

## Short report

# Dysgraphia for letters: a form of motor memory deficit?

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**SUMMARY** A case of pure dysgraphia is presented in which the patient could accurately copy letters which she could not write. The patient did not show any evidence of significant reading or speech impairment or any buccofacial or limb apraxia. Both oral and "block spelling" performance were intact. The writing impairment, which was bilateral, appeared to consist of a memory difficulty for the motor movements associated with letters. The dysgraphia was shown to be specific to letters as the patient was able to transcribe certain numbers and patterns which were similar to letters in their visuospatial complexity. It is suggested that dysgraphia for letters may represent a specific type of motor memory deficit, dissociable from copying skills and the ability to draw letter-like forms.

Writing impairment is commonly found in most dysphasic patients but pure dysgraphia, that is without any additional speech or reading disorder, is relatively rare.<sup>1</sup> Several types of pure dysgraphia have been described in the literature including those associated with confusional states,<sup>2</sup> those found in patients with callosal lesions,<sup>3</sup> those which are found after focal, frontal or temporal lobe damage,<sup>4</sup> and those which are associated with focal posterior lesions.<sup>5,6</sup> One of the last named forms of pure dysgraphia has been variously termed "apraxic agraphia",<sup>6</sup> and "optic-spatial agraphia",<sup>7</sup> and in this type of dysgraphia patients have a significant difficulty in writing individual letters. In this paper we describe a patient who displayed such a form of pure dysgraphia and who was able to accurately copy letters of the alphabet. We were also, in the case of the present patient, able to focus on the selective nature of the patient's writing impairment by asking her to transcribe symbols of equivalent graphic complexity to specific letters of the alphabet.

### Case report

A 54-year-old lady had a fourteen year history of epilepsy

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and presented with a two year difficulty in writing. She had previously been able to write normally and her age-scale score of nine on the WAIS Vocabulary subtest suggested an average premorbid intellectual level. She had always used her left hand for writing though she did use her right hand for some activities. A CT scan showed a left occipital space occupying lesion which was considered to be a slowly growing glioma. The patient was first seen briefly in July 1980 when a significant dysgraphia was noted. There was no significant speech or reading deficit as assessed by the Boston Diagnostic Aphasia Examination.<sup>8</sup> She was seen again in October 1981 when a detailed neuropsychological analysis of her condition was carried out. The results of formal IQ testing are shown in the table. On the Wechsler Adult Intelligence Scale (WAIS), she obtained a prorated Verbal IQ of 85, a Performance IQ of 65 and a Full-Scale IQ of 75. These scores represent a significant generalised drop from her premorbid intellectual level. As can be seen from the table, visual nonverbal tests were performed relatively poorly with marked impairment on a visuospatial, "constructional" task (Block Design subtest). She also had difficulty in copying the Rey-Osterrieth complex figure. Her memory performance showed a significant degree of impairment. On the various occasions on which she was tested, she usually had some degree of disorientation for time. On standard memory tests, her performance was significantly impaired—for example, on the Williams Delayed Recall Test<sup>9</sup> her score of 43 penalty points was well below the average of ten penalty points for her age group.

Apraxia tests from the Boston Diagnostic Aphasia Examination<sup>8</sup> were administered and no significant buccofacial or limb apraxia was found. There was no evidence of any unilateral tactile or naming deficit. A right homonym-

Table *The patient's WAIS subtest age-scaled scores*

Verbal tests		Performance tests	
Arithmetic	5	Digit Symbol	1
Similarities	10	Picture Completion	5
Digit Span	8	Block Design	0
Vocabulary	9	Picture Arrangement	5
		Object Assembly	4

ous hemianopia was evident on confrontation testing, though this was not consistent. There was no evidence of impairment either in her everyday speech or on formal testing. On the Boston Diagnostic Aphasia Examination (BDAE)<sup>8</sup> both speech comprehension and speech expression were relatively intact apart from low scores on the subtest for auditory comprehension of complex material and the animal naming subtest. It is possible that short term memory difficulties and some degree of anxiety may have contributed to rather low scores on these tests. Oral reading and reading comprehension tests from the BDAE did not present any difficulty. A number of additional reading tasks were administered to substantiate this. She could read all the letters of the alphabet. She was able to read 93/100 words on the Schonell Reading Test.<sup>10</sup> On a reading task in which she had to say whether two words were of a similar or different meaning, she performed correctly on all sixteen trials (the word pairs used were: irony-kingdom, shovel-spade, lie-falsehood, menace-advice, battle-crop, ocean-sea, lantern-letter, mockery-ridicule, daring-compassion, marriage-wedding, harvest-smile, trace-truth, detection-discovery, sack-happiness, thief-robber, agreement-consent).

