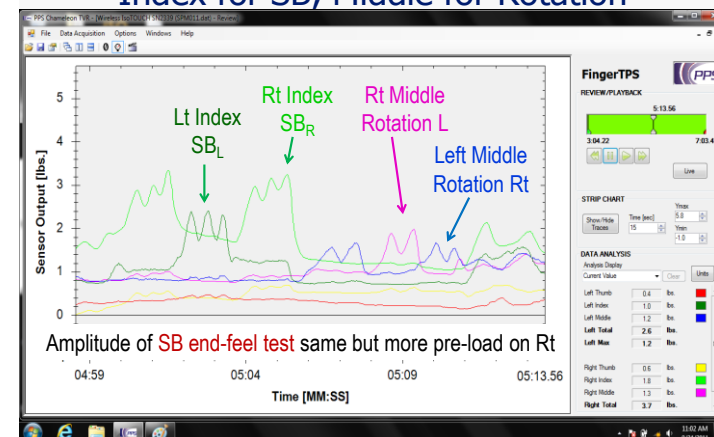
- Average **Pre-Load** = **1.25 lbs**
- Overall ave. diagnostic impulse pressure against **end-feel barrier** = **1.06 lbs** additional

Treatment Set-Up to Barrier: For each HVLA treatment, I used primarily my **middle finger** to set up the preload pressures and to deliver sidebending "thrust"

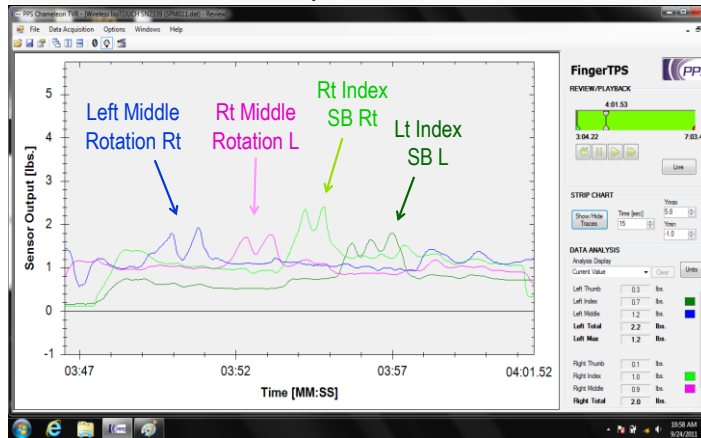
C6 No Somatic Dysfunction Index for SB, Middle for Rotation



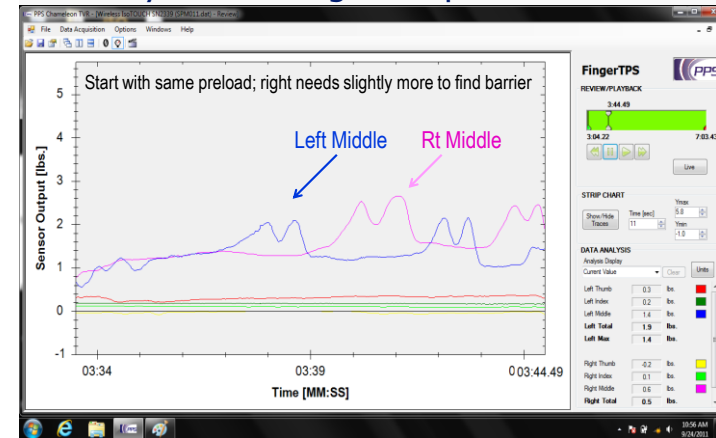
Typical Cervical Diagnosis: C5 ER_RS_R (gr2) Index for SB, Middle for Rotation



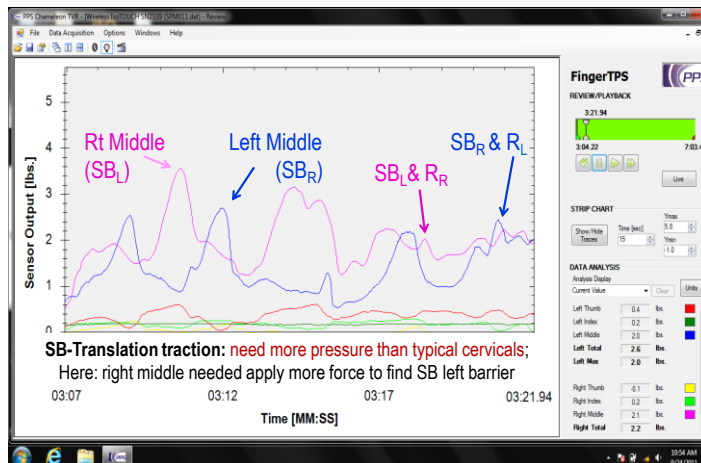
Typical Cervical Diagnosis: C2 FS_LR_L (gr1) Index for SB, Middle for Rotation



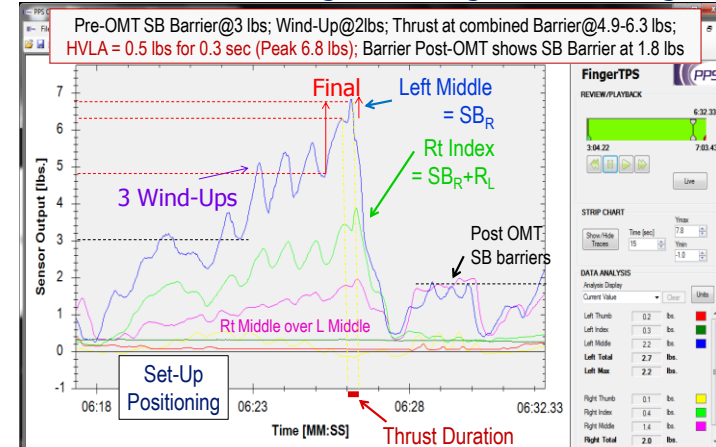
AA Rotated Left Diagnosis: Mostly Middle Fingers Superior Pressure

