Documenting Pressures Used for Manual Diagnosis and High Velocity Treatment of Cervical Spine Somatic Dysfunction

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BACKGROUND

Somatic dysfunction (SD) is defined as "impaired or altered function of components relating to the somatic (body framework) system: skeletal, arthrodial, and myofascial structures related to the vascular, lymphatic, and neural elements." Tissue texture and quality of end-feel motion are objective palpatory findings used to identify spinal SD but these are often difficult characteristics to quantify.

The IsoTOUCH® (Neuromuscular Engineering LLC; Nashville TN, USA) is a non-invasive, tactile pressure sensor palpation monitoring system developed to measure forces used in palpatory SD diagnosis and its treatment with Osteopathic Manipulative Treatment (OMT). Capacitance pressure sensors placed over finger pads wirelessly transmit real-time data to a computer (*see figures 1-2.)*

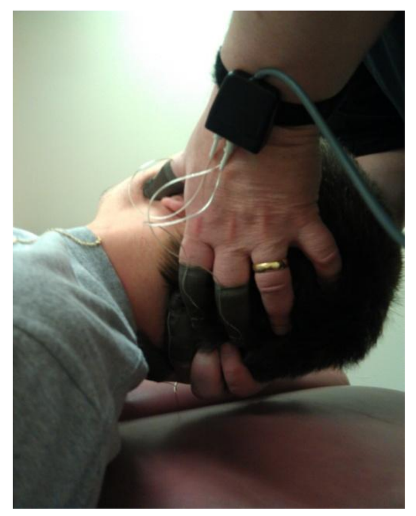
The Spineliner® System (Sigma Instruments; Pittsburgh PA, USA) is a durometer capable of analyzing and quantifying hysteresis and fixation at various spinal levels by measuring deformation and recoil tissue responses to a specific piezoelectric impulse generated precisely at the end of a 4-pound deformation pressure.

HYPOTHESES

1. Instrumented measures of palpatory pressures and tissue texture changes used in diagnosing SD of the occipitoatlantal (OA) region and its treatment with high velocity low amplitude (HVLA) thrust OMT are possible and quantifiable.
2. The pressure range for palpation will fall in the tissue hysteresis range used by the instrumentation.
3. Clinical measures of OMT efficacy will be comparable to instrumented measures.
4. Cervical HVLA OMT involves a very low pressure very short duration tissue impulse beyond the first palpable sense of end-feel restriction.

METHODS & MATERIALS

Baseline durometer and palpatory measures of the entire cervical spine using Spineliner® and IsoTOUCH® systems were obtained in 265 subjects prior to OMT. Of these, a subpopulation (n=31) was identified for a single NMM/OMM specialty physician (MLK) in which the OA was both diagnosed as the "key SD" and treated with HVLA. OMT. Complete data was available for analysis from 25 in this group.



After placing the occiput of each subject into slight flexion (using a loose-packed position regardless of sagittal diagnosis) , a pre-load pressure was applied with lateral translation and sidebending to the SD barrier. A single HVLA curvilinear force (introduced primarily through a single third-digit fingertip placed over the occiput) was directed at the SD barrier towards the opposite orbit.

Perceptions of OMT efficacy were interpreted from recorded palpatory changes in assessed post-OMT SD severity values. Any audible cavitation was also noted. The Spineliner® physician was always blinded to the type of OMT used and cervical level treated.

IsoTOUCH® data was later abstracted to analyze palpatory pressures used for preload and end-feel moments at the time of articular sidebending and rotation diagnoses, manual pressures used to engage "the SD restrictive barrier" prior to HVLA, and the additional HVLA thrust pressure characteristics used during the OMT. Spineliner® tissue texture data was independently abstracted to analyze the percentage of OA SD showing statistically different fixation measures post-OMT.

CONCLUSION

Consistent intraoperator OA-C7 palpatory pressures were documented using IsoTOUCH® technology. Diagnostic tissue load averaged 1.35lbs (6N); 1.31lbs (5.83N) added to assess barrier end-feel. Consistent OMT pressure parameters were also documented for this singular form of OA SD HVLA.

During the treatment, after reaching the SD barrier, the treating physician employed an additional fractional-second force averaging 1.10lbs (4.89N) focused over occipital tissues. The preload over these tissues immediately before the final thrust averaged less than 3lbs and was essentially under 3.5lbs (15.57N) of pressure. Such parameters remained consistent between the subjects, despite the variable cervical tissue composition and musculature development.

RESULTS

Of 31 subjects with OA SD, 28 (90%) preferred the diagnosis of sidebending right, rotation left; 3 were diagnosed with a sidebending left, rotation right SD.

IsoTOUCH® data analysis revealed similar overall segmental diagnostic palpatory pressures from OA to C7 vertebrae in this population. Preload averaged 1.35lbs (6.00N) (95%CI=1.31-1.40lbs [5.83N-6.23N]) with end-feel pressures averaging 2.64lbs (11.74N) (95%CI=2.56-2.72lbs [11.39-12.09N]). The average difference between the preload and end-feel pressure was 1.31lbs (5.83N) (p<0.001) (*see figure 3).*

The overall treatment pressures for the OA SD averaged a preload pressure of 2.89lbs (12.86N) (95%CI=2.42-3.35lbs [10.76-14.90N]) and the final thrust pressures averaged 4.05lbs (18N) (95%CI=3.53-4.57lbs [15.70-20.33N]). The actual HVLA activating force averaged 1.10lbs (4.89N) (95%CI=0.83-1.36lbs [3.69-6.05N]) with a fractional-second duration. There was no significant difference between the end-feel diagnostic barrier and the preload used to contact the SD barrier prior to HVLA OMT *(see figure 3.)*

