Spontaneous speech based web screening test for MCI

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Background / Aim

Even today there is a great diagnostic uncertainty in the prodromal stages of Alzheimer's disease (AD). Our recent effort has focused on the very earliest detectable indicators of cognitive decline in mild cognitive impairment (MCI). Since language impairment has been demonstrated even in the mild stage of AD (1), the aim of the present study was to develop a sensitive neuropsychological screening method based on a memory task triggered by spontaneous speech which could be suitable for recognition the MCI via internet based interactive computerized test and software in the future.

Methods

Participants of the study:
- 25 normal controls (NC)
- 25 clinically diagnosed MCI patients.

Spontaneous speech was generated. Among the phonological parameters, speech tempo, hesitation ratio, length of silent and filled pause, number of filled pause and length of utterance were measured.

Additionally four dementia diagnostic tests were assessed: the Clock Drawing Test (CDT) (2), the Mini-Mental State Examination (MMSE) (3), the Alzheimer Disease Assessment Scale (AGAS-Cog) (4) and the Early Mental Test (EMT) (5).

Main results

Significant difference was found in speech tempo in the delayed recall task ($p = 0.025$), as well as in the length of silent breaks during the spontaneous speech task ($p = 0.04$). The differences between the experimental groups were more prononuced in the spontaneous speech and in the delayed recall task compared to the immediate recall task.

The phonological analysis of the spontaneous speech did show difference between the examined groops in articulation rate, speech tempo, silent pause, hesitation ratio, lenght of utterance and break-to-utterance ratio.

	Age	Years of education	MMSE	CDT	ADAS-Cog	EMT
NC (n = 25) (mean ± S.D.)	71.6 ± 6.54	13.56 ± 2.94	29.04 ± 0.88	9.12 ± 1.87	8.84 ± 2.15	78.07 ± 16.85
MCI (n = 25) (mean ± S.D.)	74.8 ± 6.33	11.08 ± 2.87	27.04 ± 0.93	6.76 ± 3.26	11.81 ± 2.89	52.81 ± 20.23
Statistics (t and *p* values)	t(48) = -1.756 $p = 0.08$	t(48) = 2.978 $p = 0.005$	t(48) = 7.754 $p < 0.001$	t(47) = 3.09 $p = 0.003$	t(46) =-3.99 $p < 0.001$	t(27) = 3.597 $p < 0.001$