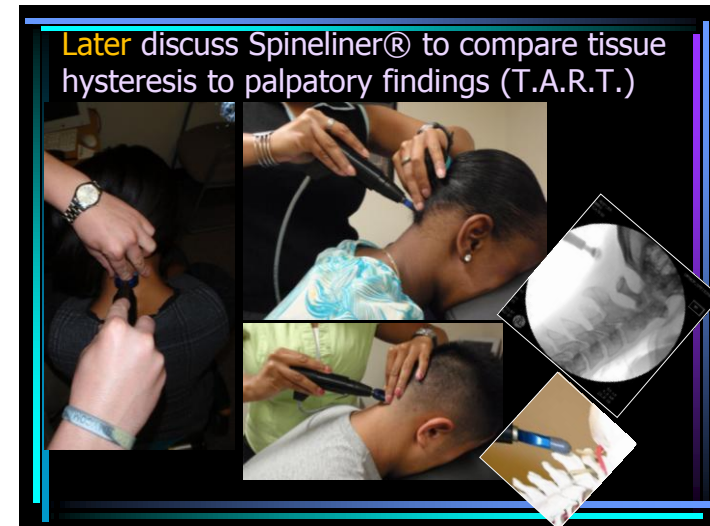
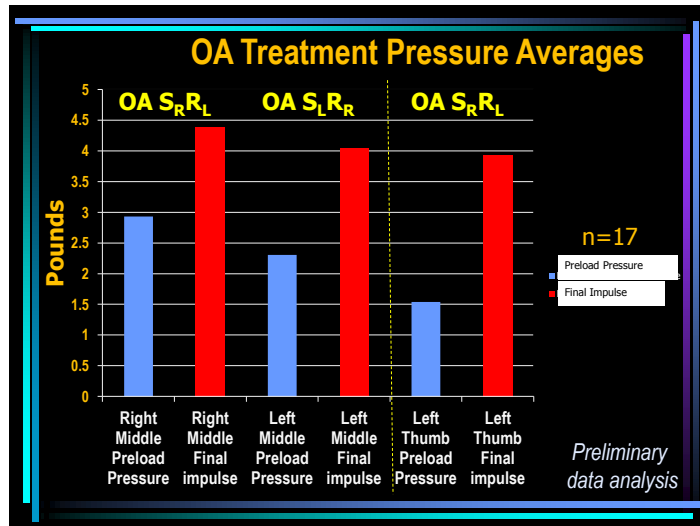


OA E S_L R_R Diagnosis: Mostly Index Traction



HVLA to OccipitoAtlantal Site (OA S_L R_R) Activation: Sidebending Arc through L Middle Finger





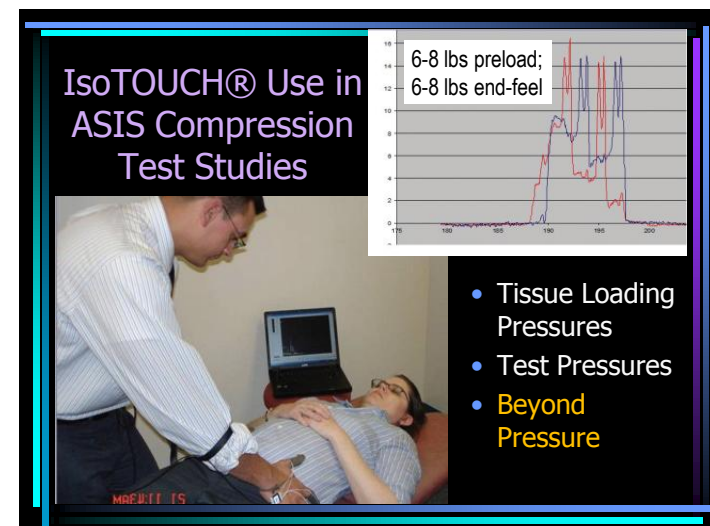
Ongoing Pressure Monitor Studies

MultiCenter Study to Evaluate "Touch"

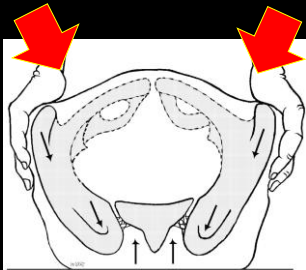
- PCOM Lead – Kuchera with Craniocervical concentration
- ATSU-KCOM – Degenhardt with Lumbar concentration (& other system)
- EVVCOM – Brolinson with Thoracic concentration

PCOM has approval for 1800 appendicular & 1800 axial subjects

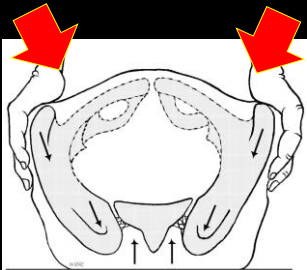
- Spineliners® arranged for these centers too to do further studies on correlating palpation & OMT to tissue texture changes



