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# The use of immersive 360° videos to induce different strategies of postural control

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## Background

Visual perception is a decision-making process of the central nervous system based on recognitions of relative distances and velocities between objects. With the input from visual perception, an appropriate postural control is applied to maintain balance. (1-3)

Previous studies on how visual perception affects the postural control were only in one direction. (4,5) Therefore, this study used immersive 360° videos to identify how visual perception affects the postural control in multiple directions.

## Hypothesis

We hypothesized that video with more turns could induce more ML (medial-lateral) body sway, and video with higher elevation could induce more AP (anterior-posterior) body sway.

## Subjects

Nineteen healthy young adults (aged 20-31; 12 females) were recruited in this study. All subjects were free of any neurological and musculoskeletal problems and had normal or corrected normal visual acuity.



Figure 1: Sitting trial (left) and standing trial (right)

## Method

A Wii Board (Nintendo, Redmond, WA) was used to measure body sway. A smart phone placed in a pair of goggles displayed three 360° videos: 1) a static room (baseline); 2) a roller coaster (MA) at a height of 205 feet with two intense hills, several small hills and one helix; and 3) a roller coaster (PA) at a height of 149 feet with one intense hill, one big loop and one quick corkscrew. Three standing trials on the Wii Board and three sitting trials on the Wii Board placed on a chair were randomly performed. (Figure 1) After each trial, subject rated their fear of falling (FOF) by using visual analog scale. Dependent variables were body sway range (distance in AP and ML directions of the center of pressure trajectory) and FOF grading (0-100). Two separate two-way repeated ANOVA measures were used to examine the interactions between the postural effect (sit/stand) and the visual effect (three videos) on body sway range and FOF.

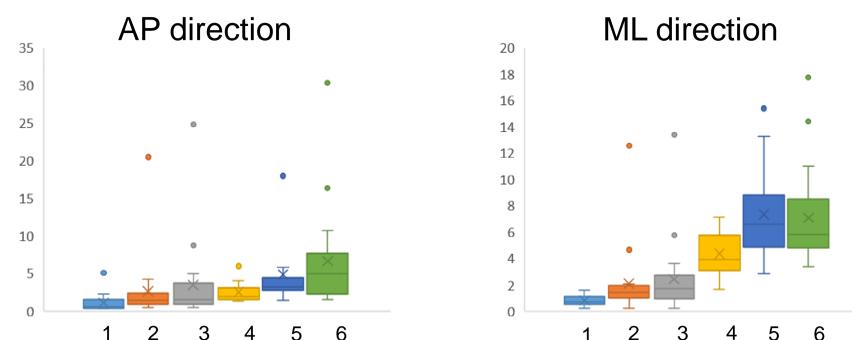


Figure 2: Body sway range in AP and ML directions (1: Sit\_baseline; 2: Sit\_MA; 3: Sit\_PA; 4: Stand\_baseline; 5: Stand\_MA; 6: Stand\_PA)

## Results

A significant interaction was found in body sway range in AP ( $F=4.34$ ,  $p=0.02$ ) and ML directions ( $F=5.37$ ,  $p=0.009$ ). (Figure 2) The post-hoc comparisons indicated that body sway range was larger in standing than sitting in both directions ( $p_{AP}=0.008$ ,  $p_{ML}<0.001$ ). Baseline body sway range in AP direction was smaller than in viewing MA ( $p=0.016$ ) but no difference than in viewing PA ( $p=0.05$ ). However, in ML direction, baseline body sway range was smaller than in viewing both MA ( $p=0.01$ ) and PA ( $p=0.002$ ). Both PA and MA induced higher FOF than baseline ( $p<0.001$ ), and the FOF was higher in viewing PA than MA ( $p=0.016$ ).

## Conclusion & Clinical Relevance

Different 360° videos induced different postural control strategies in AP and ML directions in young adults. The visual perception affected more in ML than AP direction.

Based on the active control hypothesis, higher level of imbalance requires higher active control to maintain balance. (6) Increasing FOF indicated that 360° videos could pose an environment with certain postural threat, and rotational roller coaster (PA) induced higher FOF than taller roller coaster (MA).

Since ML direction is more sensitive to postural threat, ML balance training should be emphasized for patients with compromised balance to reduce falls risk. The immersive 360° video could be a useful tool in generating challenging environments for clinical use and research.

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