Usability and validity of a phone battery to assess language functions in brain tumor patients undergoing awake surgery

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Introduction

Awake surgery in eloquent brain regions is performed to preserve language functions. Although in general no major permanent language deficits are found after awake brain surgery, clinically relevant impairments are detected and language recovery takes longer than the generally assumed 3 months. Unfortunately, follow-up of tumor patients in the San Francisco (California) area is difficult since most patients are not local and come from far. Therefore, we developed a short language phone battery for pre- and postoperative language assessments.

Methods

- Phase 1: task and item selection of the phone battery
  - Two parallel versions (AB)
  - Controlled for linguistic variables
- Phase 2: clinical use of the phone battery in 10 tumor patients
  - pre- and postoperatively (1 week, 1 month, 3 months)
  - 5 patients ABAB, 5 BABA
  - 10 age, gender & education matched controls (AB)

Task	Example Stimulus
Comprehension screening (n = 5) *(Adapted from WAB[4])*	Answer yes or no: 1. Is your name Smith? 2. Do you eat a banana before you peel it?
Phonological & semantic fluency *(Adapted from WAB[4])*	1. Name as many animals as you can in one minute. 2. Name as many words that start with the letter F as you can in one minute.
Word & sentence repetition (n = 10) *(Adapted from WAB[4], BDAE[2])*	Repeat after me: 1. Bed 2. Screwdriver 3. Methodist episcopal 4. He unlocks the heavy oak door.
Semantic noun & verb selection (n=10) *(Adapted from DuLIP[1])*	Which word does not fit? 1. Banana, apple, carrot 2. Walk, ride, run
Verbal naming test *(Adapted from verbal NT Yochim et al.[7])* (n = 25)	What is the name of… 1. A baby cat? 2. What ice does when it gets hot?
Story completion (n = 5) *(Adapted from Goodglass Story Completion[3])*	Complete the story: 1. My dog is hungry and I have a bone in my hand. What next? 2. The mouse was running around. A cat came along. The mouse did not see the cat running after him. What happened to the mouse?
Sentence completion (n = 10) *(Adapted from DuLIP[1])*	Complete the sentence in a meaningful way: 1. The man knows that… 2. I'll do it when…

Results

- Phase 1: task and item selection of the phone battery
  - No significant differences between version A & B
- Phase 2: Tumor group vs matched controls:
  - Pre: naming, phonological & semantic fluency impaired
  - Post 1w: all language tasks impaired
  - Post 1m/3m: sem selection, phon & sem fluency impaired
- Phase 2: Different time points within tumor group
  - Post 1w: significant decline for all tasks (vs pre)
  - Post 3m: significant improvement for all tasks (vs post 1w)
  - Semantic tasks: significant improvement during course

