Cognitive Neuropsychological and Regional Cerebral Blood Flow Study of a Japanese-English Bilingual Girl with Specific Language Impairment

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(Abstract)

We report a case study of the patient, EM, a 14-year-old Japanese-English bilingual girl who exhibits specific language impairment (SLI) in both Japanese and English. She was born in the UK to Japanese parents and is an only child. At the age of 8/9 years, EM's language problems in both languages were suspected. At primary school in the UK, a delay in her English language development was identified, which was then attributed to her bilingualism. However, the deficient language skills in both English and Japanese, more than adequate educational opportunities (including additional ESOL support) persisted into her adolescence. EM's language development in both languages was assessed at the start of her secondary education, and the results showed a normal IQ coupled with comprehension deficit as well as a below average vocabulary development when compared to same age peers. EM's profile is commensurate with SLI as defined by the researchers. Further, her brain single photon emission computed tomography (SPECT) revealed significantly lower rCBF (Regional Cerebral Blood Flow) in the left temporo-parietal area. Thus her cognitive behavioural and regional blood flow data converge to suggest this neurobiological diagnosis of SLI..

Key words: specific language impairment (SLI), single photon emission computed tomography (SPECT), Regional Cerebral Blood Flow (rCBF)

1. INTRODUCTION

Approximately half the world's children are exposed to more than one language[1] and a frequently addressed question concerning bilingual development is whether bilingual children demonstrate a developmental delay in each language compared with monolingual children. Some suggested that there is a significant developmental language delay in bilingual children[2,3], while others[4] found that the bilingual children had comprehension vocabularies in each language comparable to that of monolinguals.

Bishop[5] has extensively discussed abnormal language development, albeit *monolingual* rather bilingual, in particular children with specific language impairment (SLI). SLI is a disorder in the development of language despite adequate educational opportunities and normal intelligence, "where delayed or deviant language learning has no obvious cause, and where development is proceeding normally in other respects"[7] (p.369).

The patient, EM, was a 14-year-old Japanese-English bilingual girl who exhibited SLI in both Japanese and English. She was born in the UK to Japanese parents with no other siblings. At primary school in the UK, a delay in her English language development was identified, which was attributed to her bilingualism. However, the deficient language skills in both languages, more than adequate educational opportunities (including additional language support) persisted into her adolescence.

We report a case study of the patient, EM, a 14-year-old Japanese-English bilingual girl who exhibits specific language impairment (SLI) in both Japanese and English.

2. CASE STUDY

Assessments in English

A summary of EM's results on the standardized ability and literacy attainment tests (Matrix Analogy Test (MAT), British Picture Vocabulary Scale (BPVS), Wide Range Achievement Test (WRAT3) – Spelling, Wide Range Achievement Test (WRAT3) – Word Reading, and WORD Reading Comprehension) is given in Table 1.

Table 1.

Test	**Age equiv.**	**Standard score**	
MAT		102	average
BPVS	11y10m	82	*below ave.*
WRAT3 - Spelling	10y6m	82	*below ave.*
WRAT3 - Word Reading	13y6m-14y6m	98	average
WORD Reading Comp.		81	*below ave.*

Results of the Test of Adolescent and Adult Language (TOAL) including Listening Grammar, Speaking Vocabulary, Reading Vocabulary, Reading Grammar, Writing Vocabulary, and Writing Grammar are summarized in Table 2.

Table 2.

Test	**Standard Score**	
TOAL		
Listening Grammar	75	*Below Average*
Speaking Vocabulary	75	*Below Average*
Reading Vocabulary	95	Average
Reading Grammar	90	Average
Writing Vocabulary	64	*Low*

Writing Grammar	75	*Below Average*

The results of diagnostic tests for dyslexia including the Test of Word Reading Efficiency (TOWRE) and Phonological Assessment Battery (PhAB) are summarized in Table 3.

Table 3.

Test	**Age equiv.**	**Standard score**	
TOWRE			
Sight word efficiency	12y3m	87	Low ave.
Phonemic decod. effici.	13y9m	98	average
Digit Span Memory		88	Low ave.
PhAB			
Naming Speed – pic.		97	average
Naming Speed - digits		102	average
Fluency - Alliteration		94	average
Fluency - Rhyme		98	average
Fluency - semantic		103	average
Spoonerisms		87	Low ave.

Assessments in Japanese

Table 4 shows a summary of EM's results on the tests conducted in Japanese consisting of WISC-III (PIQ), RCPM (Raven's Colored Progressive Matrices), reading/writing single hiragana/katakana characters and hiragana/katakana words, SCTAW (Standardized Comprehension Test of Abstract Words)[6], Rey's Auditory Verbal Learning Test (immediate recall and delayed recall), and arithmetic (addition and subtraction).

Table 4.

TESTS	**Score Control (s.d.)**	**EM**	**Accra. (%)**	
WISC-III PIQ		97		*low average*
RCPM	33/36 (3.8)	33	91.70	normal
Reading Single Hira. CHR	19.95/20 (0.21)	20	100	normal
Writing Single Hira. CHR	19.84/20 (0.51)	20	100	normal
Reading Single Kata. CHR	19.98/20 (0.15)	19	95	normal
Writing Single Kata. CHR	19.90/20 (2.07)	11	55	*Below -2 s.d.*
Reading Hira. WD	19.95/20 (2.6)	20	100	normal
Writing Hira. WD	19.70/20 (1.9)	20	100	normal
Reading Kata.WD	19.90/20 (0.2)	20	100	normal
Writing Kata. WD	19.40/20 (2.2)	7 /10	40	*below -2 s.d.*
SCTAW	28.3/32 (3.2)	12	37.5	*below -2 s.d.*
RAVL Test				
Immediate Recall	13.0 (2.6) words	13 words	86.7	normal
Delayed Recall (30 min.)	11.2 (1.9) words	11 words	73.3	normal
Addition	4.9 (4.8)	5/5	100	normal
Subtraction	4.8 (0.6)	5/5	100	normal

RAVL (Rey's Auditory Verbal Learning Test)

The results revealed that EM's performance on these tests was well within normal range including PIQ, except for writing Katakana character ($z = -4.30$, $p<.0001$) as well as Katakana words (we stopped the test after presenting half the total number of the stimuli, as it was apparent that she was struggling), and SCTAW (with age matched controls) ($z = -5.09$, $p<.0001$). The former results can be explained by her lack of exposure to Katakana, and we do not necessarily think that her poor performance on Katakana writing was abnormal. In contrast, the latter results (i.e., her performance on the SCTAW) indicated that she had a severe comprehension deficit.

Her brain SPECT revealed significantly lower rCBF in the regions of the left temporal and parietal lobules.

3. Discussion

EM's comprehension deficits and below average vocabulary development, when compared to same age peers, in both Japanese and English were not attributable to her language environment but to her SLI, and that her brain SPECT further lends support to this neurobiological diagnosis.

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