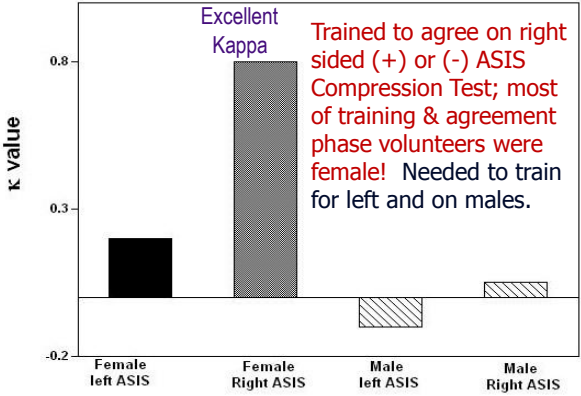
Angle of the Arms Was Important Too
Direction of Compression to Match SI



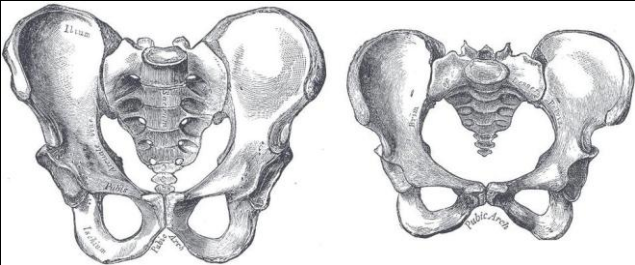
Dominant Eye Center; Side to Stand
Height of Table; Foot Position (etc)



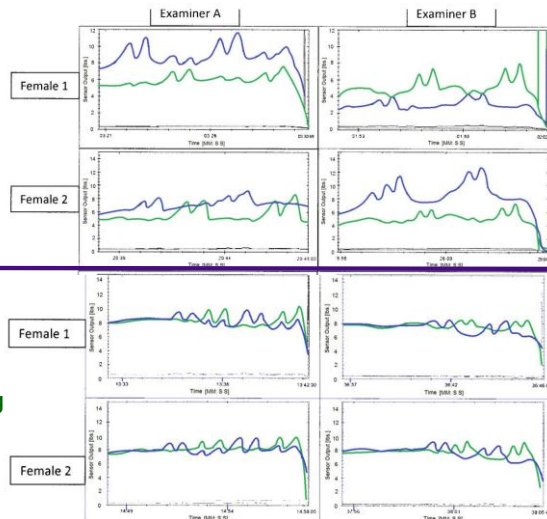
For those attending the **Inter-Examiner Reliability Workshop tomorrow**: All to be discussed & negotiated



Why Might Need to Vary the Test for Male vs Female Pelvises?



- Asymmetry of pressures right vs left hands intra-examiner & between subjects inter-examiner

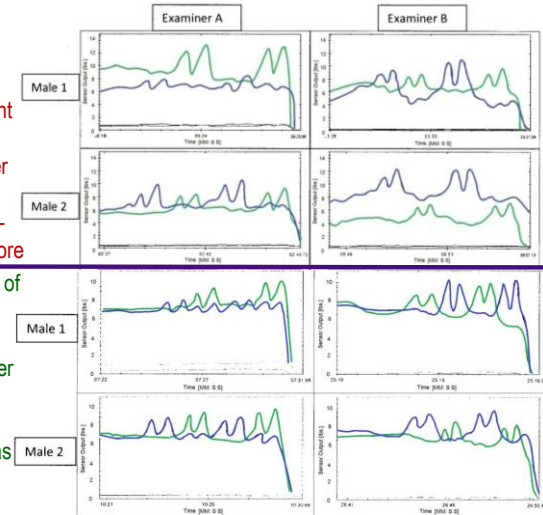


- Symmetry of preload and end-feel pressures after training with IsoTOUCH® monitors

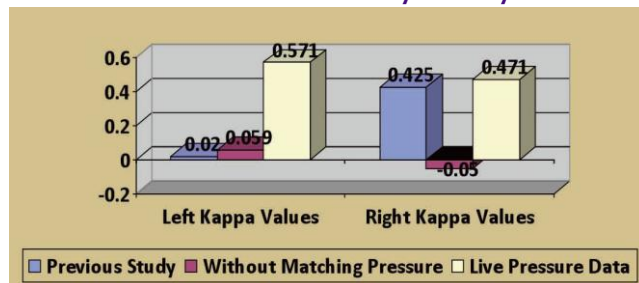
Training Difference

- Asymmetry of pressures right vs left hands intra-examiner & between subjects inter-examiner before

- Better symmetry of preload and end-feel pressures after training with IsoTOUCH®; not as good as female ASIS



IsoTOUCH® Sped Both Training & Agreement Phases to Conduct Kappa InterExaminer Reliability Study



No agreement on left training (assumed agreement on right would translate to left) -- Feedback to students improved repeated kappa)

Prior right kappa test (with prior agreement) could still show improvement

An Additional Question Was Raised Concerned Whether Pressure From 1st Palpator Affected the 2nd ???

In advance:

- We limited to 2 end-feel impulses and 2 trials each

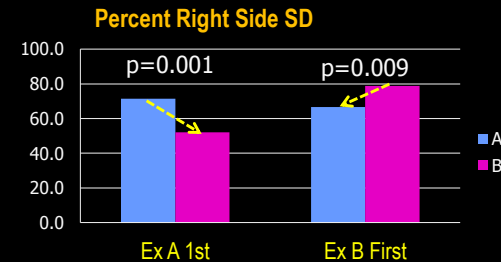
- Discovered initial loading pressures averaged 6-8 lbs

Effect of Second Palpator in ASIS Inter-Examiner Reliability Tests (n=330)

*Half of population examined first by Examiner A and then by B;
 other half examined first by Examiner B then A. Literature suggests
 prevalence of right-sided innominate SD may be 80%.*

