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review. Child Care Health Dev. 2013;39:562–580. Zwicker JG, Missiuna C, Harris SR, Boyd LA. Developmental coordination disorder: A review and update. Eur J Paediatr Neurol. 2012;6:573–581. Zwicker JG, Missiuna C, Harris SR, Boyd LA. Brain activation associated with motor skill practice in children with developmental motor coordination disorder: An fMRI study. Int J Dev Neurosci. 2011;29:145–152. 31.8b Stereotypic Movement Disorder Stereotypic movements include a diverse range of repetitive behaviors that usually emerge in the early developmental period, appear to lack a clear function, and sometimes cause interruption in daily life. These movements are typically rhythmic, such as hand flapping, body rocking, hand waving, hair-twirling, lip-licking, skin

picking, or self-hitting. Stereotypic movements often appear to be self-soothing or selfstimulating; however, they can result in self-injury in some cases. Stereotypic movements appear to be involuntary; however, they frequently can be suppressed with a concentrated effort. Stereotypic movement disorder occurs with increased frequency in children with autism spectrum disorder and intellectual disability, but they also exist in typically developing children. Stereotypic movements, such as head-banging, face slapping, eye poking, or hand-biting, can cause significant self-harm. Nail-biting, thumb-sucking, and nose-picking are often not included as symptoms of stereotypic movement disorder because they rarely cause impairment. When impairment occurs, however, they can be included in stereotypic movement disorder. Stereotypic movements share several features with tics, including the repetitive, seemingly involuntary, and characteristically identical nature of the movements each time they are displayed. However, distinguishing features of stereotypical movements compared to tics include a younger age of onset, lack of changing anatomical locations, lack of premonitory “urge,” and decreased response to medication management. According to the Fifth Edition of the American Psychiatric Association’s Diagnostic and Statistical Manual of Mental Disorders (DSM-5), stereotypic movement disorder is characterized by repetitive, seemingly driven, and apparently purposeless motor behavior that interferes with social, academic, or other activities and may result in selfharm. EPIDEMIOLOGY Repetitive movements are common in infants and young children, with greater than 60 percent of parents of children between the ages of 2 and 4 years reporting transient emergence of these behaviors. The most frequent age of onset is in the second year of life. Epidemiologic surveys estimate that up to 7 percent of otherwise typically developing children exhibit stereotypic behaviors. A prevalence of about 15 to 20 percent in children younger than the age of 6 years display stereotypic behavior, with diminishing rates over time. The prevalence of self-injurious behaviors, however, has been estimated to be in the range of 2 to 3 percent among children and adolescents with intellectual disability. Stereotypic movements appear to occur in about twice as many boys as girls. Determining which cases are sufficiently severe to confirm a diagnosis of stereotypic movement disorder may be difficult. Stereotypic behaviors occur in 10 to 20 percent of children with intellectual disability, with increased rates being proportional to level of severity. Self-injurious behaviors frequently occur in genetic syndromes, such as Lesch-Nyhan syndrome, and in children with sensory impairments, such as blindness and deafness. ETIOLOGY The etiology of stereotypic movement disorder includes environmental, genetic, and neurobiological factors. Although the neurobiological mechanisms of stereotypic movement disorder have yet to be proven, given their similarity to other involuntary

movements, stereotypic movement disorder is hypothesized to originate from the basal ganglia. Dopamine and serotonin are likely to be involved in their emergence. Dopamine agonists tend to induce or increase stereotypic behaviors, whereas dopamine antagonists sometimes decrease

