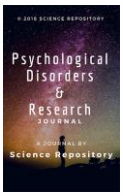

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Editorial

Word processing defects in Chinese developmental dyslexia

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ABSTRACT

Chinese as an ideogram is different from phonetic writing system, and the children who use Chinese may not exist reading disorder problem. Chinese word Semantic processing provides a wealth of experimental material for the study of language processing differences, comparing the semantic processing mechanism of brain of dyslexia children in Chinese and English helps to further clarify the common defects of dyslexia children between different languages. Discovering the processing differences between real words and pseudo-words is important for understanding the reading disturbances in dyslexia. The differences between the dyslexic and control groups were mainly in the N130, RP, N400, and P600 components. The results suggest that Chinese dyslexic children have semantic processing defects.

Editorial

Dyslexia is a specific developmental disorder in learning to read and is not the direct result of impairments in general intelligence, gross neurological deficits, uncorrected visual or auditory problems, emotional disturbances, or inadequate schooling. Over the years, there has been increasing evidence that dyslexic readers have impairments in several systems relevant to reading [1-5]. Many studies suggest that the main source of their word decoding deficits lies in the difficulties of the phonological system, which is responsible for the use of the sound structure of language to process written and spoken language [6-8]. Discovering the processing differences between real words and pseudo-words is important for understanding the reading disturbances in dyslexia. Reading pseudo-words requires phonological decoding, whereas reading regular or real words relies on the orthographic presentation of the visual form of the letters [2]. There is a large body of evidence on problems encountered by dyslexic children in phonological awareness tasks including grapheme-to-phoneme conversion [9].

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When examining the semantic processing of dyslexic children, the most commonly used ERP indicators are the recognition potential (RP), N400, and P600 components. The morphological identification of familiar words induces a peak in the range of 200–250 ms in the positive wave, and this component is called the RP. In addition to the importance of the RP in shape recognition, the consistency of its response with the

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expected stimulus is also important [12-14]. The N400 component was first described by Kutas and Hillyard (1980) and is generally considered to reflect an early stage of processing and the semantic integration of relevant information [15]. Sebsequently, many studies found that the N400 effect could not only be elicited by the processing of sentence but also by the processing of real and pseudo words [15-19]. The P600 was first discovered by Osterhout and Holcomb (1992) [20]. It was initially thought that the P600 component showed specific wave abnormalities during syntactic processing, which reflects the process of syntactic reanalysis. However, in recent years, some studies have found that semantic violations within a sentence can lead to a P600 effect [21-24]. After this phenomenon was found, it prompted researchers to re-interpret the meaning of the P600. Although, N400 effects in Chinese dyslexic children have been reported, most of these studies adopted the ambiguous sentences as stimuli [25]. It may need a further discussion about whether the N400 effects would still exist when the Chinese two-character words are used as the experimental materials. Meanwhile, the semantic processing of Chinese dyslexic children and normal children in terms of the RP and P600 are unknown. Are Chinese words with phonetic recognition processed along similar time courses in both groups of children? Solving these problems requires more research on Chinese semantic processing. Examining differences in language processing between children with dyslexia and normal children may help reveal the different types of defects exhibited by children with dyslexia.

Chinese as an ideogram is different from phonetic writing system, and the children who use Chinese may not exist reading disorder problem [26]. Stevenson (1982) conducted across language researches in Japan, Taiwan and the United States, respectively and results showed that the incidence rate of dyslexia in three places have no significant difference and three incidence rates were 5.4%, 7.5% and 5.4%, respectively. The results confirmed by the subsequent researches, since then, people have a new understanding on the relationship between dyslexia and language [27]. The explanation of Chinese dyslexia mainly divided into language specificity theory and non-verbal theory, and non-verbal theory involves some general cognitive ability defects of dyslexia children, such as working memory, attention, executive function, etc. Language specificity theory refers to verbal information representation and processing of dyslexia children, including phonetic defects, surface defects and deep defects three theories [27]. We aimed to study the time course and between-group variations in different stages of word/pseudo-word processing, lexical decision making, and response choice in Chinese-speaking dyslexics and controls by recording ERPs and behavioral measures such as response time (RT) and response accuracy.

Eighteen dyslexic children (ages 12~14) and 18 matched control children were tested, and the event-related potentials (ERPs) to real words and pseudo-words were recorded simultaneously with behavioral measures [28]. The N130 is a negative, early semantic processing stage component with a latency of 100–150 ms. Although the amplitude of N130s did not differ between the dyslexia group and control group, the latency was significantly delayed in the dyslexia group compared to the control group in the pseudo-word judgment condition. These results suggest the existence of early word recognition defects in dyslexic children. The N400 component has previously been shown to reflect sentence processing and semantic integration. In this study, using Chinese double words, we also found significant N400 effects. What is more, the amplitude of the N400 component during both the word and pseudo-word conditions in the dyslexia group was significantly higher, while the N400 latency in the dyslexia group was significantly delayed. The results also showed that in the pseudo-word recognition, the amplitude of the N400 component in dyslexic children was significantly higher. Consistent with previous findings, these results suggest that pseudo-word recognition under conditions of semantic processing took more time for participants in the dyslexia group than for participants in the control group, which indicate that children with dyslexia may need to devote more cognitive resources when recognizing words, thus implying there is a semantic integration defect in dyslexic children [29-32]. Chinese word recognition is similar to the word recognition in other phonetic languages. The present study found that when presented with the same recognition task, both normal and dyslexic Chinese children showed P600 effects. We also found that in the dyslexia group, the pseudo-word condition was associated with a longer latency and lower amplitude compared to the control group. It is generally believed that the P600 component reflects the later stages of semantic integration and decision processes. This may be due to post-processing difficulties and flawed semantic integration in these children during reading, with fewer resources being available for a longer duration. The dyslexic group was impaired in the later cognitive stages of lexical decision-making and response-choice processes. As ideographic characters and phonetic system similarities, there are semantic processing defects in Chinese dyslexic children.

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