Persistent Idiopathic Mirror Writing in a Right-Handed Healthy Young Woman: A Case Report

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Conflict of interest: None declared

Patient: Female, 19-year-old
Final Diagnosis: Idiopathic mirror writing
Symptoms: Mirror writing
Medication: —
Clinical Procedure: —
Specialty: Family Medicine

Objective: Rare disease
Background: Mirror writing is unusual handwriting, in which the writing is in the opposite direction to normal, with reversed letters can be effortlessly read using a mirror. Studies reported that the condition can occur temporarily during the normal development of writing skills in children, and can also occur in children with developmental delays. In adults, it can be acquired after a brain lesion.

Case Report: A right-handed 19-year-old Saudi woman presented with progressive-onset mirror writing in both hands, and with writing both languages, Arabic and English. The condition was transient and had gradually worsened over the previous 3 years. Recently, it was continuous. She denied a history of alcohol or illicit drug abuse. There was no history of head injury, dyslexia, learning disabilities, or transient mirror writing during writing development in her early school-age years. There was no similar condition in her family. The neuropsychological assessment was normal. Laboratory and imaging were performed to rule out structural lesions, and no underlying etiology was found. After 2 years of follow-up, the patient did not have other associated neuropsychological symptoms, and mirror writing was persistent.

Conclusions: Mirror writing in this case was in the right-handed, healthy young woman and was idiopathic. The condition was benign and the 2-year follow-up neuropsychological assessment was normal. The patient lived with the condition, depending on computer typing instead of handwriting, and she had very good academic performance in the university. We suggest that physicians have to diagnose this condition by exclusion and reassure and support the patients to cope with the condition.

MeSH Keywords: Functional Laterality • Handwriting • Writing

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Background

Mirror writing is defined as “that variety of script which runs in the opposite direction to the normal, the individual letters being also reversed” and “writing from right to left, that only corresponds to our usual writing when it is seen in the mirror” [1–4]. This condition can occur in healthy children temporarily during the normal writing development, or in children with developmental delay [2]. In adults, it can be acquired after a head injury or hemorrhagic lesion in the brain affecting the left hemisphere; in these conditions, mirror writing is associated with other manifestations, such as hemiplegia and speech disorders [2,5]. Additionally, mirror writing was reported to be associated with Parkinson’s disease, essential tremor, and cerebellar disease [6].

In the present case report, we describe a case of progressive-onset mirror writing in both hands, in a right-handed young Saudi woman with both languages, Arabic and English, with no obvious underlying etiology after investigations.

Case Report

On April 2018, a 19-year-old Saudi woman, who was a right-handed student, was referred to the family medicine clinic from the student counseling clinic with a complaint of unintentional abnormal handwriting (mirror writing) that affected her academic performance. The patient noticed a transient and gradual worsening of handwriting over the previous 3 years in the opposite direction to normal and with letters reversed, for both her native language (Arabic) and the English language, and the condition recently had become continuous. There was no history of being forced to switch to her right hand for writing in early childhood. Her reading and writing for both languages (English and Arabic) were learned at the same time in kindergarten at age 5 years. She was a born at full term, without antenatal or postnatal complications. Her medical, surgical, family, and social histories were unremarkable. She denied a history of alcohol intake or illicit drug abuse. There was no history of head trauma, dyslexia, learning disabilities, or transient mirror writing during writing development in her early school-age years.

There was no history of focal neurological deficit and psychological disorders, and no family history of similar conditions or neurological disorders. The patient was aware of her problem and she was able to recognize that she wrote in the wrong direction. She was in the preparatory year in the College of Applied Studies and Community Service. All students who are accepted in this college should start with preparatory semesters that cover the basic sciences in the college. After that, the students are distributed between specialties based on the capacity of each department. Sometimes the nomination is based on the student’s grade point average (GPA). The patient has good attendance, understanding her lectures, and had good concentration. Her computer skills were excellent, and she did not have difficulty typing on a computer or mobile device. The only problem she had was during exams, which required writing short essays. Her condition was affecting her exam evaluations and, consequently, her grades and GPA.

On examination, she was alert, cooperative, and well oriented in time and place. A standard neurological and psychological assessments were unremarkable, and other systemic examinations were insignificant.

The patient was asked to write a paragraph with her right and left hands. She performed the task 3 times and the time needed to complete each task was observed (Figure 1). Analysis of the patient’s writing in Figure 1 revealed the following:

The $ character was never reversed in spite of its 4 occurrences in the mirror-written texts (2 times with each hand writing in Figure 1C and 1E). This observation is even more curious in that the $ character is composed from a vertical line (which cannot be reversed) and an “S”, the “s” (in lowercase) being reversed in all the different mirror writings (Figure 1C, 1E, 1G, and 1I), except in 1 occurrence.

All reversible digits (0, 1, and 8 cannot be distinguished from their reversal) were systematically reversed in the mirror writings of Figure 1C and 1E: digits 3 six times; 4 two times; 5 four times, and 6 two times.

