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both simultaneously, or to provide interventions for the expressive component first, and then address the receptive language. Preschoolers with mixed receptive–expressive language problems optimally receive interventions designed to promote social communication and literacy as well as oral language. For children at the kindergarten level, optimal intervention includes direct teaching of key pre-reading skills as well as social skills training. An important early goal of interventions for young children with mixed receptive–expressive language disturbance is the achievement of rudimentary reading skills, in that these skills are protective against the academic and psychosocial ramifications of falling behind early on in reading. Some language therapists favor a low-stimuli setting, in which children are given individual linguistic instruction. Others recommend that speech and language instruction be integrated into a varied setting with several children who are taught several language structures simultaneously. Often, a child with receptive and expressive language deficits will benefit from a small, specialeducational setting that allows more individualized learning. Psychotherapy may be helpful for children with mixed language disorder who have associated emotional and behavioral problems. Particular attention should be paid to evaluating the child’s self-image and social skills. Family counseling in which parents and children can develop more effective, less frustrating means of communicating may be beneficial. 31.4b Speech Sound Disorder Children with speech sound disorder have difficulty pronouncing speech sounds correctly due to omissions of sounds, distortions of sounds, or atypical pronunciation. Formerly called phonological disorder, typical speech disturbances in speech sound disorder include omitting the last sounds of the word (e.g., saying mou for mouse or drin for drink), or substituting one sound for another (saying bwu instead of blue or tup for cup). Distortions in sounds can occur when children allow too much air to escape from the side of their mouths while saying sounds like sh or producing sounds like s or z with their tongue protruded. Speech sound errors can also occur in patterns because a child has an interrupted airflow instead of a steady airflow preventing their words to be pronounced (e.g., pat for pass or bacuum for vacuum). Children with a speech sound disorder can be mistaken for younger children because of their difficulties in producing speech sounds correctly. The diagnosis of a speech sound disorder is made by comparing the skills of a given child with the expected skill level of others of the same age. The

disorder results in errors in whole words because of incorrect pronunciation of consonants, substitution of one sound for another, omission of entire phonemes, and, in some cases, dysarthria (slurred speech because of incoordination of speech muscles) or dyspraxia (difficulty planning and executing speech). Speech sound development is believed to be based on both linguistic and motor development that must be integrated to produce sounds. Speech sound disturbances such as dysarthria and dyspraxia are not diagnosed as

speech sound disorder if they are known to have a neurological basis, according to DSM5. Thus, speech sound abnormalities accounted for by cerebral palsy, cleft palate, deafness or hearing loss, traumatic brain injury, or neurological conditions are not diagnosed as speech sound disorder. Articulation difficulties not associated with a neurological condition are the most common components of speech sound disorder in children. Articulation deficits are characterized by poor articulation, sound substitution, and speech sound omission, and give the impression of “baby talk.” Typically, these deficits are not caused by anatomical, structural, physiological, auditory, or neurological abnormalities. They vary from mild to severe and result in speech that ranges from completely intelligible to unintelligible. EPIDEMIOLOGY Epidemiologic studies suggest that the prevalence of speech sound disorder is at least 3 percent in preschoolers, 2 percent in children 6 to 7 years of age, and 0.5 percent in 17year-old adolescents. Approximately 7 to 8 percent of 5-year-old children in one large community sample had speech sound production problems of developmental, structural, or neurological origins. Another study found that up to 7.5 percent of children between the ages of 7 and 11 years had speech sound disorders. Of those, 2.5 percent had speech delay (deletion and substitution errors past the age of 4 years) and 5 percent had residual articulation errors beyond the age of 8 years. Speech sound disorders occur much more frequently than disorders with known structural or neurological origin. Speech sound disorder is approximately two to three times more common in boys than in girls. It is also more common among first-degree relatives of patients with the disorder than in the general population. Although speech sound mistakes are quite common in children younger than 3 years of age, these mistakes are usually selfcorrected by age 7 years. Misarticulating after the age of 7 years is likely to represent a speech sound disorder. The prevalence of speech sound disorders reportedly falls to 0.5 percent by mid to late adolescence. COMORBIDITY More than half of children with speech sound disorder have some difficulty with language. Disorders most commonly present with speech sound disorders are language disorder, reading disorder, and developmental coordination disorder. Enuresis may also accompany the disorder. A delay in reaching speech milestones (e.g., first word and first sentence) has been reported in some children with speech sound, but most children with the disorder begin speaking at the appropriate age. Children with both speech sound and language disorders are at greatest risk for attentional problems and specific learning disorders. Children with speech sound disorder in the absence of language disorder have lower risk of comorbid psychiatric disorders and behavioral problems. ETIOLOGY