During HVLA OMT, audible cavitations were appreciated by the treating physician in 80% of the subjects. Manual physical re-examination by the treating physician after OMT was reported to show improved palpatory motion characteristics in 84% of the subjects. By comparison, the independent durometer data (by a blinded physician) documented an objective improvement of tissue texture changes for fixation (resistance) in 76% of the subjects (*see figure 4.)*

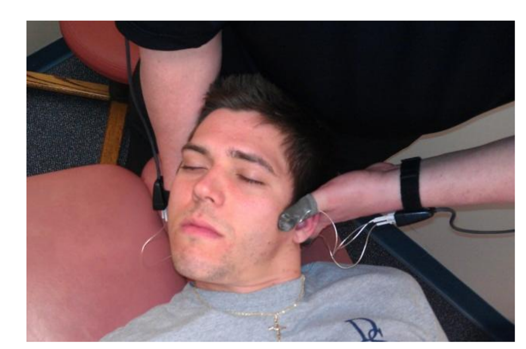


Figure 1: IsoTouch® palpation monitors in use

Figure 2: IsoTOUCH® cervical diagnostic palpation data recording

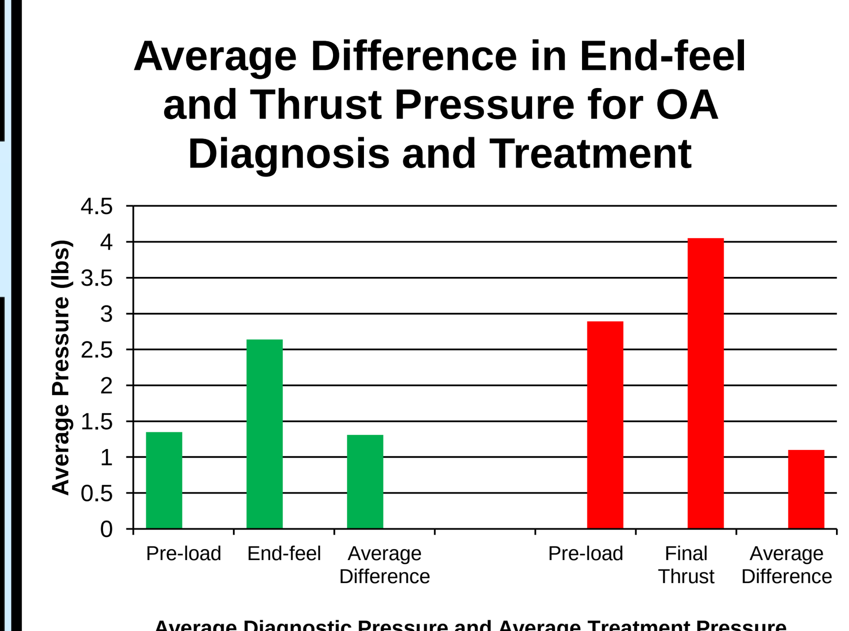


Figure 3: Average difference in diagnostic and treatment pressures. Also note that the diagnostic end-feel pressures are consistent with the amount of pressure used to set-up the tissues to the restrictive barrier prior to application of the HVLA thrust.

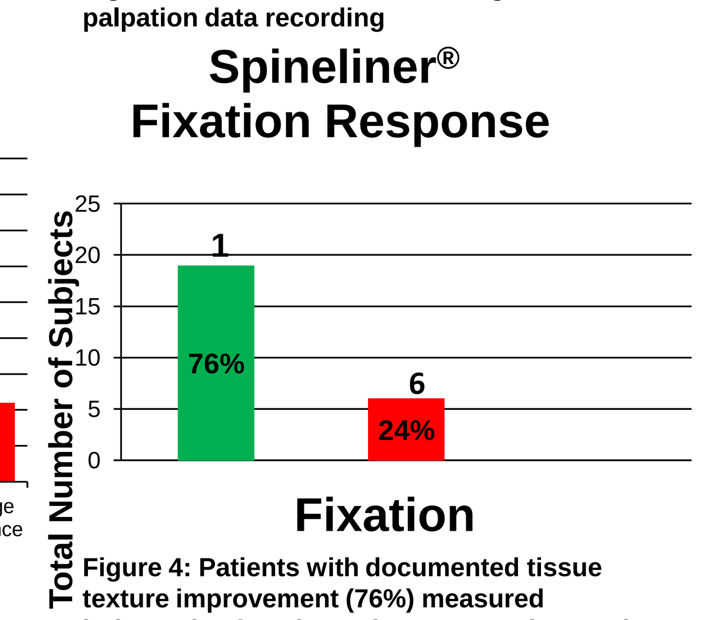


Figure 4: Patients with documented tissue texture improvement (76%) measured independently using a durometer. The treating physician reported audible cavitation (80%) and improvement in palpable motion changes (84%) after treatment of OA SD using HVLA OMT.

DISCUSSION

IsoTOUCH® technology appears capable of quickly and consistently measuring pressures used in the palpatory diagnosis and treatment of SD. Documentation of palpatory pressures will facilitate reproduction of these or similar techniques, helping to expand the evidence base for manual medicine. Furthermore, real-time feedback and comparison capabilities will likely aid those wishing to enhance manual palpatory diagnostic and OMT skills; this could also aid in the agreement phase of both intra- and inter-examiner studies.

Furthermore, objective durometer measurements of documented tissue texture change closely mirrors perceptions of clinical improvement in palpatory motion and tissue texture characteristics after treatment of OA SD using HVLA thrust OMT technique.

Acknowledgments: The researchers wish to thank Neuromuscular Engineering LLC for providing the IsoTOUCH® palpation monitor system and Sigma Instruments for the donation of the Spineliner® durometer system needed to objectively document change in the tissues tested before and after treatment.