In the normal English writing (Figure 1A), there is an intrusion of 14 reversed letters: the “s”, “e”, and “r” are each reversed 3 times, the “a” reversed 2 time, and the “F”, “y”, and “u” are each reversed 1 time. A systematic analysis of the letters shows that there are more reversed letters in the normal writing of Figure 1A (14 out of 248) than in the mirror writing of Figure 1C (0 out of 248). In the normal Arabic writing (Figure 1B), there is an intrusion of 1 reversed letter that was reversed 1 time (1 out of 246). On the other hand, in the mirror writing of Figure 1D, there is no reversed letter to the normal (0 out of 246). The Fisher’s exact test yielded a p-value <0.0001 for the difference between normal and abnormal writing in English and the same for the difference between normal and abnormal in Arabic. Therefore, in the writing of the dictated sentence the patient was not only faster (8 vs. 2 minutes in English and 6 vs. 1 in Arabic), but also there were more letter (or digit) reversals in her normal English and Arabic writings than in her English and Arabic mirror writing.

Moreover, the ability of the patient to copy and dictate through the computer was assessed (Figure 2). She was able to write in the normal direction, but with more effort. When we showed her a mirrored text, she found it difficult to read.
Blood chemistry and thyroid function tests were within the normal limits.

Neurological consultation was done to rule out any pathological causes. Non-contrast computerized tomography (CT) scan of the head and magnetic resonance imaging (MRI) scan of the brain were performed after 2 months and the results were normal. The neurologist finally discharged the patient with a diagnosis of idiopathic mirror writing without any evidence of neuropathological causes.

After that, based on all previous assessments, a medical report was released in July 2018 by her family medicine consultant with recommendations for the patient to be enrolled in a specialty that suited her condition. The medical report recommendations were reviewed and approved by the deanship of the academic affair to support her academic progress.

Finally, on April 2020, the patient still had the mirror writing, she was in the fourth semester in accounting specialty undergraduate school, with a good academic performance, her GPA was 4.4 out of 5 and she received positive feedback from her tutors. Moreover, the neuropsychological assessment during follow-up was normal.

**Discussion**

Arabic characters, unlike English, are normally written from right to left. The patient in this report reversed the directions in both languages, Arabic and English. Additionally, the condition was not associated with difficulties in reading or typing on the computer or mobile device. There were no previously reported cases of mirror writing in Arabic.
The literature revealed that this condition occurs almost always in left-handed individuals [2,7]. The pathophysiology of the mirror writing is unclear. One hypothesis was that lesions in the left hemisphere resulted in a failure of the dominant hemisphere to prevent contribution of the non-dominant hemisphere during the writing process [8].

Our patient's neurological examination was normal. Moreover, no lesions appear with brain CT or MRI, which excluded the structural cause of the condition. Della Sala et al. reported a case of 59-year-old women with mirror writing after anxiety, and the condition disappeared when her anxiety resolved [9]. In our patient, the psychological assessment revealed no abnormality. She was right-handed, but when we ask her to write with the left hand, mirror writing occurred also. Canzano et al. reported that mirror writing with both hands is unusual [1]. Gottfried et al. reported a case of 51-year-old with mirror writing in both hands after traumatic brain injury [10]. Our patient did not have a history of trauma.

The patient's writing in this case report demonstrated that all reversible digits were reversed in the mirror writing text. Moreover, there are more reversed letters in the normal writing of our patient than in mirror writing. A similar finding was seen in the Arabic writing. Additionally, in the writing of the dictated sentence (in both English and Arabic) the patient was faster and there were more letter (or digit) reversals in her normal writing than in her mirror writing. These observations are important for 2 different reasons.

First, they contradict some classical ideas about mirror writing. Our patient, who mirror wrote with both hands, demonstrates that mirror writing is not be restricted to persons writing with their left hand, as is generally the case [11]. The patient in this case, who mirror wrote by abduction (Figure 1D, 1E, 1H, I) as well as by adduction (Figure 1C, 1F, 1G, 1J), demonstrates that the abdution process is not necessary for mirror writing. About abduction, it could be recalled that Erlenmeyer, in 1880, suggested “abductive left-hand writing” (linkshändige Abductionsschrift in German) as a more appropriate name for Buchwald’s “mirror writing” [12].

Second, many features of our patient’s writing in this case can be compared with the recent findings in 5-year-old typical developing children. Our patient’s facility for mirror writing is consistent with children’s facility, the latter being demonstrated by the numerous character reversals and by the speed of mirror writing [12,13]. The patient’s mirror writing with the right hand as well the left hand is consistent with the finding that there was no difference in mirror writing between the children who spontaneously wrote with the left hand and those who spontaneously wrote with the right hand [14].

Conclusions

In conclusion, mirror writing is a rare condition, especially in right-handed individuals, and with both hands writing. This case demonstrated a rare idiopathic etiology of this condition. The condition in our patient was benign for 2 years of follow up, she did not develop other symptoms, and she succeeded in her academic life. Moreover, to the best of our knowledge, this is the first reported case from an Arab country, and onset was in a young adult. Physicians should diagnose the condition by exclusion. In these cases, since no underlying etiology was detected, we recommend that physicians reassure the patients and support them to continue with the most appropriate specialty for them in which they depend on computer typing rather than handwriting during studying and even in their career.

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Statement

This study was conducted at Imam Abdulrahman Bin Faisal University Hospital.

Conflicts of interest

None.
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