Contributing factors leading to speech disturbance may include perinatal problems, genetic factors, and auditory processing problems. Given the high rates of spontaneous remission in very young children, a maturational delay in the developmental brain process underlying speech has been postulated in some cases. The likelihood of neuronal cause is supported by the observation that children with speech sound disorder are also more likely to manifest “soft neurological signs” as well as language disorder and a higher-than-expected rate of reading disorder. Genetic factors are implicated by data from twin studies that show concordance rates for monozygotic twins that are

higher than chance. Articulation disorders caused by structural or mechanical problems are rare. Articulation problems that are not diagnosed as speech sound disorder may be caused by neurological impairment and can be divided into dysarthria and apraxia or dyspraxia. Dysarthria results from an impairment in the neural mechanisms regulating the muscular control of speech. This can occur in congenital conditions, such as cerebral palsy, muscular dystrophy, or head injury, or because of infectious processes. Apraxia or dyspraxia is characterized by difficulty in the execution of speech, even when no obvious paralysis or weakness of the muscles used in speech exists. Environmental factors may play a role in speech sound disorder, but constitutional factors seem to make the most significant contribution. The high proportion of speech sound disorder in certain families implies a genetic component in the development of this disorder. Developmental coordination disorder and coordination in the mouth such as in chewing and blowing the nose may be associated. DIAGNOSIS The essential feature of speech sound disorder is a child's delay or failure to produce developmentally expected speech sounds, especially consonants, resulting in sound omissions, substitutions, and distortions of phonemes. A rough guideline for clinical assessment of children's articulation is that normal 3-year-olds correctly articulate m, n, ng, b, p, h, t, k, q, and d; normal 4-year-olds correctly articulate f, y, ch, sh, and z; and normal 5-year-olds correctly articulate th, s, and r. Speech sound disorder cannot be accounted for by structural or neurological abnormalities, and typically, it is accompanied by normal language development. CLINICAL FEATURES Children with speech sound disorder are delayed in, or incapable of, producing accurate speech sounds that are expected for their age, intelligence, and dialect. The sounds are often substitutions—for example, the use of t instead of k—and omissions, such as leaving off the final consonants of words. Speech sound disorder can be recognized in early childhood. In severe cases, the disorder is first recognized at between 2 and 3 years of age. In less severe cases, the disorder may not be apparent until the age of 6 years. A child's articulation is judged disordered when it is significantly behind that of most children at the same age level, intellectual level, and educational level.

In very mild cases, a single speech sound (i.e., phoneme) may be affected. When a single phoneme is affected, it is usually one that is acquired late in normal language acquisition. The speech sounds most frequently misarticulated are also those acquired late in the developmental sequence, including r, sh, th, f, z, l, and ch. In severe cases and in young children, sounds such as b, m, t, d, n, and h may be mispronounced. One or many speech sounds may be affected, but vowel sounds are not among them. Children with speech sound disorder cannot articulate certain phonemes correctly and may distort, substitute, or even omit the affected phonemes. With omissions, the phonemes are absent entirely—for example, bu for blue, ca for car, or whaa? For what's that? With substitutions, difficult phonemes are replaced with incorrect ones—for example, wabbit for rabbit, fum for thumb, or whath dat? For what's that? With distortions, the correct phoneme is approximated but is articulated incorrectly. Rarely, additions (usually of the vowel uh) occur—for example, puhretty for pretty, what's uh that uh? For what's that? Omissions are thought to be the most serious type of misarticulating, with substitutions the next most serious, and distortions the least serious type. Omissions, which are most frequent in the speech of young children, usually occur at the ends of words or in clusters of consonants (ka for car, scisso for scissors). Distortions, which are found mainly in the speech of older children, result in a sound that is not part of the speaker's dialect. Distortions may be the last type of misarticulating remaining in the speech of children whose articulation problems have mostly remitted. The most common types of distortions are the lateral slip—in which a child pronounces s sounds with the airstream going across the