- Examiner A 1st - 118/165 (72%) right-sided SD
 - Examiner B 2nd - only 86 of this same group (52%) right-sided SD;
 20% drop in prevalence (p=0.001)
 - Examiner B 1st - 130 of other 165 subjects (79%) right-sided SD
 - Examiner A 2nd - 110/165 (67%); 12% prevalence drop (p=0.009)
 - Overall SD was lateralized to the right side 76% of the time for
 whichever examiner palpated first and only 60% of the time for
 whoever followed immediately as a second examiner.
- κ-values for first palpator cohorts: fair to moderate (κB=0.30; κA=0.55)
 76% of first palpator's findings → close to literature's suggestion of 80%

Performing Test Alters Subject's Findings for Second Palpator



Man Med 2010

Conclusion of Pressure Monitors & Documentation

- Help document pressures used in diagnosis and treatment
- Help standardize (& publish) palpation parameters for interexaminer (kappa) testing or study replication
- Identify where more agreement is needed
- Enhances ability to identify where problem may lie male-female, (R-L), etc
- Visual feedback of technique (for teaching)
- Immediate feedback to students trying to learn

Switch to Tissue Texture Responses Hysteresis and Durometer Measures

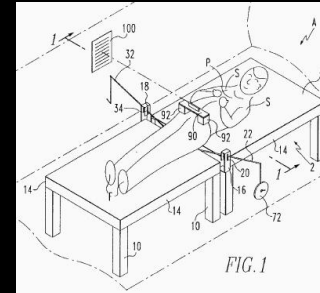


Hysteresis Discussion

- **Cervical Measurements**
 - Comparison to palpation (still processing data)
 - Documentation of change post-OMT (partial data analysis done)
- **Cranial Mechanism-of-Action ???**
 - From Inside-Out ???
 - From Outside-In ???

Historically

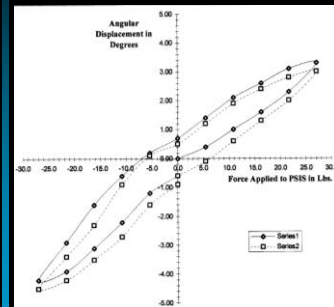
Warner: Reverse-Engineered an Osteopathic Palpatory Diagnosis Maneuver



X axis = displacement (degrees)
 Y axis = force to PSIS (in lbs)

- **Zink CCP Model**
- **Force:** applied increasing amount of weight to lever arms over PSIS's to replicate the Pelvic Roll
- **Displacement:** laser platform rests on the ASIS and projects a beam of light onto a grid

Warner Was Surprised to Document a Hysteresis Response

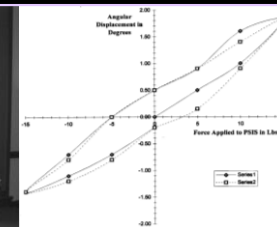


X axis = displacement (degrees)
 Y axis = force to PSIS (in lbs)

Hysteresis:
 "to lag behind"




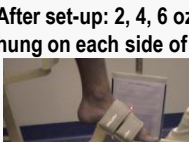


- ... is not introduced by device or person applying force
- ... is the "inelastic" response of the human tissue to applied forces
- Hysteresis loops are widely used in material science research

Clinical Palpation Test Documentation "Zink's Fascial Pattern Testing Method"



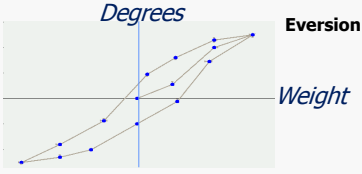
Kessler Institute for Rehabilitation: New Jersey

Warner M, Mertz J, Zimmerman A: "The hysteresis loop as a measure of low back motion analysis"
 JAOA (July 97)




Early PCOM Hysteresis Research: Ankle Sprains

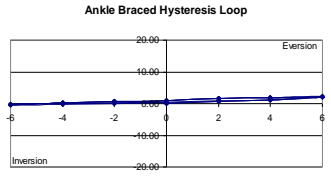
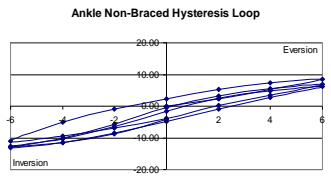
Document Tissue Characteristics in Healing
PCOM Human Performance & Biomechanics Lab



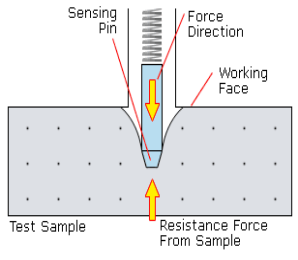
After set-up: 2, 4, 6 oz weights successively hung on each side of Ankle Torsion Monitor™



Example of Altering Hysteresis Using Conventional Ankle Bracing



Loops demonstrate decreased ROM and less tissue viscoelasticity

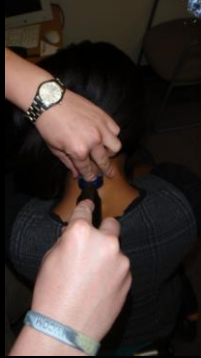


Durometer: Standard Instrument Method

Durometer: Unitless Measure


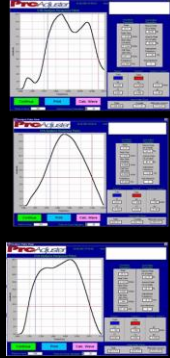
- The principle used to measure hardness is based on measuring the resistance force of the penetration of a pin into the test material under a known spring load.
- The amount of penetration (few mm) is converted to hardness reading on a scale with 100 units.