Phonological Task Performance

Phonological Task Performance

Syntactic Task Performance
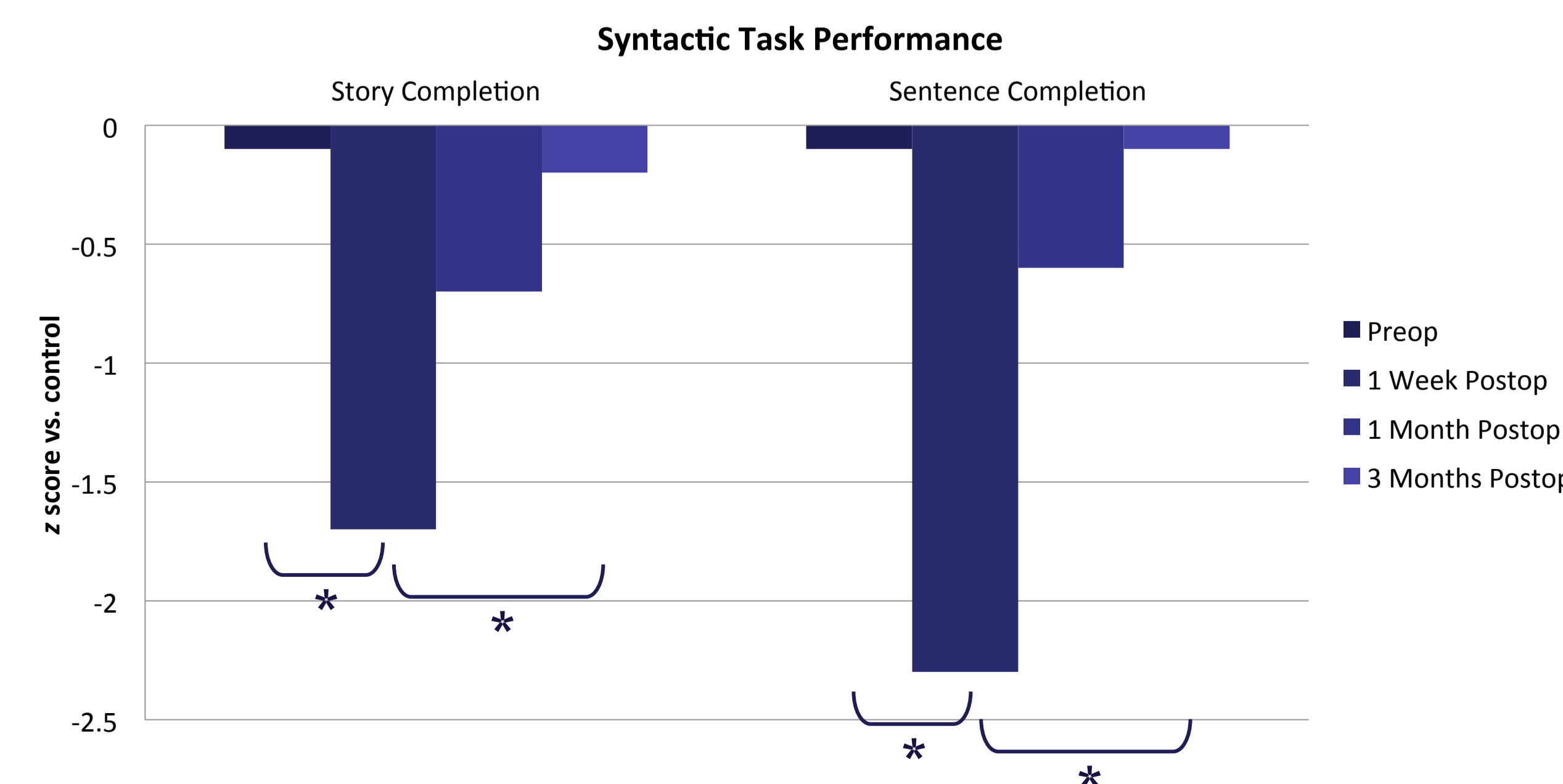