Table 1. Demographic description and results of dementia tests of the normal controll (NC) and patient group (MCI)
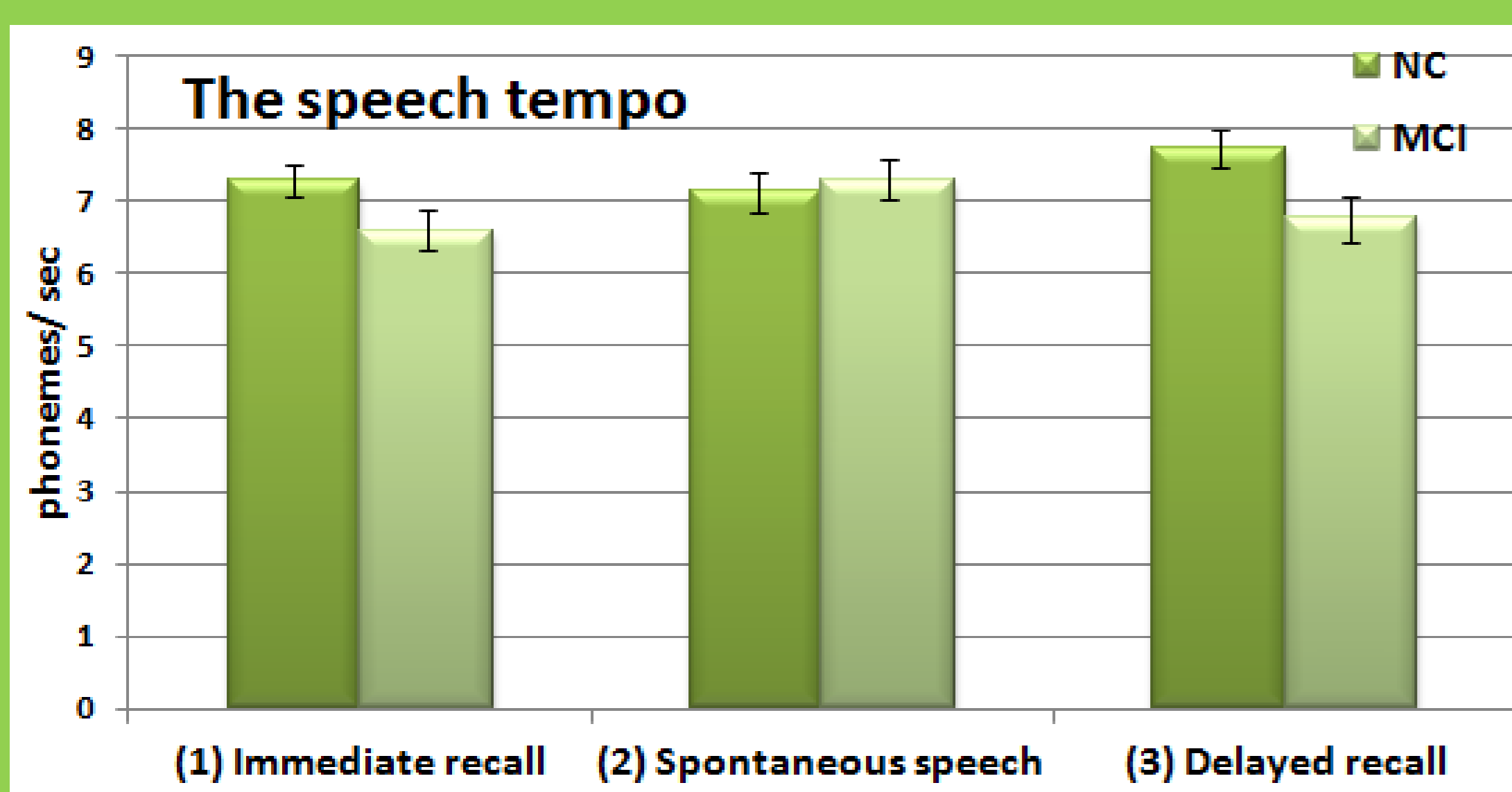

