Impairment-Based Versus Dynamic Digital Language Therapy in Two Cases of Logopenic Variant Primary Progressive Aphasia

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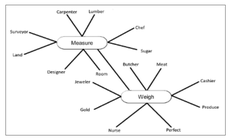
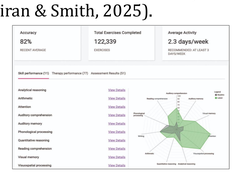
Introduction

- Primary Progressive Aphasia (PPA) is a neurodegenerative syndrome characterized by progressive language deficits (Mesulam, M. M., 2001)
- Individuals with logopenic variant PPA present with word-finding pauses, impaired sentence repetition, and moderate naming deficits (Gorno-Tempini et al. 2008; Lukic et al., 2019, 2021).
- Two main approaches of speech-language therapy (SLT) exist: **(1) impairment-based therapy** targeting specific language deficits and **(2) functional communication therapy** aimed at improving everyday speech (see Fridriksson & Hillis, 2021; Cotteli et al., 2020 for reviews)
- Impairment-based SLT (e.g., Verb Network Strengthening Therapy; VNeST) elicits nouns and verbs as co-units (the verb-thematic network).
  - ❖ Only one study by Sheppard et al. (2025) paired VNeST with/without neuromodulation tDCS and found an increase in verbs and conversational speech post-therapy.



- Personalized adaptive SLT (e.g., Digital Constant Therapy; CT) provides high-intensity practice that may strengthen communication pathways and improve word finding in stroke aphasia (Kiran & Smith, 2025).
  - ❖ No studies have examined Constant Therapy in lvPPA.



- The studies fail to translate effectively to:
  - Other context (conversational speech, memory, etc.)
  - Pre- to post-therapy brain changes
  - Compare the effects of different SLT

Objectives

Aims:

1) Examine the effects of impairment-based and dynamic therapy in two cases of lvPPA:
   - VNeST in 58 years-old male
   - Digital CT in 70 years-old male

2) Examine the generalization of treatment effects across item conditions and contexts (conversational speech)

Hypothesis:

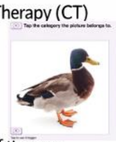
Targeted impairment-based and dynamic therapies in **lvPPA** may yield distinct gains, with the latter providing a more direct pathway to improvements in both **linguistic and everyday communication functions**.

Who Should Get Tested?

Method

Therapy Protocol

	LvPPA 1	LvPPA 2
A phase	• Pre-Tx Evaluation • 3 Baseline sessions • **Quick Aphasia Battery** • MRI Scanning • Structural T1 image • Functional task-based MRI • Adaptive Language Paradigm	• Pre-Tx Evaluation • 3 Baseline sessions • **Quick Aphasia Battery** • MRI Scanning • Structural T1 image • Functional task-free MRI • • Perfusion (blood flow)
B phase	Verb Network Strengthening Therapy (VNeST) • 2 times/week for 2h per session • Only treating 3-arg verbs • Weekly probes (1,2, 3-arg verbs) • 13 weeks, 26 sessions, 52 hours of therapy	Dynamic Digital Constant Therapy (CT) • 3 times/week for 1h per session • Multiple tasks • Weekly accuracy and latency • 8 weeks, 24 sessions, 24 hours of therapy
C phase	• Post-Tx Evaluation • Quick Aphasia Battery • MRI Scanning	• Post-Tx Evaluation • Quick Aphasia Battery • MRI Scanning



Discussion

- Both participant resembles lvPPA profile (naming deficits & left parietal atrophy)

LvPPA 1

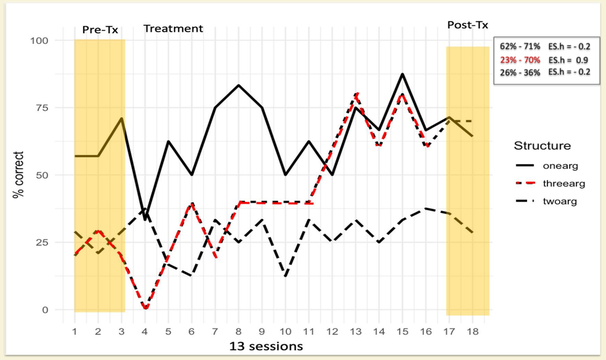
- **Behavioral improvement: 20–70% increase** on trained verbs from pre- to post-therapy
- **Generalization:** Verb-focused therapy increased **verb production in conversational speech**
- **Neural pattern:** Task-based activation within the language network remained similar but became **more focal after therapy.**

LvPPA 2

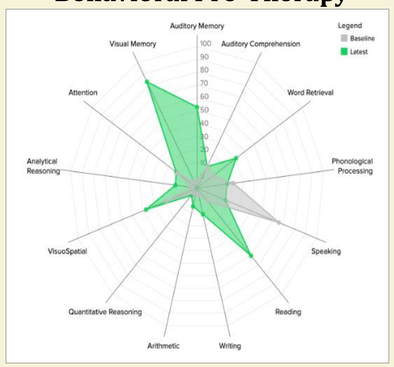
- **Stable baseline:** Language performance remained stable across **three baseline assessments**
- **Neural change:** Presence of cerebral perfusion in left language regions, despite atrophy
- **Functional outcome: Continuous digital SLT** may improve conversational speech ability and other cognitive functions.

Results

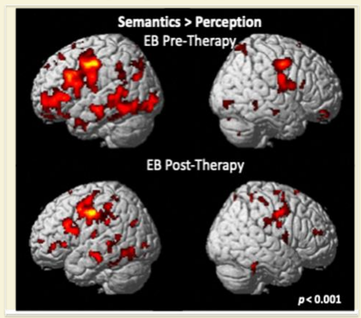
Behavioral Pre/post Therapy



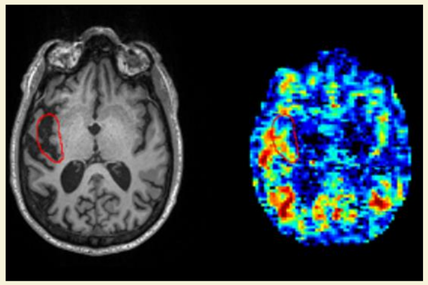
Behavioral Pre-Therapy



Neuroimaging Pre/post Therapy



Neuroimaging Pre-Therapy



	LvPPA 1	LvPPA 2
QAB subtests	Pre- / Post-Tx	Pre-Tx
Sentence Comp	52/54%	71%
Repetition	54/75%	83%
Motor Speech	4	4
Picture Naming	**65/85%**	**21%**
Reading Aloud	71/75%	8.3%
Word Comp	100/100%	91%
Connected Speech (talk about Best Trip)		
Speech rate	2.26/2.66	2.55
Type to Token Ratio	0.33/0.45	0.31
Words Type count	122/135	162
Content words count	77/84	107
Verb quantity	23/31	117
Noun quantity	22/25	40
No of pauses (min-max duration)	68/76 (0.35–10.9)/ 0.30-3.66)	81 (0.3-7.3)
Semantic granularity	7.2/6.3	6.6
Syntax dependency (core dependents)	63/52	90

Conclusions & Future Directions

- **Combining impairment-based and digital home therapy** can increase treatment intensity and accessibility.
- Addition of motivational interviewing and counseling can address psychological/behavioral barriers and increase engagement.

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