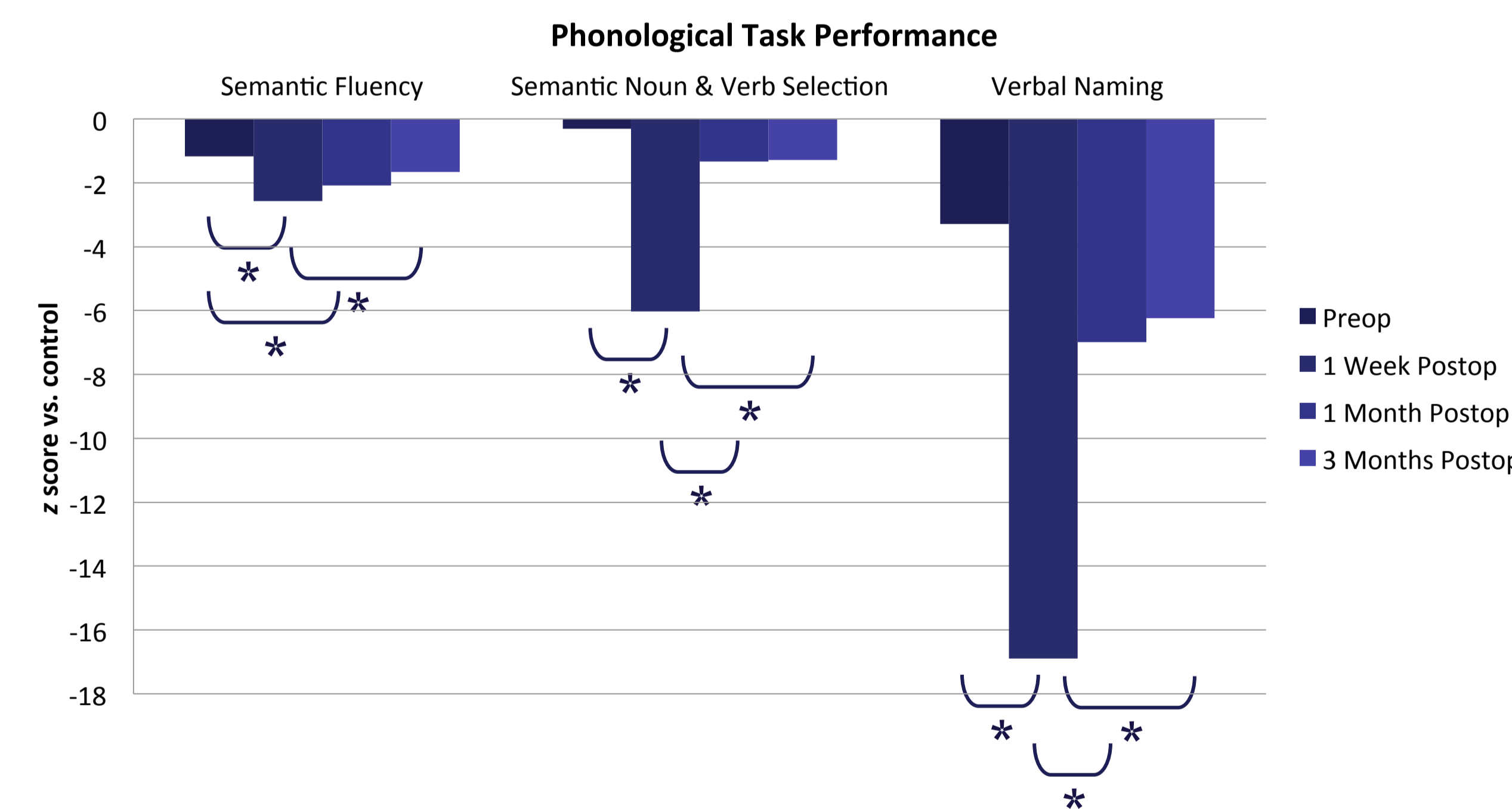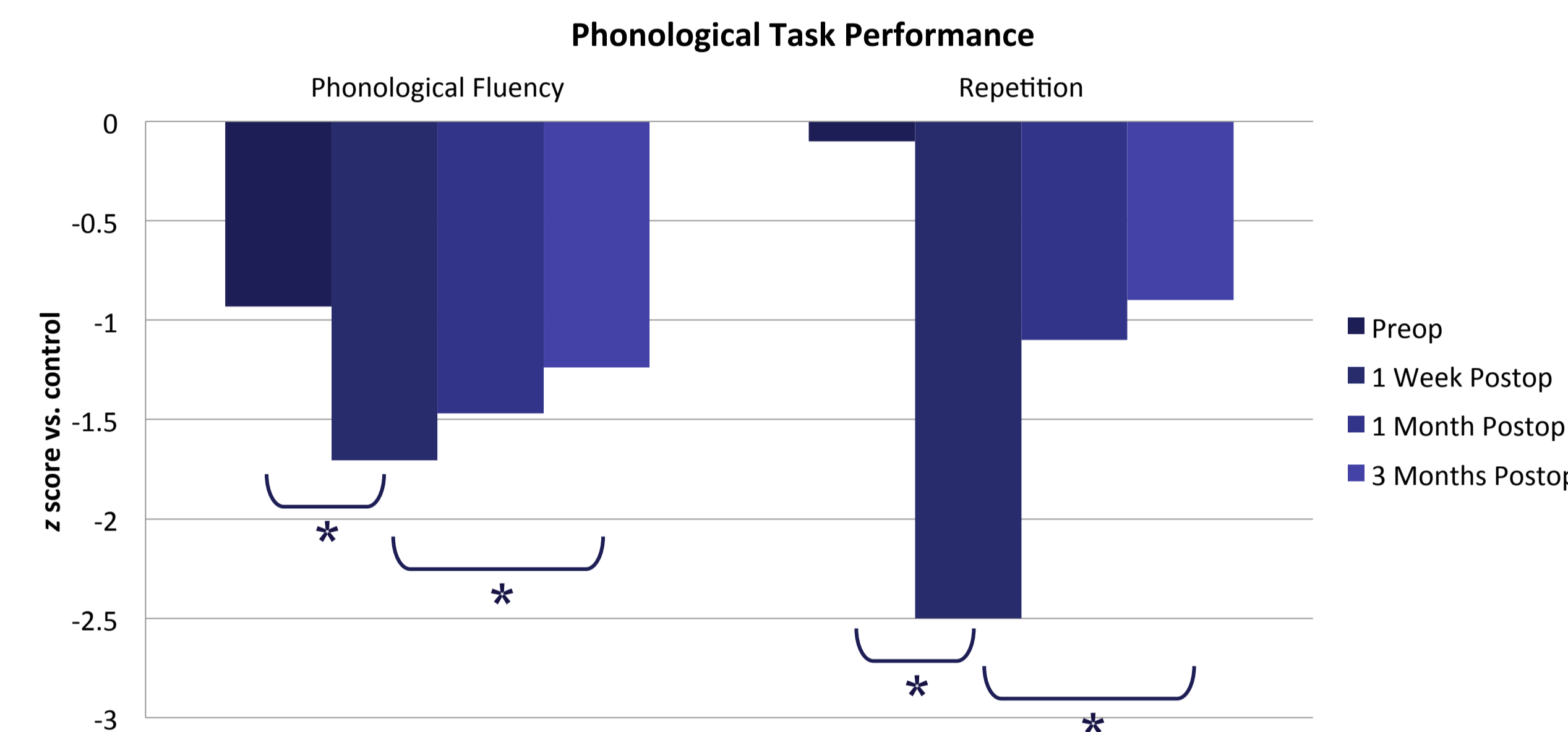
Discussion & Conclusion

