



Modern Challenges In The Speech Therapy Correction Of Speech Disorders In Children Associated With Central Nervous System Disorders And Comorbid Conditions

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ABSTRACT

This article analyzes the underlying mechanisms of severe speech disorders (dysarthria, alalia, aphasia) occurring in children against the background of organic diseases of the central nervous system, infantile cerebral palsy (ICP), dysontogenesis, and genetic syndromes. Within the framework of the clinical-pedagogical classification, the negative impacts of these pathologies on the speech apparatus and cortical speech areas are highlighted. The article provides a detailed paragraph-by-paragraph substantiation of modern strategic approaches to speech therapy correction, integrating traditional educational methods with advanced neurological practices and medical-pedagogical collaboration.

Keywords: Modern speech therapy, central nervous system diseases, infantile cerebral palsy, dysarthria, alalia, neurological pathogenesis, speech therapy massage, medical-pedagogical correction.

INTRODUCTION

One of the most complex and fundamental challenges in the fields of special education, defectology, and speech-language pathology is the diagnosis and systematic correction of severe speech disorders in children resulting from various neurological, genetic, and somatic diseases. Although advances in medicine and technology have increased the survival rates of infants born with severe perinatal pathologies, this has also led to a growing number of children who subsequently experience conditions such as cerebral palsy (CP), intracranial infections, and organic disorders of the nervous system. These conditions directly interfere with the development of higher mental functions, particularly the formation of the speech system.

In clinical speech-language pathology, speech disorders arising in the context of underlying diseases differ fundamentally from ordinary functional impairments in terms of their pathogenesis, structure, and developmental course. Such children experience not merely the incorrect pronunciation of individual sounds but also severe impairments in the development of the motor, sensory, grammatical, and communicative components of speech. These conditions may manifest as severe speech and language disorders (SSLD). Such pathological conditions are directly associated with damage to the neural structures responsible for speech production and speech perception as a consequence of neurological disorders affecting the central nervous system.

Therefore, in contemporary speech-language pathology practice, the use of general pedagogical lesson formats alone is insufficient to achieve the expected outcomes when working with children whose speech disorders are associated with underlying medical conditions. Speech-

language pathologists must possess an in-depth understanding of the mechanisms underlying the pathology, the child's neurological status, and the nature of the primary disease. Organizing speech-language intervention at the intersection of medicine—including neurology, physiotherapy, and kinesitherapy—and special education, while taking into account the principles of neuroplasticity, has become one of the most pressing and urgent challenges in contemporary practice.

The normal functioning of the speech system depends on the coordinated activity of specific areas of the cerebral cortex, including Broca's and Wernicke's areas, the subcortical nuclei, and the cranial nerves. When an organic disorder develops during the prenatal, perinatal, or postnatal period, this complex neuronal network may be disrupted. The major conditions most frequently encountered in speech-language pathology practice that can lead to severe speech and language impairments, along with their underlying neurobiological mechanisms, include the following.

Cerebral palsy (CP) is a complex neurological condition caused by damage to the brain structures responsible for motor control and posture, occurring during prenatal development, around the time of birth, or in the early stages of life. In addition to motor impairments, dysarthria—a disorder associated with impaired innervation of the speech apparatus—is reported in approximately 70–80% of cases. From a neurological perspective, damage to the pyramidal and extrapyramidal pathways may result in significantly increased muscle tone (spasticity) or reduced muscle tone (hypotonia) in the articulatory muscles, including the tongue, lips, and soft palate. Consequently, the child may be unable to position the tongue appropriately for speech production, resulting in speech that is severely unintelligible and characterized by indistinct, mumbling-like articulation.

Neuroinfections such as encephalitis and meningitis, as well as brain injuries sustained during early childhood, may cause organic damage to the cortical regions responsible for speech and language. If the damage affects Broca's area in the frontal region of the dominant, usually left, hemisphere, the child may develop motor alalia, a severe speech and language impairment characterized by significant difficulties in expressive speech despite relatively preserved comprehension in some cases. If Wernicke's area in the temporal region is affected, sensory alalia may occur, involving substantial difficulties in understanding the meaning of spoken words despite the ability to hear them. In these conditions, disruption of neuronal and synaptic connections may interfere with the child's ability to acquire language independently, including its grammatical and phonological systems.

Down syndrome, Martin–Bell syndrome (Fragile X syndrome), and various metabolic disorders, such as phenylketonuria, can affect the development of the nervous system and the functioning of the body as a whole. These conditions may be associated with abnormalities in brain development, reduced muscle tone, macroglossia (an unusually large tongue), and cognitive impairments. The combined effects of these factors can significantly affect a child's ability to communicate, articulate words, and develop functional speech.