Records part of hysteresis loop



The Spineliner® Printout:

4 Characteristics of Durometer



Spineliner Pilot Project

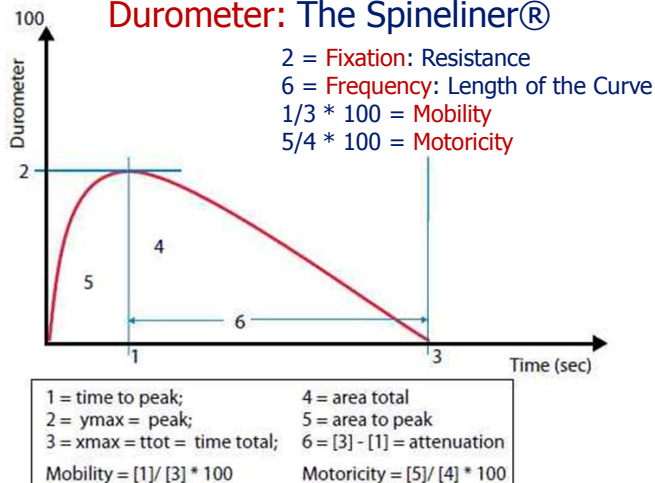
- Total of **240 subjects**
- Randomized: **5 OMT Groups; 1 "Sham"**
- **Standardized** the primary objective outcome measure (Durometer)
 - **A single technician performed all 7680 applications (240 subjects)**
 - **Large amount of data ... in process now**

Methods & Materials

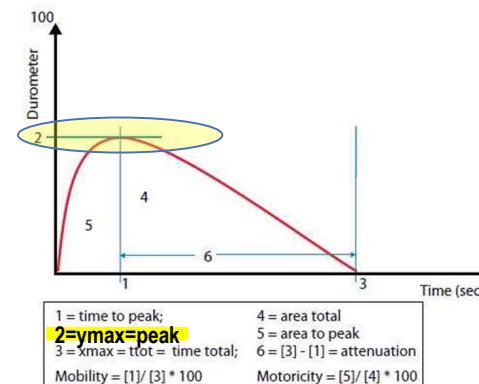


- 1st Diagnosis with the **Spineliner**
- 2nd Osteopathic **Palpatory** Diagnosis
- 3rd **Osteopathic Treatment (1/[5+1])**
 - Subjects randomly chose their treatment (envelope)
 - If no dysfunction → automatically sham
- 4th Reassessment with the **Spineliner**
- **Questionnaire** at beginning and end about pain, treatment, & Spineliner

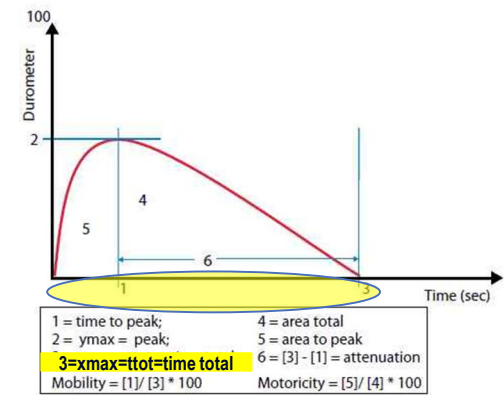
Durometer: The Spineliner®



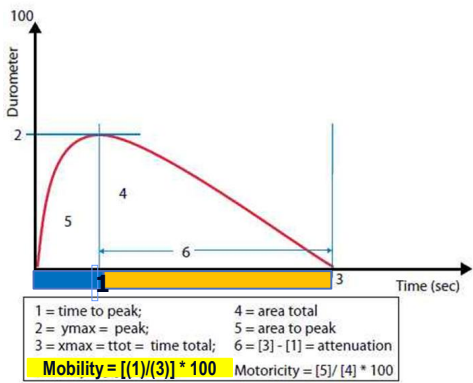
Durometer Fixation: Resistance = 2



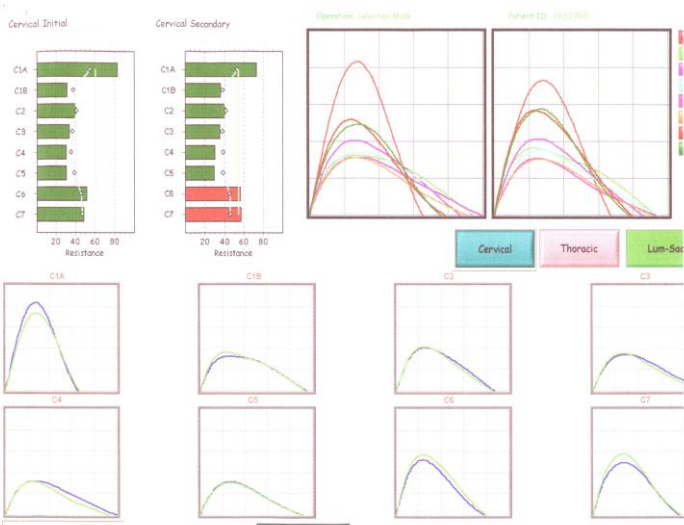
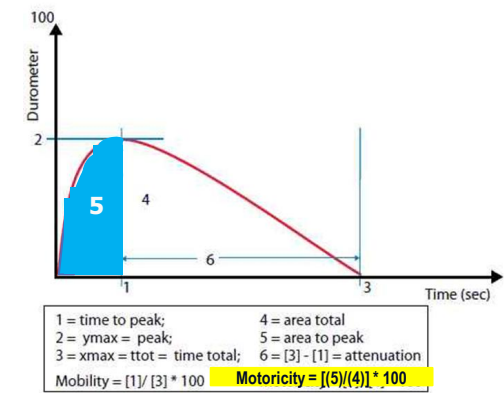
Durometer Frequency: Length of the Curve=3