Figure 1. Results of speech tempo: (1) t(48) = 1.899; p = 0.064; (2) t(48) = -0.419; p = 0.677; (3) t(48) = 2.316; p = 0.025
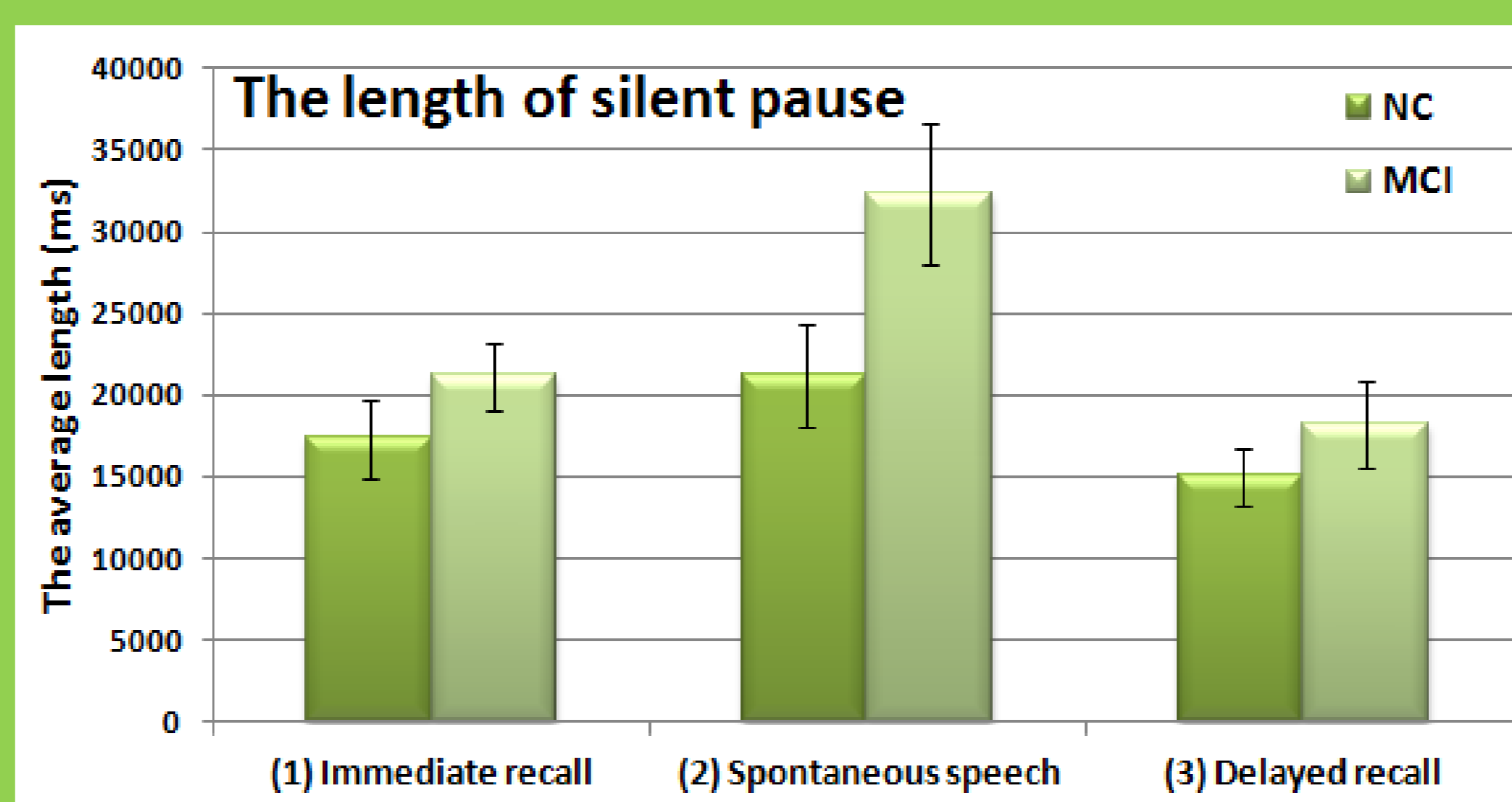

