

# **COGNITIVE POTENTIAL (P300) IN CHILDREN WITH PHONOLOGICAL DISORDER**

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## **Abstract**

Phonological disorder does not have a known origin. Among the possible causes related to it there is otitis. Furthermore, studies demonstrate that individuals with language disorders may present alterations in the neural codification of the auditory information. Twenty four children without phonological disorder and 23 children with phonological disorder were evaluated. The children with phonological disorder were divided in two subgroups: IA with 12 children attending speech-language therapy, and IB with 11 children not attending speech-language therapy. The results showed that children with phonological disorder present alteration in the P300 and that this potential results improved with speech-language therapy.

## **Summary**

The phonological disorder does not have a definite cause<sup>1</sup>, nevertheless the otitis in the first years of life are among the causes related to this disorder, once children with this background may present a specific phonological profile<sup>2,3</sup>.

Furthermore, studies involving individuals with language disorders suggest a failure in the neural codification of the auditory information which interferes in the adequate development of language skills, probably due to an alteration in the perception of acoustic traces of the speech signs<sup>4</sup>.

The damages in the perception and in the neurophysiologic codification of the speech sounds may be improved and modified through the perceptual learning associated to the auditory training<sup>5</sup>.

The changes that might occur in the neural activity due to the practice of a skill, or to the frequent exposure to a stimulus, are named neuronal plasticity <sup>6</sup>, which can be evaluated through auditory electrophysiological tests<sup>7</sup> also named auditory evoked potentials.

The auditory evoked potentials may be defined as electric responses obtained from acoustic stimulation <sup>8</sup> and may be classified in early, middle and late <sup>9</sup>.

Studies on auditory evoked potentials of long latency showed that children with phonological disorder present alterations of the waves' latency and amplitude <sup>10</sup>. The long latency auditory evoked potentials are registered between 80 to 500 milliseconds (ms) after the acoustic stimulation, being the Cognitive Potential, or P300, is the most used one <sup>11</sup>. This potential appears around 300 ms and requires attention, auditory discrimination and memory for its generation <sup>12</sup>. The P300 generators include the frontal cortex, the centro-parietal cortex and the hippocampus <sup>13</sup>.

The auditory evoked potentials are also used in the evaluation of the central auditory pathway in individuals with language problems <sup>14</sup>.

As the phonological system development depends on the adequate functioning of the auditory pathway, it is important to know the central auditory system functioning in children with phonological disorder.

Therefore, the aim of this study was to evaluate children with phonological disorder, characterizing the P300, and to verify the improvement of this potential's results with the speech-language therapy.

Forty seven children took part in this study, 23 with phonological disorder (study group) and 24 without phonological disorder (control group), ranging in age from eight to 11 years. Children from the study group were divided in two subgroups: subgroup IA

composed by 12 children attending speech-language therapy, and subgroup IB composed by 11 children not attending speech-language therapy.

The audiological evaluation was comprised by acoustic immitance measures, tonal and speech audiometry, to assure the normal hearing sensibility, and P300.

Children from the study group were diagnosed with phonological disorder and were referred by the Speech and Language Laboratory in Phonology. The audiological evaluation for all children was carried out in the Speech and Hearing Laboratory in Auditory Evoked Potentials of the Speech and Hearing Pathology Course of the University of São Paulo.

Children from subgroup IA underwent audiological re-evaluation after 12 speech-language therapy sessions, and children from subgroup IB, three months after the initial evaluation. Of the 12 children from subgroup IA, one abandoned the speech-language therapy and, therefore, didn't underwent audiological re-evaluation; and of the 11 children from subgroup IB, two didn't show up for the audiological re-evaluation.

The results showed a statistically significant difference in the comparison of the averages of the P300 latencies between the control and study groups ( $p$ -value = 0,005), and the study group presented the highest average. Concerning the re-evaluation of the study group, it was verified that there was an statistically significant difference between the P300 latencies obtained in the first and in the second evaluations ( $p$ -value = 0,024) of the children from subgroup IA (children who attended speech-language therapy) – the second evaluation presented a lower average; while there wasn't any statistical difference between the P300 latencies obtained in the two evaluations ( $p$ -value = 0,677)

These results allowed us to conclude that children with phonological disorder present alteration in the P300, suggesting an impairment in the cortical regions of the

auditory pathway, and that this potential's results improve after speech-language therapy.

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