

POSTER SUBMISSION EXAMPLES APTA'S Combined Sections Meeting

Research Report

TITLE: Postural Multi-Muscle Synergies: The Influence of Vision to the Distribution of Common Neural Inputs

ABSTRACT BODY:

Purpose/Hypothesis : Posture and postural reactions to mechanical perturbations require the harmonic modulation of the activity of multiple muscles. Temporal, spatial, and activation magnitude need to be controlled with precision. This precision can become suboptimal in the absence of optimal visual afference and result in higher fall risk and associated levels of comorbidity. This study was designed to further investigate the role of common neural inputs to the organization of multi-muscle synergies and the possible effects of disruption of visual input to this mechanism of control. Specifically, we investigated two hypothesis: [1] that correlated neural inputs is a mechanism used by the CNS to coordinate the formation of postural muscle synergies and [2] that this mechanism is affected by the interruption of visual input. Both hypotheses were investigated by analyzing the strength and distribution of correlated neural inputs to postural muscles during the execution of a quiet stance task.

Number of Subjects : 9

Materials/Methods : Nine participants, 4 females and 5 males, mean age 26 years old (\pm 2.7 SD), performed the task of standing up either with eyes opened (EO) or eyes closed (EC) for 30 seconds while the activity of six postural muscles was recorded by surface electrodes: soleus (SOL), biceps femoris (BF), lumbar erector spinae (ERE), tibialis anterior (TA), rectus femoris (RF), and rectus abdominis (RA). Intermuscular EMG-EMG coherence estimates were computed for 12 muscle pairs formed by these muscles including those pairs formed solely by either posterior, or anterior, or mixed (one posterior and one anterior) muscles.

Results : Intermuscular coherence was only found to be significant for muscle pairs formed solely by either posterior or anterior muscles and no significant coherence was found for mixed muscle, non-synergy pairs. Significant levels of intermuscular coherence estimations were only found within a distinct frequency interval bounded between 1-10 Hz for experimental situations where visual inputs were available (OE trials). Absence of visual information caused a significant decrease in intermuscular coherence within this same frequency interval of 1-10Hz

Conclusions : These findings are consistent with the hypothesis that organized distribution of correlated neural inputs one mechanism used by the CNS to assemble synergistic muscle groups. Further, this mechanism is affected by interruption of visual input.

Clinical Relevance : Increased risk of falls is possibly linked to impairments in the ability of the neuromuscular system to generate optimal multi-muscle synergies. This impairment can result from several factors including poor vision. This study has provided a step forward towards the understanding of mechanisms involved in the generation and distribution of motor inputs to postural muscles under circumstances of poor vision. In addition, this study prepares the foundation for future clinical studies focusing on interventions for individuals with balance disorders.

References (At Least 5 Within The Last 10 Years) (Abstract Submission - Research Report): Danna-dos-Santos A, Poston B, Jesunathadas M, Bobich LR, Hamm T, Santello M (2010) Influence of fatigue on hand muscle coordination and EMG-EMG coherence during three-digit grasping. *J Neurophysiol* 104: 3576-3587. Danna-dos-Santos A, Boonstra TW, Degani AM, Cardoso VS, Magalhaes AT, Mochizuki L, Leonard CT (2014) Multi-muscle control during bipedal stance: an EMG-EMG analysis approach. *Exp Brain Res*. Doi 10.1007/s00221-013-3721-z. Duarte M, Freitas SMSF (2010) Revision of posturography based on force plate for balance evaluation. *Rev Bras Fisiot (Brazilian Physiotherapy Journal)* 14.3: 183-192. Poston B, Danna-dos-Santos A, Jesunathadas M, Hamm TM, Santello M (2010) Force-independent distribution of correlated neural inputs to hand muscles during three-digit grasping. *J Neurophysiol* 104: 1141-1154. Boonstra TW, Daffertshofer A, Roerdink M, Flipse I, Groenewoud, Beek PJ (2009a) Bilateral motor unit synchronization of leg muscles during a simple dynamic balance task. *European Journal of Neuroscience* 29.3: 613-622. Boonstra TJ, van Wijk BCM, Praamstrad P, Daffertshofer A (2009b)

Special Interest Report

TITLE: Identifying Determinants of Low Back Pain Behaviors

ABSTRACT BODY:

Purpose : The purpose of this project is to explore patient knowledge and beliefs about:

- 1) LBP
- 2) clinician-patient shared decision making
- 3) what drives care seeking behavior.

Description : The study used a mixed methods approach.

Literature review: A systematic literature search was performed with a research librarian. Two researchers screened the references using pre-defined inclusion-exclusion criteria. Of the 1120 titles found, 47 met the inclusion criteria, were reviewed in full.