Figure 2. Results of silent pause: (1) t(48) = -1.198; p = 0.237; (2) t(48) = -2.059; p = 0.04; (3) t(48) = -1.003; p = 0.321
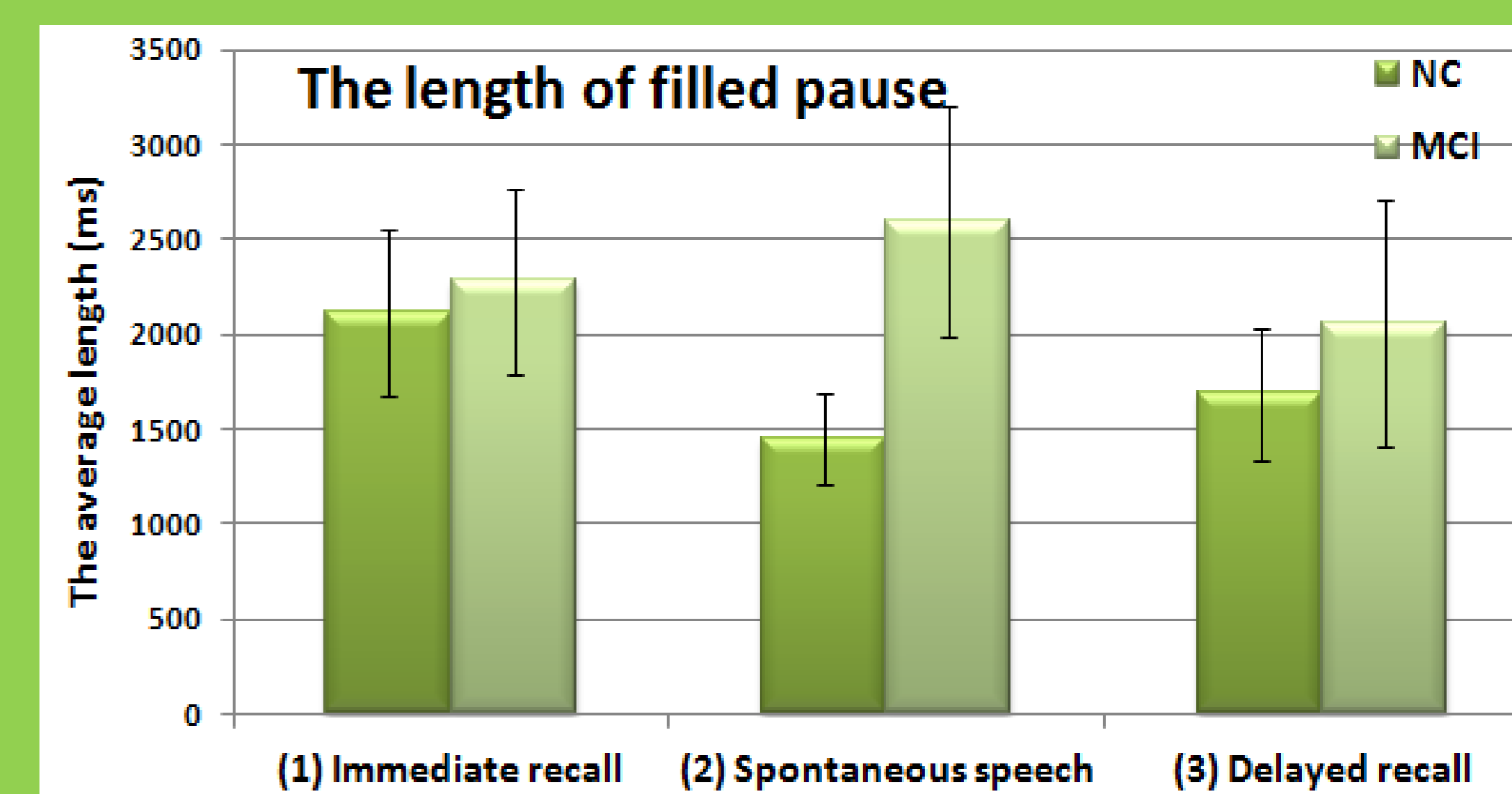