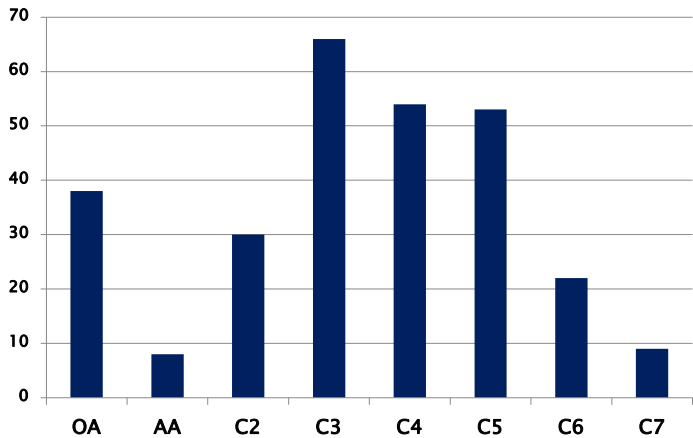
Durometer Mobility = Range of Motion



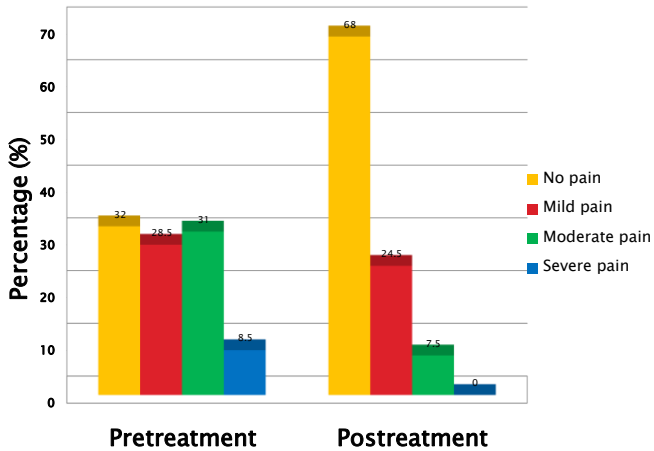
Durometer Motoricity = Overall Segmental Dysfunction



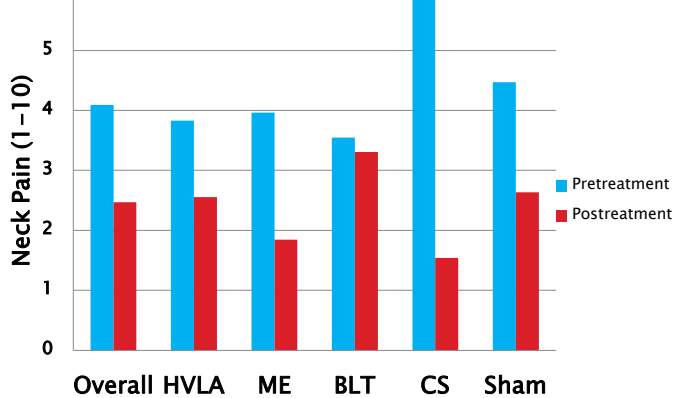
Total # of Dysfunctions at Each Cervical Level



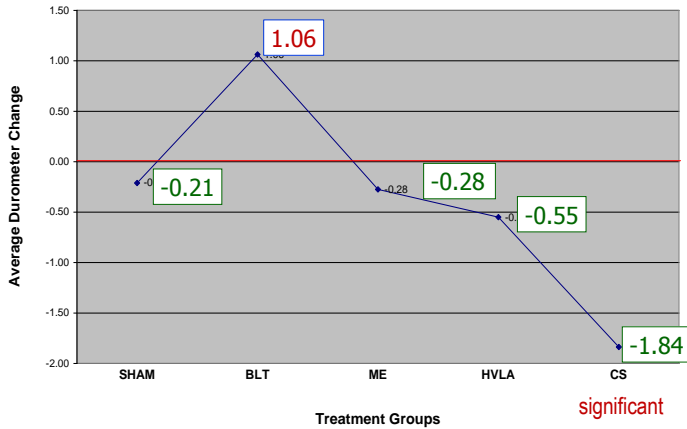
Neck pain pretreatment vs posttreatment



Pretreatment vs Immediate Posttreatment Pain
with patients having initial neck pain



Eg: Change in Fixation Durometer Post-OMT @ C3



Close of Discussion: Changing Paradigms

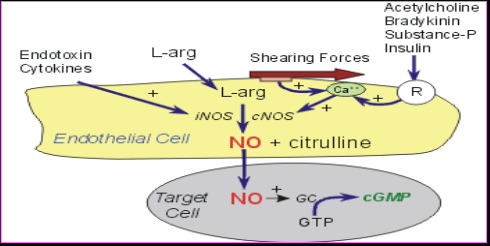
Establishment Says:

- Pressure changes between compartments move venous & lymphatic fluids
- Cranium is rigid
- Neurodegenerative process are genetic with infectious

Hi-Tech / Hi-Touch →

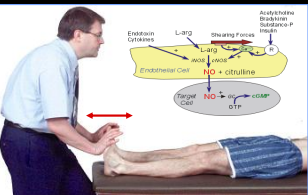
- Pedal pump may also upregulate eNOS
- Cranium is compliant AND may have clinical relevance
- Removing infectious, metabolic & immune by-products may avoid progression towards dementias

Nitric oxide as a possible mechanism for understanding the therapeutic effects of osteopathic manipulative medicine



-- E. Salamon, W. Zhu and George B. Stefano
International J Molecular Med 14: 443-449, 2004