them. One study found that 17 percent of typically developing children with stereotypic movement disorder had a first-degree relative with the disorder, and 25 percent had a first- or second-degree relative with stereotypic movement disorder. Transient stereotypic behaviors in very young children can be considered a normal developmental phenomenon. Genetic factors likely play a role in some stereotypic movements, such as the X-linked recessive deficiency of enzymes leading to Lesch-Nyhan syndrome, which has predictable features including intellectual disability, hyperuricemia, spasticity, and self-injurious behaviors. Other minimal stereotypic movements that do not usually cause impairment (e.g. nail-biting) appear to run in families as well. Some stereotypic behaviors seem to emerge or become exaggerated in situations of neglect or deprivation; such behaviors as head-banging have been associated with psychosocial deprivation. DIAGNOSIS AND CLINICAL FEATURES The presence of multiple repetitive stereotyped symptoms tends to occur frequently among children with autism spectrum disorder and intellectually disability, particularly when the intellectual disability is severe. Patients with multiple stereotyped movements frequently have other significant mental disorders, including disruptive behavior disorders, or neurological conditions. In extreme cases, severe mutilation and lifethreatening injuries can result from self-inflicted trauma. Head-Banging Head-banging exemplifies a stereotypic movement disorder that can result in functional impairment. Typically, head-banging begins during infancy, between 6 and 12 months of age. Infants strike their heads with a definite rhythmic and monotonous continuity against the crib or another hard surface. They seem to be absorbed in the activity, which can persist until they become exhausted and fall asleep. The head-banging is often transitory, but sometimes persists into middle childhood. Head-banging that is a component of temper tantrums differs from stereotypic head-banging and ceases after the tantrums and their secondary gains have been controlled. Nail-Biting Nail-biting begins as early as 1 year of age and increases in incidence until age 12. Most cases are not sufficiently severe to meet the DSM-5 diagnostic criteria for stereotypic movement disorder. In rare cases, children cause physical damage to the fingers themselves, usually by associated biting of the cuticles, which leads to secondary infections of the fingers and nail beds. Nail-biting seems to occur or increase in intensity when a child is either anxious or stressed. Some of the most severe nail-biting occurs in

children with severe or profound intellectual disability, however many nail-biters have no obvious emotional disturbance. PATHOLOGY AND LABORATORY EXAMINATION No specific laboratory measures are helpful in the diagnosis of stereotypic movement disorder. Tim, a 14-year-old with autism spectrum disorder (ASD), and severe intellectual disability was evaluated when he transferred to a new private school for children with ASD. Observed in his classroom, he was noted to be a small boy who appeared younger than his age. He held his hands in his pockets and spun around in place. When offered a toy he took it and manipulated it for a while. When he was prompted to engage in various tasks that required that he take his hands out of his pockets, he began hitting his head with his hands. If his hands were held by the teacher, he hit his head with his knees. He was adept in contorting himself, so that he could hit or kick himself in almost any position, even while walking. Soon, his face and forehead were covered with bruises. His development was delayed in all spheres, and he never developed language. He lived at home and attended a special educational program. His self-injurious behaviors developed early in life, and, when his parents tried to stop him, he became aggressive. Gradually, he became too difficult to be managed in public school, and, at 5 years of age, he was placed in a special school. The self-abusive and self-restraining (i.e., holding his hands in his pockets) behavior was present throughout his stay there, and, virtually all of the time; he had been tried on several second-

generation antipsychotics with only minimal improvement. Although the psychiatrist's notes mentioned some improvement in his self-injurious behavior, it was described as continuing and fluctuating. He was transferred to a new school because of lack of progress and difficulties in managing him as he became bigger and stronger. His intellectual functioning was within the 34 to 40 intelligence quotient (IQ) range. His adaptive skills were poor. He required full assistance in self-care, could not provide even for his own simple needs, and required constant supervision for his safety. In a few months, Tim settled into the routine in his new school. His self-injurious behavior fluctuated. It was reduced or even absent when he restrained himself by holding his hands in his pockets or inside his shirt or even by manipulating some object with his hands. If left to himself, he could contort himself, while holding his hands inside his shirt. Because the stereotypic self-injurious and self-restraining behavior interfered with his daily activities and education, it became a primary focus of a behavior modification program. For a few months, he did well, especially when he developed a good relationship with a new teacher, who was firm, consistent, and nurturing. With him, Tim could successfully engage in some school tasks. When the teacher left, Tim regressed. To prevent injuries, the staff started blocking his self-