tongue, producing a whistling effect—and the palatal or lisp —in which the s sound, formed with the tongue too close to the palate, produces a ssh sound effect. The misarticulating of children with speech sound disorder is often inconsistent and random. A phoneme may be pronounced correctly one time and incorrectly another time. Misarticulating is most common at the ends of words, in long and syntactically complex sentences, and during rapid speech. Omissions, distortions, and substitutions also occur normally in the speech of young children learning to talk. But, whereas young, normally speaking children soon replace their misarticulating, children with speech sound disorder do not. Even as children with articulation problems grow and finally acquire the correct phoneme, they may use it only in newly acquired words and may not correct the words learned earlier that they have been mispronouncing for some time. Most children eventually outgrow speech sound disorder, usually by the third grade. After the fourth grade, however, spontaneous recovery is unlikely, and so it is important to try to remediate the disorder before the development of complications. Often, beginning kindergarten or school precipitates the improvement when recovery from speech sound disorder is spontaneous. Speech therapy is clearly indicated for children who have not shown spontaneous improvement by the third or fourth grade. Speech therapy should be initiated at an early age for children whose articulation is significantly unintelligible and who are clearly troubled by their inability to speak

clearly. Children with speech sound disorder may have various concomitant social, emotional, and behavioral problems, particularly when comorbid expressive language problems are present. Children with chronic expressive language deficits and severe articulation impairment are the ones most likely to suffer from psychiatric problems. Martin was a talkative, likeable 3-year-old with virtually unintelligible speech, despite excellent receptive language skills and normal hearing. Martin’s level of expressive language development was difficult to quantify due to his very poor pronunciation. The rhythm and melody of his speech, however, suggested that he was trying to produce multiword utterances, as would be expected at his age. Martin produced only a few vowels (/ee/, /ah/, and /oo/), some early developing consonants (/m/, /n/, /d/, /t/, /p/, /b/, /h/, and /w/), and limited syllables. This reduced sound repertoire made many of his spoken words indistinguishable from one another (e.g., he said bahbah for bottle, baby, and bubble, and he used nee for knee, need, and Anita [his sister]). Moreover, he consistently omitted consonant sounds at the end of words and in consonant cluster sequences (e.g., /tr-/, /st-/, /-nt/, and /-mp/). Understandably, on occasion Martin reacted with frustration and tantrums to his difficulties in making his needs understood. Brad was a pleasant, cooperative 5-year-old, who was recognized as early as preschool to have articulation problems, and these persisted into kindergarten. His language comprehension skills, and hearing were within normal limits. He showed some mild expressive language problems, however, in the use of certain grammatical features (e.g., pronouns, auxiliary verbs, and past-tense word endings) and in the formulation of complex sentences. He correctly produced all vowel sounds and most of the early developing consonants, but he was inconsistent in his attempts to produce later-developing consonants (e.g., /r/, /l/, /s/, /z/, /sh/, /th/, and /ch/). Sometimes, he omitted them; sometimes, he substituted other sounds for them (e.g., /w/ for /r/ or /f/ for /th/); occasionally, he even produced them correctly. Brad had particular problems in correctly producing consonant cluster sequences and multisyllabic words. Cluster sequences had omitted or incorrect sounds (e.g., blue might be produced as bue or bwue, and hearts might be said as hots or hars). Multisyllabic words had syllables omitted (e.g., efant for elephant and getti for spaghetti) and sounds mispronounced or even transposed (e.g., aminal for animal and lemon for melon). Strangers were unable to understand approximately 80 percent of Brad’s speech. Brad often spoke