Osteopathic Pedal Pump vs Mechanical Acceleration-Deceleration



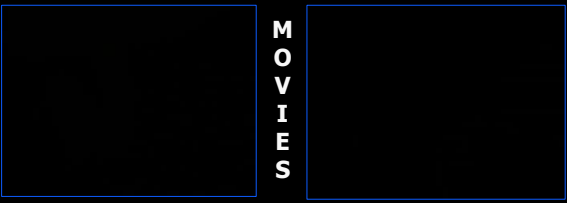
OMT "Lymphatic" Pump



AT-101 Table

Demonstrated that equal increases of nitric oxide seen with 5 minutes of Pedal Pump or AT-101 or moderate exercise (only exercise ↑'ed BP & HR)

Force & Frequency Used in Dalrymple Pedal Lymphatic Pump



An accelerometer attached with an ACE wrap to the thigh (n=52) measured frequency (Hz) & acceleration/deceleration (G-force)

Pedal Pump *vs* AT101: Accelerometer

Results: **Group 1, manual pump** frequency and force averaged **2.23Hz** and **0.27G** respectively with successful F&F replication on the **AT101®** (average= **2.20Hz** at **0.26G**). On the AT101® a visible "slosh" in the same subjects was re-created using an average F&F of 2.18Hz at 0.29G.

Results: **Group 2** subjects, optimal **manual pump** averaged **2.34Hz** at **0.29G**.

Machine presettings in group 2 subjects created higher F&F averages (2.47Hz at 0.42G); manual F&F replication attempts averaging 2.35 Hz at 0.43G.

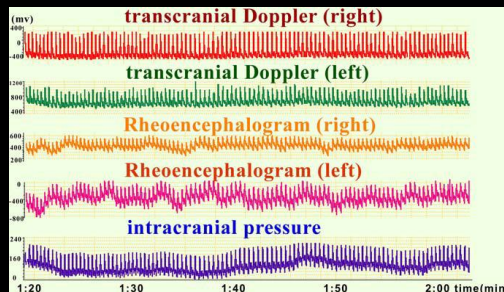
Enhancing Computer Software to Gather New Insights



- Simultaneous Physiological Input
- Physiological Maneuvers Changing Certain Values Relative to Other Values
- Enhanced Computer Analysis
- Mathematical Modeling

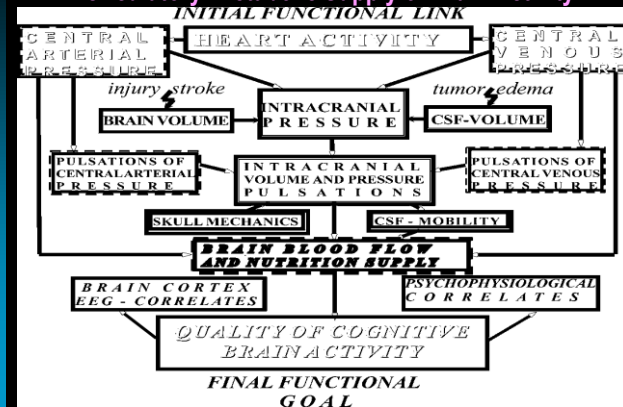
*Eg: Moskalkenko Method
 Cranial Compliance; CSF Flow*

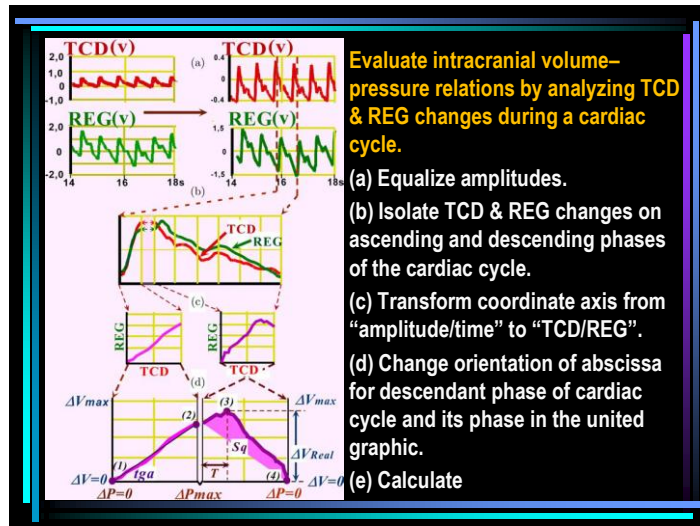
Transcranial Doppler/Rheoencephalography



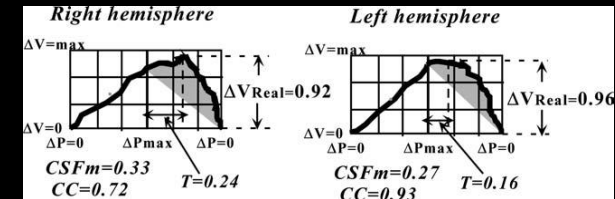
Simultaneous recordings of transcranial dopplerography (TCD); rheoencephalography (REG) (fronto-mastoid electrode position), from **left & right hemispheres & intracranial pressure (ICP)** in cysterna magna in quiet, comfortably awake recumbent subject

Systems & Structures Responsible for Circulatory-Metabolic Supply of Brain Activity

