Abstract for ISPGR 2014

Validity and reliability of dynamic visual acuity (DVA) measurement during walking

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BACKGROUND AND AIM:

DVA is primarily subserved by the vestibulo-ocular reflex mechanism. Individuals with vestibular hypofunction commonly experience highly debilitating illusory movement or blurring of visual images during daily activities possibly, due to impaired DVA. Even without pathologies, gradual age-related morphological deterioration is evident in all components of the vestibular system. We examined the construct validity to detect age-related differences and test-retest reliability of DVA measurements performed during walking.

METHODS:

Healthy adults were recruited into 3 groups: 1. young (20-39years, n=18), 2. middle-aged (40-59years, n=14), and 3. older adults (60-80years, n=15). Randomly selected seven participants from each group (n=21) participated in retesting. Participants were excluded if they had a history of vestibular or neuromuscular pathologies, dizziness/vertigo or >1 falls in the past year. Older persons with MMSE scores <29/30 were excluded to minimize cognitive errors. Participants' age, height, weight and normal walking speed were recorded. The binocular DVA was measured while walking on a treadmill1 at 0.8 m/s, 1.0 m/s and 1.2 m/s speeds. The walking speeds chosen represent a range of slow to moderate walking speeds for adult life span in participants who have no current mobility problems. The monitor that displayed Landolt 'C' optotypes was placed at 50 cm from the eyes for nearDVA (primary compensation by otolith organs) and at 3.0 m for farDVA (primary compensation by semicircular canals). A mixed factor ANOVA (age group x speed) was performed separately for the Near and FarDVA for detecting group differences. Intraclass correlation coefficients (ICCs) were calculated for each condition to determine test-retest reliability.

RESULTS:

The three age groups were not different in their height, weight and normal walking speed ($p>0.05$). The post hoc analyses for DVA measurements demonstrated that each group was significantly different from the other two groups for Near as well as FarDVA ($p<0.001$-$p=0.031$). The effect of speed was significant for both NearDVA ($p=0.012$) and FarDVA ($p=0.014$), however, there was no age group x speed interaction (FarDVA $p=0.607$, NearDVA $p=0.343$). The ICCs for Near and FarDVA ranged between 0.85-0.88 and 0.71-0.87, respectively.

CONCLUSIONS:

Differences in DVA between the three age groups were detected by using both Near and FarDVA protocols irrespective of the walking speed. Therefore, age group-specific reference values should be used for detecting malfunction. Further, consistency in walking speed is critical for comparing between

studies. NearDVA at all walking speeds and FarDVA at the speed of 1.2 m/s demonstrated excellent test-retest reliability. FarDVA at 0.8 m/s and 1.0 m/s demonstrated good test-retest reliability (ICCs 0.71 and 0.77, respectively).

REFERENCES

1. Peters BT, Bloomberg JJ. Acta Otolaryngol 125(4):353-7, 2005