Figure 3. Results of length of filled pause: (1) t(48) = -0.254; p = 0.801; (2) t(48) = -1.739; p = 0.08; (3) t(48) = -0.502; p = 0.618
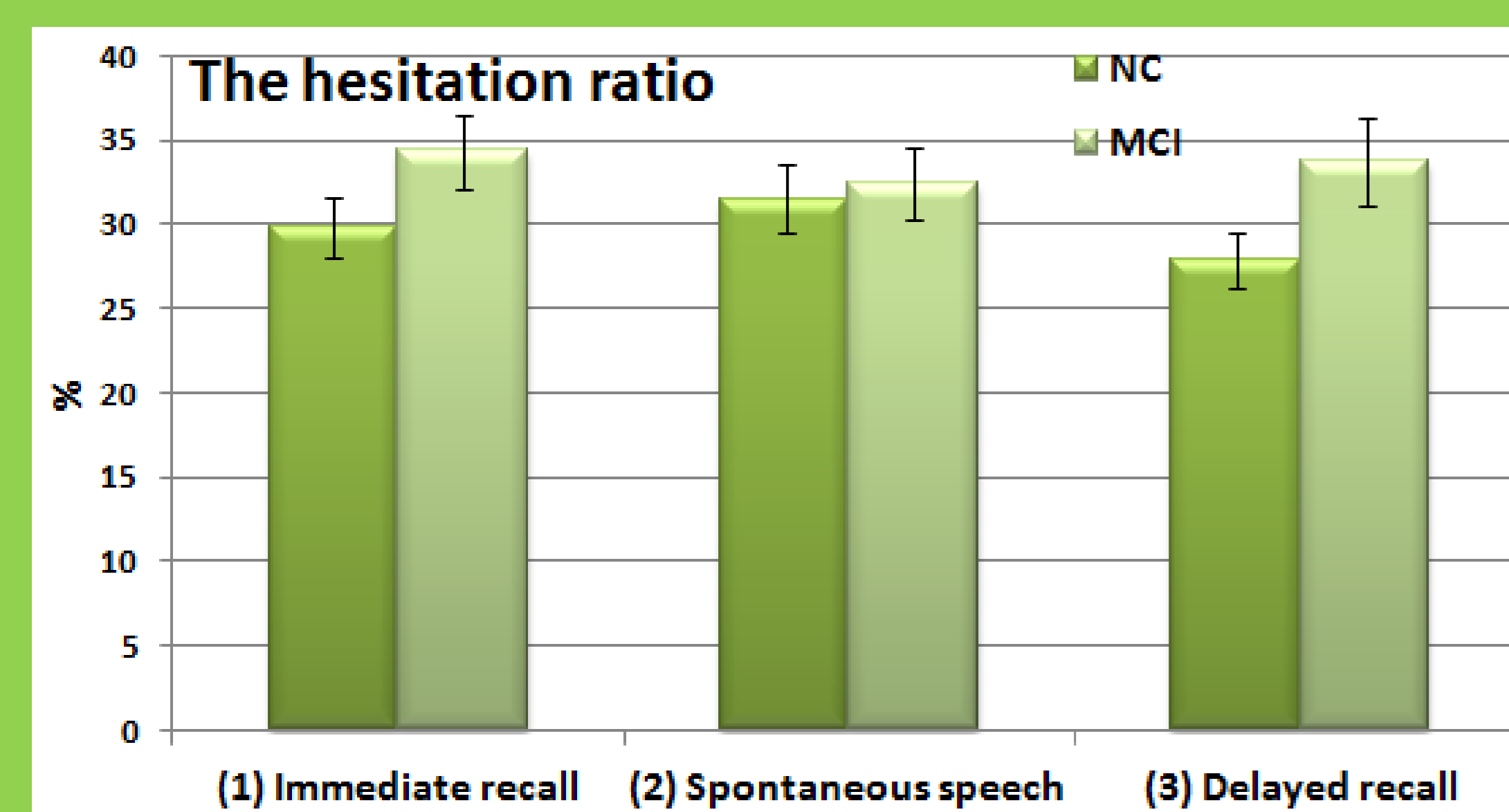