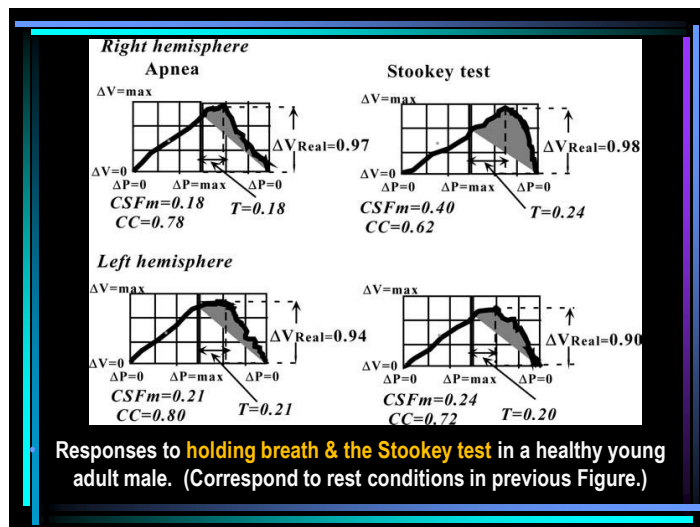




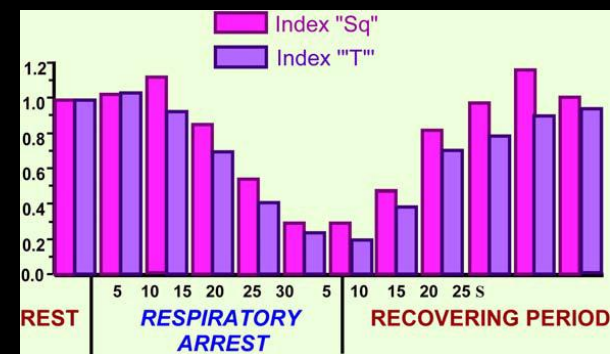
Can measure right & left hemispheres

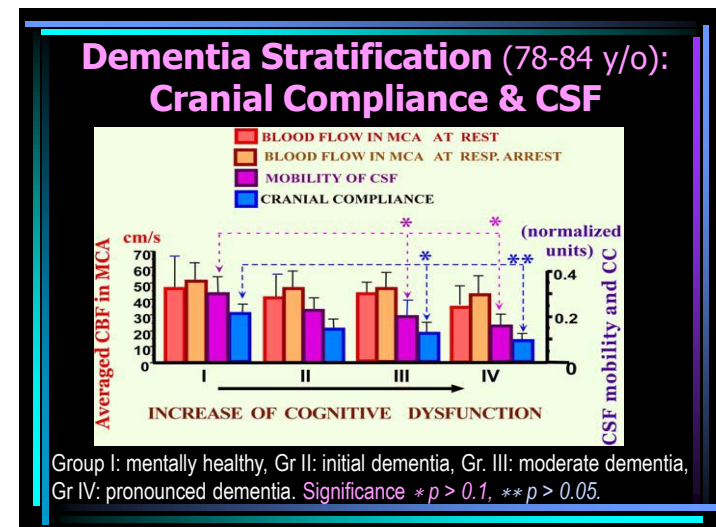
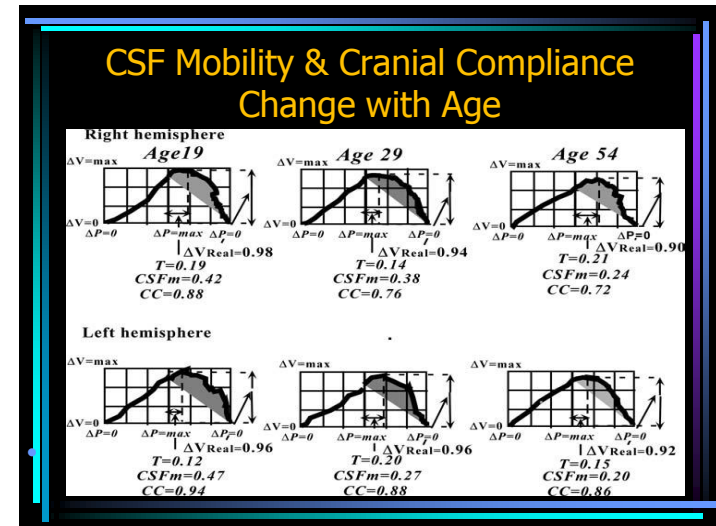


- Results of the calculations including **cranial compliance** on each hemisphere side and **CSF flow** for the cardiac cycle of a 26-year-old healthy man recorded at rest, in a comfortable horizontal position.



CSF mobility in response to voluntary breath holding for 30-seconds (27 y/o)





Plans: IsoTOUCH & Moskalenko Method Pre- and Post- OMT

- OMT to Base of Skull, Upper Cervical & Venous Sinus
- Document Specifics of Techniques Used
- Document Cranial Compliance & CSF Flow
- IRB for several hundred subjects
- Subanalysis for head trauma, concussion history
- Subanalysis for attention deficit / foggy thinking
- Future: Alzheimer / Dementia groups

Interpret Research Correctly!



Students Appreciate Role of Osteopathic Research



Curiosity almost killed the cat.
Canine science kept it alive.

Thanks & Acknowledgements

Grant &/or equipment support

- American Osteopathic Association
- Bodiflo (equipment)
- Neuromuscular Engineering grants and equipment
- Non-Invasive Monitoring Systems (equipment)
- Sigma Corporation (equipment)
- USA Department of Defence

Students & research coordinators of the **Human Performance & Biomechanics Laboratory** at PCOM Pre- AND Post- OMT to Base of Skull, Upper Cervical & Venous Sinus

Special Acknowledgments



See also **PCOM Masters Theses** in Biomedical Sciences for Nicole Myers DO, Precious Barnes DO, Frank Casella, and Victoria Ferencz DO (Sponsor: Kuchera)

See also abstracts for **AOA Research Conventions** (2010 & 2011) and the 3rd International **Fascia Research Congress** (2012)

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Bibliography

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