Forward Head Posture in Older Subjects is Associated with Executive Deficits

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Introduction

Forward Head Posture (FHP) is the tendency to carry one's head forward of one's torso. FHP has been associated with numerous health problems, including:

- ❖ neck pain[1]
- ❖ carpal tunnel syndrome[2]
- ❖ headaches[3]
- ❖ reduced lung capacity[4]

and, in older people,

- ❖ increased fall risk[5]
- ❖ higher mortality[6]

Although FHP tends to increase with age[7], it is not directly attributable to physiological causes such as osteoporosis[6]. Thus, it is important to consider possible alternative factors.

Some aspects of posture, such as balance during gait, have recently been shown to be associated with **executive functions (EF),** the high level cognitive processes that organize and order behavior[8-10]. ***Therefore, we hypothesized that EF is associated with postural alignment, as characterized by FHP.***

Study Goal: To investigate the possible relationship between FHP and specific aspects of cognition in older adults

Methods

Subjects:

- ❖ 53 neurologically healthy adults (part of a larger study)
  - Exclusions: neurological disease , history of stroke, brain surgery
- ❖ aged 50-86 (median 67)
- ❖ 62% female
- ❖ 11-20 years of education (median 16)

Measures:

- ❖ FHP: Subjects were instructed to stand normally. Neck angle (tragus-C7) was measured from horizontal with an inclinometer. FHP is characterized by smaller than normal neck angles.
- ❖ Cognitive function: We tested executive and non-executive cognitive functions. EF tasks were grouped as proposed by Miyake[11] into inhibition, task switching, and working memory categories, with the addition of verbal fluency[12]. Non-EF tasks focused mostly on memory.

Analysis: We computed correlations between neck angle and performance on cognitive tasks, with and without corrections for age.

Stimuli for the Stroop task

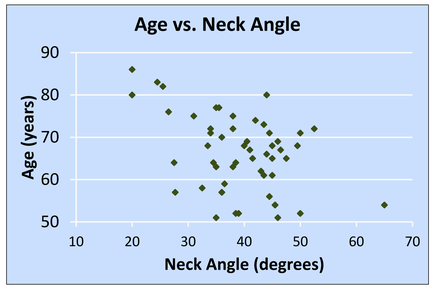
RED BLUE GREEN PURPLE BLACK

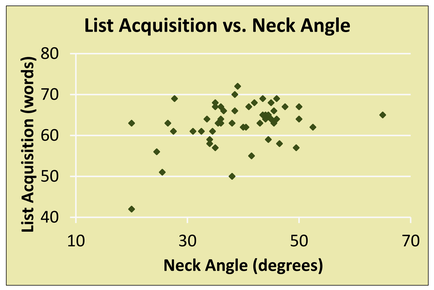
Results

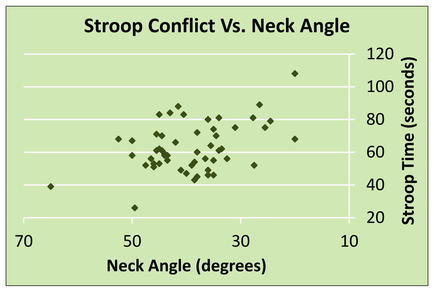
DEMOGRAPHICS		Uncorrected		Age-Corrected	
Correlations	N	R	P	R	P
Age	53	.421	.002		
Years of Education	53	-.178	.202	.255	.068
Number of Medications	33	.170	.345	-.134	.464
Gender (point-biserial)	53	.160	.252	-.154	.276
Arthritis Severity	53	.037	.793	.034	.811

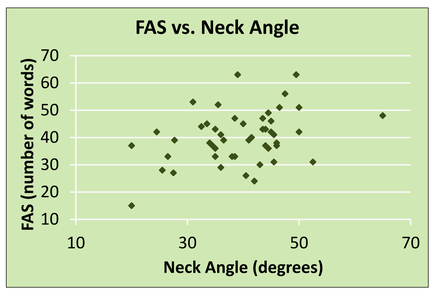
MEMORY		Uncorrected		Age-Corrected	
Correlations	N	R	P	R	P
List Acquisition	53	.353	.010	.181	.198
Delayed Recall	53	.367	.007	.215	.126
Prose Recall	53	.012	.933	-.170	.227
Task Recall	53	.170	.223	.105	.458
Prospective Memory	53	.128	.361	.052	.714
Spatial Span Forward	52	.177	.209	.133	.354
Facial Recognition Memory	53	.080	.569	.056	.695

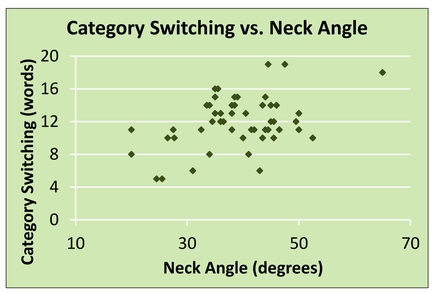
EXECUTIVE FUNCTION			Uncorrected		Age-corrected	
Category	Task	N	R	P	R	P
Inhibition	Stroop Conflict	53	.440	.001	.312	.024
Task Switching	Trails B-A	53	.281	.042	.154	.275
	Category Switching	53	.427	.001	.303	.029
Working Memory	Backward Digit Span	53	.123	.382	.136	.337
	Backward Spatial Span	52	.184	.192	.111	.439
Verbal Fluency	Phonemic Fluency (FAS)	52	.369	.007	.329	.019
General	Frontal Assessment Battery	53	.147	.293	-.020	.887











- ❖ Neck angles averaged 37 degrees, which is about 13 degrees less than what is typically seen in healthy young adults.
- ❖ Some items in the tables have been reverse-scored so that a higher score always indicates better performance, and a positive correlation means that FHP is associated with poor task performance.

Conclusions

- ❖ FHP in healthy older adults is associated with deficits in EF, including inhibition, task switching, and verbal fluency.
- ❖ List learning, the only aspect of memory that correlated with FHP, was recently shown to be related to EF in subjects with Parkinson's disease.[13]
- ❖ The results are consistent with recent findings that EF is associated with deficits in postural control in Parkinson's disease[8].
- ❖ Do these correlations indicate an underlying causal relationship?
  1. FHP could interfere with blood flow to the brain, thus affecting the most fragile cognitive functions (EF).
  2. Inhibitory deficits could cause people to allow the head to move ahead of the body, and this "head leading" posture could become habitual.
- ❖ Further studies will explore these possibilities.

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