more slowly and clearly than usual, however, when he was asked to repeat something, as he often was. Jane was a hyperactive 8-year-old, with a history of significant speech delay. During her preschool and early school years, she had overcome many of her earlier speech errors. A few late-developing sounds (/r/, /l/, and /th/), however, continued to pose a challenge for her. Jane often substituted /f/ or /d/ for /th/ and produced /w/ for /r/ and /l/. Overall, her speech was easily understood, despite these minor

errors. Nonetheless, she became somewhat aggressive with her peers because of the teasing she received from her classmates about her speech. DIFFERENTIAL DIAGNOSIS The differential diagnosis of speech sound disorder includes a careful determination of symptoms, severity, and possible medical conditions that might be producing the symptoms. First, the clinician must determine that the misarticulating is sufficiently severe to be considered impairing, rather than a normative developmental process of learning to speak. Second, the clinician must determine that no physical abnormalities account for the articulation errors and must rule out neurological disorders that may cause dysarthria, hearing impairment, mental retardation, and pervasive developmental disorders. Third, the clinician must obtain an evaluation of receptive and expressive language to determine that the speech difficulty is not solely attributable to the above mentioned disorders. Neurological, oral structural, and audiometric examinations may be necessary to rule out physical factors that cause certain types of articulation abnormalities. Children with dysarthria, a disorder caused by structural or neurological abnormalities, differ from children with speech sound disorder in that dysarthria is less likely to remit spontaneously and may be more difficult to remediate. Drooling, slow, or uncoordinated motor behavior; abnormal chewing or swallowing; and awkward or slow protrusion and retraction of the tongue indicate dysarthria. A slow rate of speech also indicates dysarthria (Table 31.4b-1). Table 31.4b-1 Differential Diagnosis of Speech Sound Disorder

COURSE AND PROGNOSIS Spontaneous remission of symptoms is common in children whose misarticulating involves only a few phonemes. Children who persist in exhibiting articulation problems after the age of 5 years may be experiencing a myriad of other speech and language impairments, so that a comprehensive evaluation may be indicated at that time. Children older than age 5 with articulation problems are at higher risk for auditory perceptual problems. Spontaneous recovery is rare after the age of 8 years. Some debate exists regarding the relationship between articulation problems and reading disorder, or dyslexia. A recent study comparing children with phonological problems only, with children who had dyslexia only, and those with both phonological difficulties and dyslexia concluded that children with both disorders have somewhat distinct profiles and are comorbid disorders rather than one mixed disorder. TREATMENT Two main approaches have been used successfully to improve speech sound difficulties. The first one, the phonological approach, is usually chosen for children with extensive patterns of multiple speech sound errors that may include final consonant deletion, or consonant cluster reduction. Exercises in this approach to treatment focus on guided practice of specific sounds, such as final consonants, and when that skill is mastered, practice is extended to use in meaningful words and sentences. The other approach, the traditional approach is utilized for children who produce substitution or distortion errors in just a few sounds. In this approach, the child practices the production of the problem sound while the clinician provides immediate feedback and cues concerning the correct placement of the tongue and mouth for improved articulation. Children who have errors in articulation because of abnormal swallowing resulting in tongue thrust and lisps are treated with exercises that improve swallowing patterns and, in turn,

improve speech. Speech therapy is typically provided by a speech-language pathologist, yet parents can be taught to provide adjunctive help by practicing techniques used in the treatment. Early intervention can be helpful, because for many children with mild articulation difficulties, even several months of intervention may be helpful in early elementary school. In general, when a child’s articulation and intelligibility is noticeably different than peers by 8 years of age, speech deficits often lead to problems with peers, learning, and self-image, especially when the disorder is so severe that many consonants are misarticulated, and when errors involve omissions and substitutions of phonemes, rather than distortions. Children with persistent articulation problems are likely to be teased or ostracized by peers and may become isolated and demoralized. Therefore, it is important to give support to children with phonological disorders and, whenever possible, to support prosocial activities and social interactions with peers. Parental counseling and monitoring of child–peer relationships and school behavior can help minimize social impairment in children with speech sound and language disorder.

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