SCIENTIFIC SESSION II
FRIDAY, OCTOBER 4, 2019 | 3:30PM – 4:30PM

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Skin Temperature Asymmetry and Stimulated Skin Wrinkling: Reliability and Validity for Evaluating Obstetrical Brachial Plexus Injuries

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Purpose: Nerve injuries in adults are evaluated via sensation, manual muscle testing and nerve conduction studies. These evaluations are difficult, if not impossible, to perform in a wiggling infant or a young child who has not yet developed sufficient skill to follow instructions and provide verbal responses describing perception. This is further complicated in obstetrical brachial plexus injuries (OBPI), where there are no external cues (e.g. a laceration) to inform an anatomical hypothesis. Historically, evaluation of pediatric nerve injuries, including OBPI, rely on clinical observations of movement patterns, with the recent addition of limb length and circumference measures. Stimulated skin wrinkling in warm water or with EMLA has been proposed to supplement surgical decision-making, but the measurement properties have limited evidence.

Recent research in adults has suggested infra-red measures of skin surface temperature asymmetry may indicate nerve dysfunction, and graded ratings of EMLA-stimulated skin wrinkling have been proposed as a reliable method for identification of nerve injury. Given both these methods do not rely on substantial participant cooperation or verbal expression, there is an opportunity to evaluate their reliability and validity for pediatric nerve injury evaluation.

Methods: We conducted a cross-sectional measurement study in infants and children attending an OBPI clinic. We evaluated participants using 1) skin temperature asymmetry measures of distal cutaneous territories representing the median, ulnar, and radial nerves, 2) EMLA-stimulated skin wrinkling of the pulp of the index and small fingers (in children over age 2), and 3) digital photographs with polarized filters to allow image processing with TiVi software to analyze blood flow. We also extracted existing data on clinical evaluations of movement and nerve repairs (where applicable) from participant medical records for correlation.

Results: Data collection in this study is ongoing: however, to date we have evaluated 21 children. We will present analysis on 1) validity of skin temperature asymmetry using receiver operating curves to present ideal sensitivity and specificity of asymmetry in children with known nerve injury (post-repair) , agreement compared to measures of blood flow, and relationship to validated clinical assessments of movement patterns; 2) inter-rater reliability estimates for a wrinkle rating scale for EMLA-stimulated skin wrinkling measures in children.

Conclusion: This study will generate insight into the measurement properties of novel evaluations for pediatric nerve injuries, including OBPI.

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Purdue Manual Dexterity Scores: A Cohort Study of Community Dwelling Elderly

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Purpose: The Purdue Pegboard Test (PPT) is a manual dexterity test that requires the manipulation of pegs, washers, and collars. Our population for this research intervention focused on the geriatric community due to the lack of recent available normative data. Much of the existing data was collected using the Purdue Pegboard model 32020 which is no longer available for purchase. Our objective was to gather normative data for community-dwelling seniors. The purpose of this study was to provide updated normative data for hand therapists to use in clinical practice to determine if seniors have dexterity deficits.

Methods: This cohort study was completed through a convenience sample. Participants were stratified into three age groups (60-69, 70-79, and 80+). The study was approved by the University IRB committee. Before data was collected, the participants signed a written consent form. The Purdue Pegboard model used Model 32020A. The participants performed 3 trials of the Purdue Pegboard test following the standardized test instructions.

Data Analysis: Descriptive data was collected. The participants mean Purdue Pegboard scores were analyzed using a un- paired t-test to determine if there was a statisically significant diffference between male and female PPT mean scores. A one-way Analysis of Variance was used to compare the mean scores of each designated age group to determine if there was a statistically significant difference between the mean group scores.

Results: One hundred and twenty-eight participants were selected via convenience sample. The sample consisted of community dwelling seniors living a community in Florida. Fifty-nine males and sixty-nine females gave oral and written consent to participate in the study. Participants' ages ranged from 60-99. Approximately eighty percent of participants were right hand dominant and twenty percent were left hand dominant.

The entire senior population's mean Purdue Pegboard Test score for the right hand was =11, SD 2.68. left hand =10, SD 2.75, bilateral hands =8, SD 2.41, and assembly =28, SD 6.72. The highest score recorded for assembly task on the PPT, was 46 pieces and was achieved by the youngest participant in the sample. A 65-year-old female performed the lowest score recorded for assembly task on the PPT of 13 pieces. Scores were stratified into percentiles. A one-way analysis of variance reported statistically significant differences between the mean scores of the three age groups ($F = 15.03$, $P < .00$). The results found that those individuals who were younger (60-69) scored better on the assessment than those (80+).There was not a statistically significant difference between PPT mean scores of males and females.

Conclusion: Dexterity declines with age which may affect occupational performance over time. It is important that hand therapists compare patient performance scores to normative data to determine fine motor deficits and determine patient specific functional performance goals and interventions.