hitting with a pillow. He was offered activities that he liked and in which he could engage without resorting to self-injury. After several months, his antipsychotic medication was slowly discontinued, over a period of 11 months, without any behavioral deterioration. (Adapted from case material from Bhavik Shah, M.D.) DIFFERENTIAL DIAGNOSIS The differential diagnosis of stereotypic movement disorder includes obsessivecompulsive disorder (OCD) and tic disorders, both of which are exclusionary criteria in DSM-5. Although stereotypic movements can often be voluntarily suppressed, and are not spasmodic, it is difficult to differentiate these features from tics in all cases. A study of stereotyped movements compared with tics found that stereotyped movements tended to be longer in duration, and displayed more rhythmic qualities than tics. Tics seemed to occur more when a child was in an "alone" condition, rather than when the child was in a play condition, whereas stereotypic movements occurred with the same frequency in these two different conditions. Stereotypic movements are often observed to seem selfsoothing, whereas tics are often associated with distress. Differentiating dyskinetic movements from stereotypic movements can be difficult. Because antipsychotic medications can sometimes suppress stereotypic movements, clinicians should note any stereotypic movements before initiating treatment with an antipsychotic agent. Stereotypic movement disorder may be diagnosed concurrently with substance-related disorders (e.g., amphetamine use disorders), severe sensory impairments, central nervous system and degenerative disorders (e.g., Lesch-Nyhan syndrome), and severe schizophrenia. COURSE AND PROGNOSIS The duration and course of stereotypic movement disorder vary, and the symptoms may wax and wane. Up to 60 to 80 percent of normal toddlers show transient rhythmic activities that seem purposeful and comforting and tend to disappear by 4 years of age. When stereotypic movements emerge more severely later in childhood they typically range from brief episodes occurring under stress, to an ongoing pattern in the context of a chronic condition, such as ASD or intellectual disability. Even in chronic conditions, stereotypic behaviors may come and go. In many cases, stereotypic movements are prominent in early childhood and diminish as a child gets older. The severity of the dysfunction caused by stereotypic movements varies with the frequency, amount, and degree of associated self-injury. Children who exhibit frequent, severe, self-injurious stereotypic behaviors have the poorest prognosis. Repetitive episodes of head-banging, self-biting, and eye-poking can be difficult to control without physical restraints. Most nail-biting is benign and often does not meet the

diagnostic criteria for stereotypic movement disorder. In severe cases in which the nail beds are repetitively damaged, bacterial and fungal infections can occur. Although chronic stereotypic movement disorders can severely impair daily functioning, several

treatments help control the symptoms. TREATMENT When stereotypic movements occur in the absence of any other symptoms or disorders, they may not warrant pharmacologic treatment. Treatment modalities yielding the most promising effects include behavioral techniques, such as habit reversal and differential reinforcement of other behavior, as well as pharmacological interventions. A recent report on utilizing both habit reversal (in which the child is trained to replace the undesired repetitive behavior with a more acceptable behavior) and reinforcement for reducing the unwanted behavior, indicated that these treatments had efficacy among 12 typically developing children between 6 and 14 years. One case report detailed a successful habit reversal treatment of a 3-year-old with severe stereotypic movements, which was largely implemented at home by her parents. The estimated change in stereotypic behaviors during regular recorded intervals during treatment diminished from presence in 85 percent of recordings to presence in less than 2 percent of recordings over a period of 4 weeks. Pharmacological interventions have been used in clinical practice to minimize selfinjury in children whose stereotyped movements caused significant harm to their bodies. Small open-label studies have reported benefit of atypical antipsychotics, and case reports have indicated use of selective serotonin reuptake inhibitor (SSRIs) in the management of self-injurious stereotypies. The dopamine receptor antagonists have been tried most often for treating stereotypic movements and self-injurious behavior. The SSRI agents may be influential in diminishing stereotypies; however, this is still under investigation. Open trials suggest that both clomipramine and fluoxetine may decrease self-injurious behaviors and other stereotypic movements in some patients. REFERENCES Barry S, Baird G, Lascelles K, Bunton P, Hedderly T. Neurodevelopmental movement disorders—an update on childhood motor stereotypies. Dev Med Child Neurol. 2011;53:979–985. Doyle RL. Stereotypic movement disorders. In: Sadock BJ, Sadock VA, Ruiz P, eds. Kaplan & Sadock’s Comprehensive Textbook of Psychiatry. 9th ed. Vol. II. Philadelphia: Lippincott Williams & Wilkins; 2009:3642. Edwards MJ, Lang AE, Bhatia KP. Stereotypies: A critical appraisal and suggestion of a clinically useful definition. Mov Disord. 2012;27:179–185. Fernandez AE. Primary versus secondary stereotypic movements. Rev Neurol. 2004; 38[Suppl 1]:21. Freeman KA, Duke DC. Power of magic hands: Parent-driven application of habit reversal to treat complex stereotypy in a 3-year-old. Health Psychol. 2013;32:915–920. Freeman RD, Soltanifar A, Baer S. Stereotypic movement disorder: Easily missed. Dev Med Child Neurol. 2010;52:733–738. Harris KM, Mahone EM, Singer HS. Nonautistic motor stereotypies: Clinical features and longitudinal follow-up. Pediatr Neurol. 2008;38:267–272. Luby JL. Disorders of infancy and early childhood not otherwise specified. In: Sadock BJ, Sadock VA, eds. Kaplan & Sadock’s Comprehensive Textbook of Psychiatry. 8th ed. Vol. 2. Philadelphia: Lippincott Williams & Wilkins; 2005:3257. Mahone EM, Bridges D, Prahme C, Singer HS. Repetitive arm and hand movements (complex motor stereotypies) in

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