- Semantic tasks and fluency tasks seem to be most impaired => executive functions involved in fluency tasks[6]
- Semantic tasks have worst recovery trajectory => influence tumor/treatment related factors? (see table)
  - Tumor location: 7/10 posterior location
  - Pt 3,4,7 show worst performance: intraop detection of subcortical sites[5], concommitant apraxia …

Pt	Gender	Age	Education	Handed-ness	Tumor location	Tumor type	Performance within tumor group
2	M	63	12	Right	L frontal	GBM IV	Good
5	M	63	15	Right	L temporal	GBM IV	Good
10	M	52	18	Right	L temporal	GBM IV	Good
1	F	50	14	Right	L temporal	ODG II	Average
6	F	68	13	Right	L parietal	GBM IV	Average
8	M	52	19	Right	L insular	GBM IV	Average
9	M	42	17	Right	L frontal	ODG II	Average
3	M	50	15	Right	L temporal	GBM IV	Bad
4	F	67	12	Right	L parietal	GBM IV	Bad
7	M	58	14	Right	L temp/insular	ODG II	Bad

The use of telephone batteries to conduct language assessments from afar can provide convenience, reduce traveling costs, and optimize patient care as assessment services might be unavailable locally. The usability and validity of the test battery appears to be high. Therefore, the phone assessment can be used for various clinical and scientific purposes.

References

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