

Investigation of the Trunk Inclination Positioning Angle on Swallowing and Respiratory Function

Authors : Hsin-Yi Kathy Cheng, Yan-Ying JU, Wann-Yun Shieh, Chin-Man Wang

Abstract : Although the coordination of swallowing and respiration has been discussed widely, the influence of the positioning angle on swallowing and respiration during feeding has rarely been investigated. This study aimed to investigate the timing and coordination of swallowing and respiration in different seat inclination angles, with liquid and bolus, to provide suggestions and guidelines for the design and develop a feedback-controlled seat angle adjustment device for the back-adjustable wheelchair. Twenty-six participants aged between 15-30 years old without any signs of swallowing difficulty were included. The combination of seat inclinations and food types was randomly assigned, with three repetitions in each combination. The trunk inclination angle was adjusted by a commercialized positioning wheelchair. A total of 36 swallows were done, with at least 30 seconds of rest between each swallow. We used a self-developed wearable device to measure the submandibular muscle surface EMG, the movement of the thyroid cartilage, and the respiratory status of the nasal cavity. Our program auto-analyzed the onset and offset of duration, and the excursion and strength of thyroid cartilage when it was moving, coordination between breathing and swallowing were also included. Variables measured include the EMG duration (DsEMG), swallowing apnea duration (SAD), total excursion time (TET), duration of 2nd deflection, FSR amplitude, Onset latency, DsEMG onset, DsEMG offset, FSR onset, and FSR offset. These measurements were done in four-seat inclination angles (5°, 15°, 30°, 45°) and three food contents (1ml water, 10ml water, and 5ml pudding bolus) for each subject. The data collected between different contents were compared. Descriptive statistics were used to describe the basic features of the data. Repeated measure ANOVAs were used to analyze the differences for the dependent variables in different seat inclination and food content combinations. The results indicated significant differences in seat inclination, mostly between 5° and 45°, in all variables except FSR amplitude. It also indicated significant differences in food contents almost among all variables. Significant interactions between seat inclination and food contents were only found in FSR offsets. The same protocol will be applied to participants with disabilities. The results of this study would serve as clinical guidance for proper feeding positions with different food contents. The ergonomic data would also provide references for assistive technology professionals and practitioners in device design and development. In summary, the current results indicated that it is easier for a subject to lean backward during swallowing than when sitting upright and swallowing water is easier than swallowing pudding. The results of this study would serve as the clinical guidance for proper feeding position (such as wheelchair back angle adjustment) with different food contents. The same protocol can be applied to elderly participants or participants with physical disabilities. The ergonomic data would also provide references for assistive technology professionals and practitioners in device design and development.

Keywords : swallowing, positioning, assistive device, disability

Conference Title : ICHMSP 2024 : International Conference on Human Movement Science and Psychology

Conference Location : New York, United States

Conference Dates : August 08-09, 2024