EasyChair Preprint

№ 6516

Vowel Dysgraphia

Maya Yachini and Naama Friedmann

September 1, 2021

Vowel Dysgraphia

Maya Yachini[1]* and Naama Friedmann[1]

[1]Language and Brain Lab, Tel-Aviv University, Tel Aviv, Israel

***corresponding author, yachinim@tauex.tau.ac.il**

Introduction

This research describes a new type of developmental dysgraphia, vowel dysgraphia, characterized by a deficit in the sublexical route for writing that selectively affects vowels. Cotelli et al. (2003) and Cubelli (1991) reported of three individuals who showed difficulty in writing vowels that was ascribed to an orthographic-output-buffer deficit. Developmental vowel dysgraphia has not been previously reported, neither was a selective vowel deficit in the sublexical route.

Methods

We examined the writing of 427 Hebrew speakers without history of brain damage who we diagnosed as having dysgraphia based on their total error rates in writing words and nonwords.

We used the TILTAN writing screening test (Friedmann et al., 2007) to explore the type of dysgraphia each participant had.

The participants who were diagnosed with vowel dysgraphia participated in a further line of tests designed to assess the characteristics of this dysgraphia and its locus in the spelling model. These tests included input and output modalities – writing to dictation, written naming, oral spelling, typing, and spontaneous writing, of words and nonwords, and words with various characteristics with respect to vowels and consonants.

Results

According to the rate of vowel errors that was significantly larger than that of the age-matched control groups and larger than 10% of the target vowels (control groups N=741), we identified 30 participants (aged 8-45) with a selective difficulty in vowel writing. The error types in the participants' writing involved omissions, additions, transpositions, and substitutions of

vowels. They made these errors only or almost only in vowels, with significantly fewer errors in consonants (see Table 1). The consonant error rate 23 of them was within the age-matched control range. Their vowel deficit manifested itself only in nonwords or, in case they also had surface dysgraphia, in words and nonwords, indicating their impairment was in the sublexical route, in the conversion of vowels into vowel letters. We analyzed their error patterns and the effects that influenced their writing, and found that they showed no per-letter length effect, ruling out a buffer impairment.

Most of the participants had more vowel errors in the root than in the morphological affix (Wilcoxon z = 3.28, p = .001). These results indicate that the sublexical writing route includes separate routes for phoneme-grapheme conversion and for the conversion of whole morphological affixes from their phonological to their orthographic representation. Vowel dysgraphia affects only the phoneme-to-grapheme route, but not the morphological route.

In addition to the 30 participants reported above, we also identified a further group of 27 participants with vowel dysgraphia who made predominantly vowel omissions in writing (which were not attributable to surface dyslexia).

Conclusions

These findings cast new light on vowel errors in writing, which until today were ascribed to a deficit in the orthographic output buffer. We concluded that the impairment underlying the vowel dysgraphia of our participants is a selective deficit in the sublexical route that affects the conversion of vowel phonemes to graphemes.

The results also indicate that there is a separate sub-lexical route for morphological conversion.

The findings of the study have theoretical implications for the dual-route model for writing, as well as for treatment.

References

Cotelli, M., Abutalebi, J., Zorzi, M., & Cappa, S. (2003). Vowels in the buffer: A case study of acquired dysgraphia with selective vowel substitutions. *Cognitive Neuropsychology, 20*, 99-114. https://doi.org/10.1080/02643290244000158

Cubelli, R. (1991). A selective deficit for writing vowels in acquired dysgraphia. *Nature, 353*, 258-260. https://doi.org/10.1038/353258a0

Friedmann, N., Gvion, A., & Yachini, M. (2007). *TILTAN writing screening test*. Tel Aviv University.

Acknowledgments

We thank Aviah Gvion and Lilach Khentov-Kraus for fruitful and stimulating discussions of vowel dysgraphia. The study was supported by Human Frontiers Science Program grant (RGP0057/201, Friedmann).

Table 1. Comparison between percentage in vowels and in consonants out of number vowels/consonants

Participant	% vowel errors	% consonant errors	Fisher (two tail)
LIZG	23%*	3%	$p < .001$
TMNG	39%*	8%	$p < .001$
AMZD	24%*	2%	$p < .001$
SLZD	31%*	14%*	$p < .01$
AMND	27%*	10%	$p < .01$
PLZA	20%*	2%	$p < .001$
EMZA	21%*	4%	$p < .001$
ROZO	45%*	11%*	$p < .001$
YNZO	10%*	5%	$p = .24$
AFZO	41%*	5%	$p < .001$
ROAZ	53%*	2%	$p < .001$
ROXZ	74%*	5%	$p < .001$
YOSZ	48%*	13%*	$p < .001$
ADINZ	11%*	7%*	$p = .31$
GRIZ	45%*	11%*	$p < .001$
IZRZ	23%*	4%	$p < .001$
NTNAZ	67%*	1%	$p < .001$
MAINZ	40%*	6%	$p < .001$
AMIZ	108%*[1]	7%*	$p < .001$
RAMZX	46%*	2%	$p < .001$
DBNX	40%*	7%*	$p < .001$
ISZX	36%*	3%	$p < .001$
SXFZX	40%*	1%	$p < .001$
AMZX	69%*	10%*	$p < .001$
YOZT	80%*	9%*	$p < .001$
YNZIA	67%*	3%	$p < .001$
ANBM	24%*	2%	$p < .001$
ONAM	22%*	1%	$p < .001$
ITZM	11%*	2%	$p < .01$
NXANM	24%*	2%	$p < .001$

* indicate that the rate of errors was significantly larger than that of the age-matched control groups

[1]AMIZ had a large number of vowels addition, this is why his errors rate is larger than 100%