Structured interviews: Ten volunteer subjects were recruited at an urban specialty spine center for a semi-structured interview developed by a multidisciplinary team of LBP experts. The purpose was to explore topics related to the natural history, red flags and management of LBP. Themes were extracted using a phenomenological qualitative research approach to describe patient knowledge, desired care and provider interaction. Theory building was done using current evidence highlighting factors that result in requests for LBP treatment.

Summary of Use : Seventy-seven percent of eligible subjects (LBP >12 weeks) consented. Ten structured interviews (seven female) were completed, transcribed and coded for analysis. All but one subject (a physician) had sought care from more than one specialist. The major interview themes that emerged were that LBP patients: 1) lack information or are misinformed about the natural history and best evidence approach to managing low back pain; 2) have negative attitudes that result from dissatisfaction with health care encounters; 3) have clear expectations regarding patient-clinician interaction, and expected treatment and outcomes. Furthermore, misinformation, lack of information and dissatisfaction with health care encounters drive patients health care seeking behaviors. The literature supported these themes. Of the 47 articles fully reviewed, 35 were deemed admissible.

Importance to Members: The results of this pilot study identified key factors that drive LBP patients to seek care and their expectations regarding the health care encounter. The literature supports the data from this study, and reinforces the need to increase the evidence based approach to care, the efficacy of which has been demonstrated in numerous studies. Negative physician attitudes and beliefs limit adherence to LBP evidence-based guidelines, which may indirectly lead to chronicity and continued health care seeking by patients. In the absence of answers to their questions and unmet expectations in the clinician encounter, patients become frustrated and feel the need to seek further care, thereby driving the high costs associated with this prevalent condition.

ABSTRACT BODY: References (at least 5 within the last 10 years) (Abstract Submission - Special Interest Report):

1. Manchikanti L, Singh V, Datta S, et al. Comprehensive review of epidemiology, scope, and impact of spinal pain. *Pain Physician* 2009;12:E35-70.
2. Lin 20112. Ivanova JI, Birnbaum HG, Schiller M, et al. Real-world practice patterns, health-care utilization, and costs in patients with low back pain: the long road to guideline-concordant care. *Spine J* 2011;11:622-32.
3. Lin CW, Haas M, Maher CG, et al. Cost-effectiveness of guideline-endorsed treatments for low back pain: a systematic review. *Eur Spine J* 2011;20:1024-38.
4. Darlow B, Fullen BM, Dean S, Hurley DA, Baxter GD, Dowell A. The association between health care professional attitudes and beliefs and the attitudes and beliefs, clinical management, and outcomes of patients with low back pain: a systematic review. *Eur J Pain*. 2012 Jan;16(1):3-17.
5. Mafi JN, McCarthy EP, Davis RB, Landon BE. Worsening trends in the management and treatment of back pain. *JAMA Intern Med*. 2013 Sep 23;173(17):1573-81.

Case Study Report

TITLE: The Effect of REST Therapy On Hypertonicity And Function In Patients With Neurologic Dysfunction: A Case Series

ABSTRACT BODY:

Background & Purpose : Restricted Environmental Stimulation Therapy (REST) has been shown to induce a strong relaxation effect in normal populations. The purpose of this study was to explain and describe REST on hypertonicity, balance and gait, in individuals with neurologic dysfunction.

Case Description : Five participants, each clinically diagnosed with one of the following: Parkinson's disease (PD), cerebral palsy (CP), multiple sclerosis (MS) and cerebrovascular accident (CVA), were recruited from a physical therapy clinic in New York City. All individuals presented with hypertonicity of the lower extremity muscles, as determined by the Modified Ashworth Scale.

Outcomes : Pre-test velocity, cadence and step length measurements were recorded with the GAITRite™ Portable Walking System, functional mobility was measured with the Timed Up and Go (TUG) and spasticity was assessed with the Modified Ashworth Scale (MAS). Each participant then received a 60-minute REST treatment session. Post-test measures were taken immediately after the completion of a REST treatment session. All participants showed a decrease in MAS scores, indicating a decrease in spasticity and in TUG time, indicating an improvement in functional mobility. The greatest decrease was seen in the participant with CP, in both lower extremities from 2+ to a 1+. The greatest improvement in TUG time was in the participant with CP, from 53.1 seconds to 46.5 seconds. Increases were seen in gait velocity, cadence and step length, post-REST therapy. The greatest increase in gait velocity was shown in the participant with PD, an improvement from 112.5 cm/s to 126.5 cm/s. The greatest increase in cadence was shown in the participant with PD, from 94 steps/min to 101 steps/min. The greatest increase in step length was shown in the participant with CP, an improvement in right lower extremity step length from 28.32 cm to 37.39 cm.

Discussion : Spasticity, TUG, gait velocity, cadence and step length all improved after REST therapy. The outcomes of this case series suggest that REST therapy may be a viable treatment for patients with hypertonicity, though more research needs to be conducted through a randomized control trial. REST therapy appears to be a possible adjunct to physical therapy as a method of reducing hypertonicity and improving functional mobility before treatment sessions.