Figure 4. Results of hesitation ratio: (1) t(48) = -1.558; p = 0.126; (2) t(48) = -0.332; p = 0.741; (3) t(48) = -1.88; p = 0.06
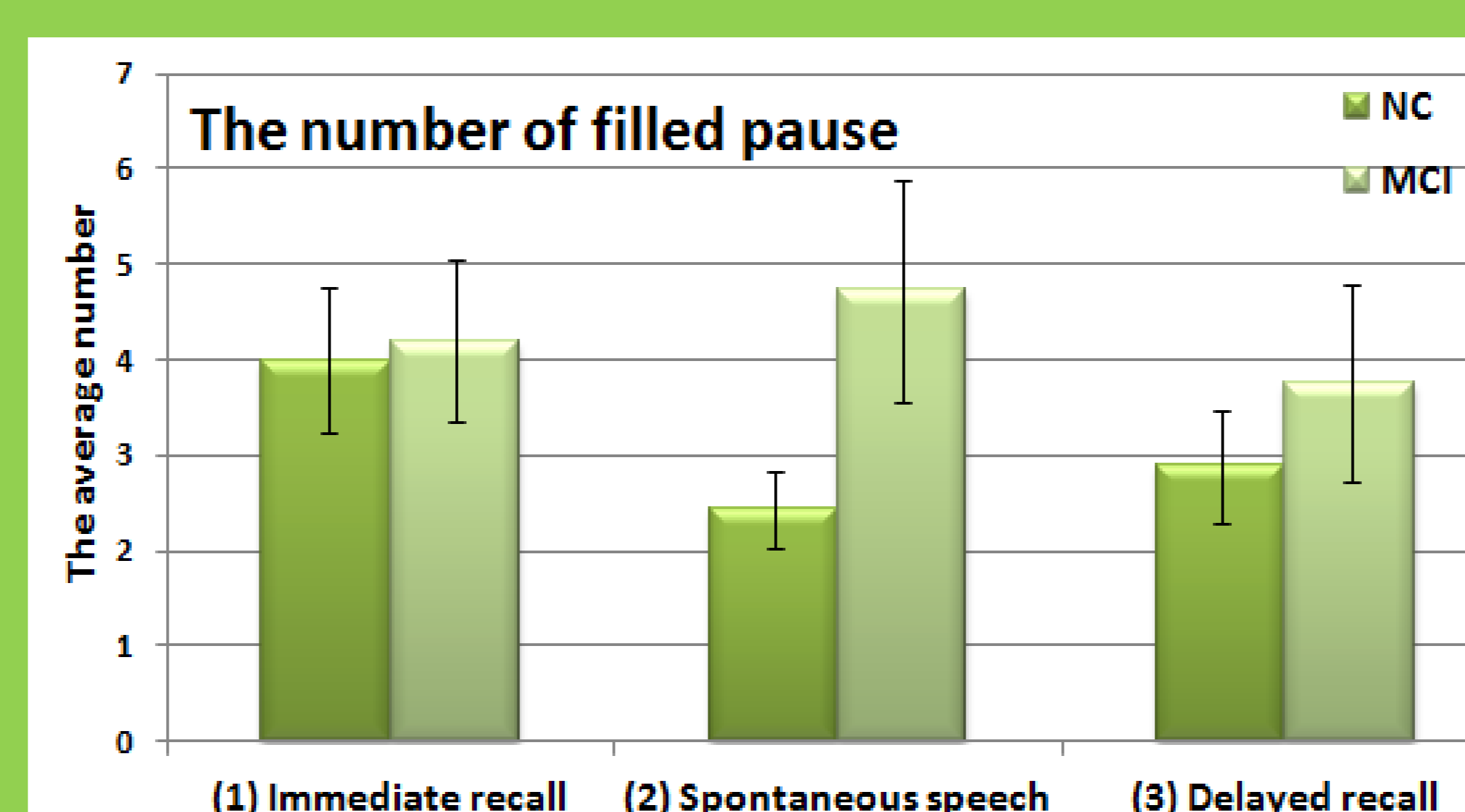