Before beginning the correction of speech impairments associated with underlying medical conditions, a speech-language pathologist must conduct a comprehensive diagnostic assessment based on clinical and educational principles. This process requires separate evaluations of the anatomical condition of the speech organs, neurological muscle tone, and reflex activity.

Identifying the following pathological symptoms during speech-language assessment provides a foundation for developing an individualized intervention plan.

Disorders of articulatory muscle tone. The speech-language pathologist assesses the condition and mobility of the child's tongue and lips, including through palpation when clinically appropriate. In cases of spasticity, the tongue may be retracted and tense. In cases of hypotonia, it may appear flaccid and spread across the floor of the oral cavity, while the lips may fail to close completely. These difficulties may be accompanied by hypersalivation, or excessive drooling.

Laryngeal and respiratory dysfunction. Children with neurological disorders may exhibit short, shallow, and irregular speech breathing. They may have difficulty coordinating the respiratory cycle with speech production, causing their voice to weaken or become a whisper during speaking.

Associated involuntary movements (synkinesias). When a child protrudes the tongue, the fingers may involuntarily extend; similarly, opening the mouth may be accompanied by upward eye movements. Such associated movements may indicate neurological dysfunction and require an individualized approach, including appropriately selected motor exercises during intervention sessions.

To address severe speech disorders resulting from underlying medical conditions, contemporary speech-language pathology should integrate traditional educational methods with appropriate neuropedagogical and kinesiotherapeutic approaches. Corrective intervention should be implemented systematically, in stages, and through a comprehensive, individualized program.

Establishing speech sounds may be difficult when significant abnormalities in articulatory muscle tone remain unaddressed. In cases of muscle spasticity, the speech-language pathologist may use gentle, relaxing massage techniques, such as light stroking and vibration, where clinically indicated. In cases of hypotonia, appropriately selected stimulating techniques may be considered to facilitate muscle activation. Specialized speech therapy probes, including those associated with the Novikova or Volkova approaches, may also be used by trained professionals when indicated. Such interventions provide sensory feedback through the nervous system and may support motor learning and neuroplasticity. These techniques must be selected according to the child's neurological condition and performed by qualified specialists.

To improve respiratory coordination, diaphragmatic breathing exercises may be incorporated into intervention sessions when appropriate. For children with cerebral palsy (CP), carefully adapted stretching and positioning activities may help address muscle tightness and improve postural control. With appropriate professional guidance, the child may be positioned lying down or sitting while specific techniques are used to reduce excessive tension in the neck and shoulder muscles. Because postural control and muscle tone can influence the coordination of speech-related movements, these factors should be considered when planning intervention.

In severe forms of alalia and dysarthria, appropriately selected kinesiological exercises, sometimes referred to as neurogymnastics, may be incorporated into individualized intervention programs to support motor coordination and engagement. For example, a child may draw symmetrical shapes with both hands or perform rhythmic finger games, such as "Locks" and "Butterflies." These activities can promote motor coordination, attention, and

sensory-motor engagement. However, claims that such exercises directly improve communication between the cerebral hemispheres or accelerate speech development should be supported by appropriate clinical evidence, and these activities should complement rather than replace evidence-based speech-language intervention.

When children remain unable to communicate effectively through speech for an extended period because of severe neurological impairment or genetic conditions, augmentative and alternative communication (AAC) methods should be introduced to prevent communication barriers from restricting their cognitive, social, and emotional development. These methods may include Picture Exchange Communication System (PECS) cards, specialized speech-generating buttons, and speech-language applications on tablets. With these tools, children can learn to express their needs, preferences, and intentions. AAC supports functional communication, participation, and social interaction and does not prevent the development of spoken language. When appropriate, it can be used alongside speech-language intervention to support the child's overall communicative development.

Conclusion

Speech disorders arising from neurological, genetic, and physical conditions in children require contemporary speech-language pathology to adopt not only an educational approach but also a comprehensive clinical and interdisciplinary perspective. Treating a child's speech difficulties separately from the underlying medical condition may limit the effectiveness of intervention. Therefore, speech-language pathologists should work in close collaboration with pediatric neurologists, physiotherapists, and kinesiotherapists to develop coordinated and individualized intervention plans.

Differentiated speech therapy techniques, appropriately selected speech-language massage, sensory-motor stimulation, and adaptations to the learning environment can support the development of communication skills while taking advantage of the nervous system's capacity for neuroplasticity. The selection of these interventions must be based on the child's individual needs, clinical condition, and response to treatment. Such a comprehensive neuro-speech-language approach can help children with complex medical conditions develop their communication potential, acquire greater independence in everyday activities, and participate more fully in the social life of their communities.

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