beneficial tool to objectively evaluate yoga pose performance for use in research, therapy, and instruction.
Clinical Relevance: Variations in upper extremity and trunk alignment may influence loads sustained at the hand-floor interface and may contribute to the development of wrist pain. Development of robust assessment instruments is a necessary precursor to develop effective evidence based guidelines for safe yoga practice. Longitudinal studies are underway to examine the role of kinematic deviations in the development of wrist pain in individuals who practice yoga.
Keywords: Wrist, Pain, Yoga.

7

Virtual Reality-Based Dance Gaming Improves Performance on an Instrumented Functional Arm Reach Task in Community-Dwelling Chronic Stroke Survivors

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Purpose/Hypothesis: The purpose of this study was to examine the feasibility and quantify the effect of virtual reality based dance training on the paretic upper extremity movement control on a reliable multi-planar, stand-reaching (i.e. functional) task in both flexion- and abduction directions.
Number of Subjects: Community dwelling chronic stroke survivors (n=11).
Materials/Methods: Community dwelling chronic stroke survivors (n=11) received a virtual reality based-dance paradigm for 6 weeks using the commercially available Kinect dance gaming "Just Dance 3 for one hour thirty minutes. The 6-week session was delivered in a high-intensity tapering method with first two weeks consisting of 5 sessions/week, next two weeks of 3 sessions/week and last two weeks of 2 sessions/week. Surface EMG and acceleration data were sampled one week pre-intervention (W1), on the 10th training session (W2) and one week post-intervention (W3) using wireless sensors from the prime movers, anterior and middle deltoid. Paired t-tests were conducted to compare response variables that were classified into performance-outcome (reaction time, time-to-peak and movement time) and performance-production (peak acceleration) between W1, W2 and W3 sessions.
Results: Post-training, participants demonstrated a significant improvement in performance outcome (i.e. shorter reaction time, time-to-peak and movement time) from pre- ($p < 0.05$) and 10th session training ($p < 0.05$) for both flexion- and abduction- reaching movements. There was a trend for peak acceleration to increase from 0.31 $\pm$ 0.33 on W1 to 0.51 467 $\pm$ 0.37 on W3.
Conclusions: The results demonstrated the feasibility and effectiveness of this virtual reality-based dance intervention in improving upper extremity performance on the instrumented functional arm reach test. Results, whilst encouraging, indicate that future studies with larger sample sizes and longer duration are necessary to determine its efficacy as a clinical intervention. Further, the intervention induced changes in upper extremity function and usage need to be examined as well.
Clinical Relevance: Findings in our study could have larger clinical implications as significant improvements were noted in motor recovery of upper-extremity when trained using a virtual reality-based dance rehabilitation. Incorporating virtual reality-based dance into clinical treatment program and assessing its long-term efficacy for translation into community rehabilitation and home therapy program is crucial, results from our study lend to a possibility that dance could be a feasible intervention for individuals with chronic stroke.
Keywords: Stroke, Upper extremity, Virtual reality-based dance.

8

Dynamic Fingertip Force Variability in Individuals With Parkinson's Disease

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Purpose/Hypothesis: Individuals with Parkinson's disease (PD) experience gradual deterioration of dexterous manipulation. Despite dexterous object manipulation requires sophisticated dynamic control of fingertip force vector, current clinical evaluations lack appropriate techniques to quantify changes in dynamic control of fingertip force with disease progression. The Strength-Dexterity (S-D) test has shown its utility to measure such changes in healthy and pathological populations, however, different degrees of motor symptoms between hands, which are common in PD, were not considered in the previous study. Therefore, the goal of study is to investigate dynamic fingertip force control in the more- and less-affected hands, and how they are associated with motor severity measured by Unified Parkinson's Disease Rating Scales (UPDRS).
Number of Subjects: 20.
Materials/Methods: A total of 20 individuals with PD (69.0 $\pm$ 7.4 yrs, 11M, 9F, H&Y 1-3) participated in the study. The participants were asked to compress a slender spring with the thumb and index finger without buckling and maintained the compression for 5 seconds. The spring was designed to be impossible to compress fully, and the maximal level of compression that is sustained reflects the integrity of the sensorimotor system for object manipulation. Fingertip force was measured by miniature load cells in the compression direction, and the signals were sampled at 400Hz. We measured the maximal sustained compression force (F) and quantified force variability at two frequency bands: standard deviation of sustained force at $<$ 4Hz (F_LF), and RMS of sustained force at 4-12Hz (F_HF) that includes tremor frequency. The force measures were further correlated with UPDRS motor scores (the total, hand-only, and non-hand motor). We used a permutation test on paired-differences between the hands and the Spearman's rho rank correlation.
Results: The more-affected hand exhibited significantly lower F and lower F_LF than those in the less-affected hand. The more-affected hand showed significant negative correlations between F_LF and the UPDRS motor scores for both total and hand-only, suggesting that greater force variability in the voluntary range was associated with less clinical motor impairment.
Conclusions: Measures of force variability during the performance of the Strength-Dexterity test hold potential as objective clinical assessment tool in PD, and may be a useful addition to current clinical assessments for characterizing and tracking the severity of both hand and general motor impairment.
Clinical Relevance: Loss of manual dexterity can impact functional independence and quality of life. Our measures appear to be informative of symptom severity in PD, and may prove valuable for monitoring changes in motor impairment, determining dosages for medication, appropriate parameters for deep brain stimulation, or even for early detection of PD. What's more, such dynamical tasks may also be used for rehabilitation to improve sensorimotor function in dexterous manipulation in clinical populations by challenging the motor system at the edge of instability.
Keywords: Dynamic force control, Hand dexterity, Parkinson's disease.