Figure 5. Results of number of filled pause: (1) t(48) = -0.175; p = 0.862; (2) t(48) = -1.842; p = 0.072; (3) t(48) = 0.736; p = 0.465
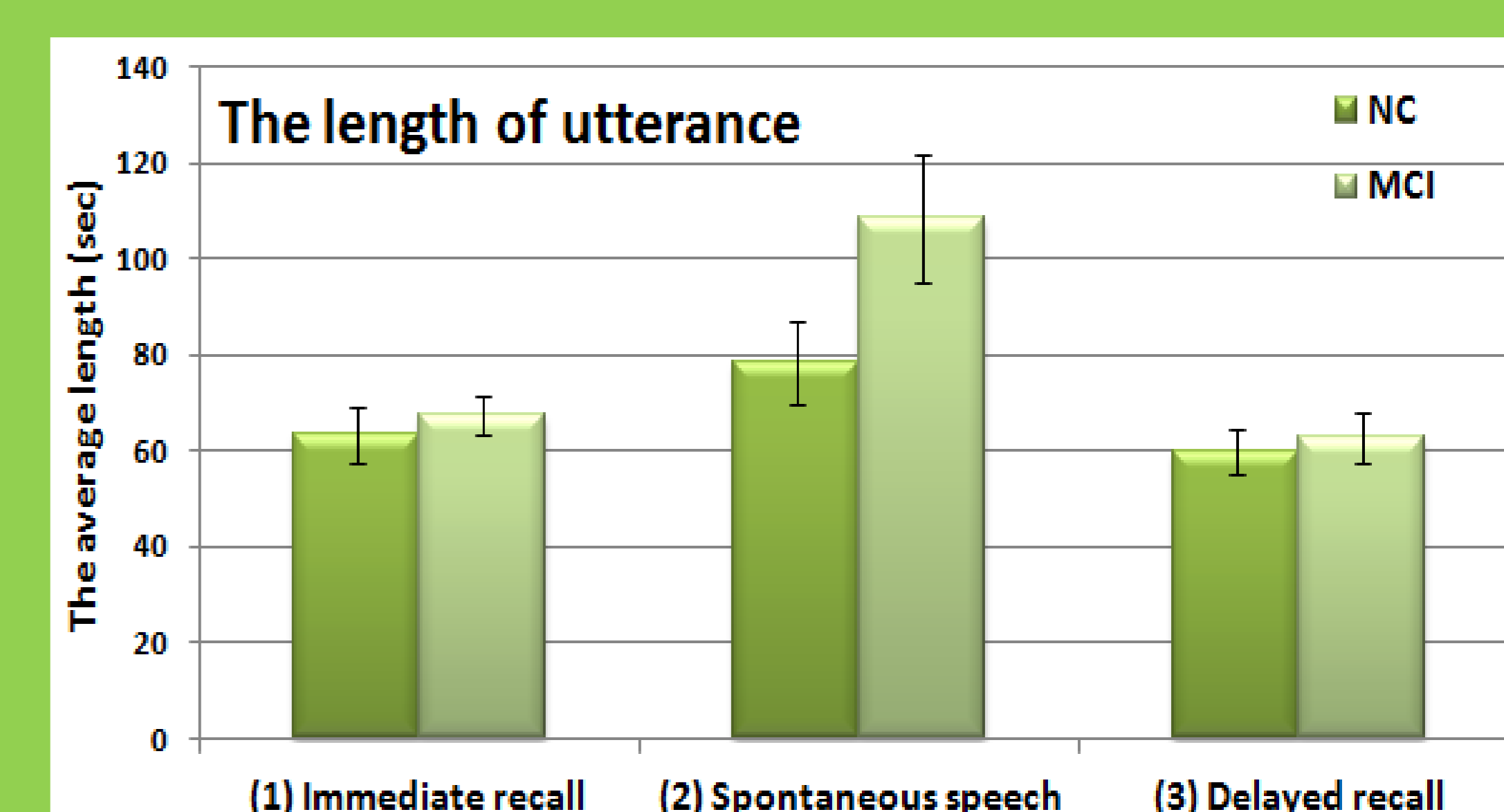

Figure 6. Results of length of utterance: (1) t(48) = -0.593; p = 0.556; (2) t(48) = -1.883; p = 0.06; (3) t(48) = -0.388; p = 0.7

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Conclusion

The higher hesitation ratio of MCI group might reflect increased recall time. It is likely that the phonological analysis of spontaneous speech in our design could be a valuable prototype of a new, sensitive web based tool for screening MCI in the community.

MAGYARORSZÁG MEGÚJUL

A projekt az Európai Unió támogatásával, az Európai Szociális Alap társfinanszírozásával valósul meg.

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