Percentiles	Right Hand	Left Hand	Both Hands	Right & Left & Both	Assembly
1	18	17	14	46	38
.99	18	17	14	43	37
.95	16	16	12	39	29
.90	14	14	11	36	26
.85	13	13	10	35	24
.80					
.75	12	11	9	32	23
.70					
.65	12	11	9	31	21
.60					
.55	11	10	8	29	19
.50	11	10	8	28	18
.45	10	9	8	27	18
.40					
.35	9	8	7	25	16
.30					
.25	9	8	6	23	14
.20					
.15	8	7	5	20	12
.10	7	6	5	19	11
.05	6.5	5	4	16	9
.01	4	2	3	13	7
$\bar{x}$	11	10	8	28	19
SD	2.68	2.75	2.41	6.72	6.40

Purdue Pegboard Score Percentile Performance of Seniors

Table 3
Mean Scores on Purdue Pegboard Test -A

	Right Hand	Left Hand	Both	Right, Left, & Both	Assembly
Males 60-69	11	10	8	29	20
Females 60-69	12	11	10	33	24
Males 70-79	10	10	8	27	18
Females 70-79	11	10	8	29	16
Males 80+	9	8	6	23	16
Females 80+	9	8	6	24	16

Table 5
Analysis of Variance

ANOVA					
RLB					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1113.344	2	556.672	15.027	.000*
Total	5743.875	127			

Analysis of Variance (ANOVA) was performed. The sum of right-hand trials, left-hand trials, and bilateral hand trials (RBL) was measured. Degrees of freedom (df). F, represents the F-Statistic which indicates variation between groups. A larger F-Statistic indicates greater variation.
Statistical Significance (Sig.) is presented through a P-value which is determined from the F-ratio and the degrees of freedom.
*indicates statistical significance.

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Characterizing Response to a Dynamic Stability Approach to Thumb Carpometacarpal Pain: A Retrospective Study

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Purpose:

- Since destabilizing changes occur in thumb Carpometacarpal (CMC) Osteoarthritis (OA), reeducating and strengthening the stabilizing muscles are believed to be critical.
- The thumb dynamic stability approach (Figures 1a-1c) intends to restore the web space, reeducate stabilizing muscles and includes client-specific joint protection training and orthotic interventions.
- There is sparse research on how patient characteristics may predict clients' responsive to this approach.
- This study Investigated response to a hand therapy dynamic stabilization program, including how various patient and treatment factors (age, OA stage, comorbidities, etc.) influenced responsiveness.

Methods: Design: Retrospective Cohort Design. Electronic medical record review of clients treated August 2009 to December 2015.

Inclusion Criteria: Presence of thumb pain, authorized release of records for research, attended hand therapy including evidence of participation and instruction in a dynamic stability approach.

Exclusion Criteria: only 1 therapy visit or report of QuickDASH score, no record of dynamic stability exercise, thumb fractures or tendon lacerations.

Measures:

- Response Variable: change in QuickDASH total disability score and percent change in NRS Pain score (0-10) from first to last visit
- Primary Predictor Variables: radiographic staging, cortisone injections, medical comorbidities.
- Secondary Predictor Variables: age, baseline QuickDASH score, affect hand(s), interaction between hand dominance and affected hand, orthosis type, number and frequency of therapy visits, and total duration of therapy.

Statistical Analyses:

- Descriptive statistics reported on demographics, response, and predictor variables.
- Paired T-test performed to compare pre and post QuickDASH scores ($p < .05$).
- Backwards stepwise mixed effects linear modeling analysis to test research question on predictive factors. β, standardized β, and the coefficient of determination were calculated.

Results:

- 265 individuals were treated for thumb CMC pain using a dynamic stability approach, ages 22 to 92.
- 143 of these had xrays, which were then staged. Linear modeling analysis results were limited to the 143 clients.
- Large significant effects on disability score (QuickDASH X=12.5; Cohen's d= .88) and Pain NRS (X=2.1 or cohen's d = .82). Change in both scales exceed the published MCIDs of 11.3 and 1.7 respectively.
- Significant predictors of QuickDASH Scores were OA stage, when the dominant hand was affected, and presence of a coexisting pain syndrome (fibromyalgia, CRPS). See figure 1d.
- Significant predictors of percent change in NRS Pain scores were Eaton OA stage, affected hand (bilateral vs. unilateral), and the presence of a metabolic condition (Diabetes, Thyroid Disorders). See Figure 1e.
- On average, clients with bilateral CMC pain improved in their NRS Pain Score by 12.8-14.3 fewer percentage points than those affected unilaterally.
- Clients with pain syndromes and systemic conditions responded less favorably, according to QuickDASH and NRS Pain findings.
- Clients with dominant thumb CMC pain, on average, improved by 8.3 fewer QuickDASH points than those with nondominant side CMC pain.
- Clients with Stage 1 OA, on average:
  1) had QuickDASH change scores 11.7 points higher than those with stage 4 wheres those with stages 2 and 3 only saw differences of 5.8 and 3.3 when compared to those with stage 4. Additionally, QuickDASH score change in those with Eaton stage 1 was significantly larger than those in stage 3 or 4; no other statistically significant differences were found.
  2) had 17.9% improvements in NRS Pain scores relative to stage 4 whereas stages 2 and 3 only experienced 5.3% and 2.7%