Different components of writing skill were examined in detail. Her ability to spell was tested by asking her to spell the first thirty words in the WAIS Vocabulary subtest. These were spoken to her and she had to spell them orally. She was able to spell all thirty words correctly. On a task which involved copying upper-case letters her performance was slow but she could copy 25/26 letters correctly. A spelling test from the Multilingual Aphasia Examination<sup>11</sup> was administered in which she was asked to spell words using plastic letters. List A from the battery, which contained 11 words, was administered and all 11 words were correctly spelt. Her ability to write words to dictation is shown in the Figure. This indicates her ability to write two words, first in lower case then in upper case. Her ability to write upper case letters is also indicated in the Figure. Her errors in writing letters were usually other well-formed letters. Her ability to write letters accurately showed some fluctuation between test sessions though she was never able to write more than two-thirds of letters of the alphabet at any one time. Her performance using her left hand varied between 7–10 letters. Using her right hand her performance was slightly better (10–15 letters) though still impaired. It is unlikely that she had an auditory-verbal agnosia for letters as she was often able to recognise when she wrote a letter incorrectly and was able to point to letter names in an array of letters. Her ability to draw visuospatial forms which were identical or very similar in structure to certain letters of the alphabet was also assessed. She was asked to draw a set of "rugby goal posts" and write the number "13". The component motor movements involved

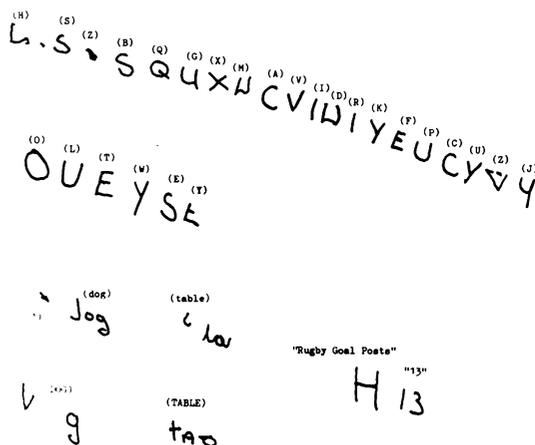


Fig Patient's writing of the alphabet, words in lower and upper case, and letter-like forms to dictation

in these are similar to those required to write the letters "H" and "B" respectively. While on most occasions the patient had considerable difficulty in writing "H" or "B", she consistently had little problem in drawing the non-alphabetic analogues (see fig).

## Discussion

The present case study shows a selective writing impairment in the presence of normal speech, reading and spelling ability. Our patient could accurately copy letters which she could not write. In addition, her writing disability was specific to letters of the alphabet since non-alphabetic shapes of similar graphic complexity could easily be written.

It would appear that a specific syndrome of agraphia for letters can exist and that this can be dissociated from other motor movements. The possibility that the patient's intact writing ability for certain stimuli was due to the fact that these were more frequent is unlikely due to the fact that her writing of lower case letters was no better than her writing of upper case letters, even though the former would have occurred more frequently in her repertoire of writing, and also the fact that drawing a set of rugby posts is likely to have been a low frequency activity in her previous history. Spelling by manual sorting was intact suggesting that our patient's writing deficit was more focal than that reported by Kinsbourne and Rosenfield.<sup>5</sup> The present findings cannot be explained in terms of a disconnection syndrome as our patient performed at similar levels using her left and right hand and did not show any evidence of unilateral apraxia or unilateral tactile naming disorder.

Research on alexic disorders<sup>12</sup> has shown how dissociations can occur between closely related oral reading tasks—for example, the word “bee” can be read quite easily by some dysphasic patients but the word “be” poses difficulty for these same patients. Recent research<sup>13</sup> has substantiated the presence of similar dissociations at the linguistic level in the dysgraphia of certain patients. The present findings suggest that a similar form of dissociation can occur at the motor level in the case of writing disorders. The fact that a letter such as “H” cannot be written easily on the basis of letter cues but can be written easily on the basis of verbal cues (“rugby goal-posts”) suggest that letters may be coded in a unique fashion and that the accessing strategies for these may be quite distinct from the types of strategies used to access other types of materials.

Apart from a few reports<sup>14,15</sup> little systematic work has been reported on the retraining of dysgraphia. In the case of our patient we explored the possibility that she might be able to write letters if she could learn an alternative representational code for the letters. We instructed her to write the letters “H” and “B” by reminding her of the similarity between these letters and the shapes of rugby posts and the number “13”. We also attempted to retrain her on the other letters of the alphabet by either working on similar alternative codes (for example horseshoe for the letter “U”) or, more commonly, to describe the letters in terms of particular feature formations—thus for example, the letter “E” was “a post with three bars across”, the letter “P” was “a post with a loop at the top”, etc. The actual writing of letters using such codes was within her repertoire but because of her poor memory and learning ability it was not possible for her to use successfully such a training programme to significantly improve her spontaneous writing performance. It remains possible that in other patients where there is less generalised cognitive dysfunction additional to the dysgraphia, an improvement in writing ability could be achieved using the sort of training procedures outlined here.

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