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MULTIPLE SCLEROSIS AND DYSPHAGIA

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MULTIPLE SCLEROSIS AND DYSPHAGIA

by

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A Research Paper

Submitted in Partial Fulfillment of the Requirements for the
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A Research Paper Submitted in Partial

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Introduction

The objective of this research paper is to illustrate the effects of multiple sclerosis (MS) on swallowing and dysphagia (i.e., difficulty swallowing). First, the discussion will include the definition of MS and its physical and emotional affects on people who have this diagnosis. Next, the normal swallow and symptoms of dysphagia will be discussed. Then, the affects of MS on the swallow will be analyzed. Additionally, preferred dysphagia assessment procedures will be reviewed. Finally, strategies to improve feeding and swallowing for individuals with MS will be described.

What is Multiple Sclerosis

MS is one of the most common neurological diseases in the world. According to the National Institute of Neurological Disorders and Stroke (2011), approximately 250,000 to 350,000 people in the United States have been diagnosed with multiple sclerosis. Worldwide, the incidence (defined as a measurement of the number of new individuals who contract a disease during a particular period of time) of MS is approximately 0.1 percent. Northern Europe, the northern United States, southern Australia, and New Zealand have the highest prevalence (defined as a measurement of

all individuals affected by the disease within a particular period of time), with more than 30 cases per 100,000 people (Schneider & Swierzewski, 2008). MS is a degenerative disease of the central nervous system (CNS), mostly affecting the brain and the spinal cord (Rumrill, 2009). MS damages the fatty tissue called myelin that surrounds white matter tracts in the brain and along the spinal cord (Rumrill, 2009). The National Multiple Sclerosis Society (NMSS) estimates the prevalence of MS in the United States to be between 350,000 and 400,000 cases, indicating that 1 in 750 people have the diagnosis at any given time (Smith & Schapiro, 2004). MS can occur at any age, although initial manifestations are most often apparent during early adulthood, usually between the ages of 20 and 40. Additionally, MS is approximately two or three times more common in women than in men (Rumrill, 2009).

The exact cause of MS remains unknown but specialists generally believe that MS results from a combination of immunologic, environmental, and genetic factors resulting in an irreversible deterioration of the nerves themselves (Schapiro, 2003). Symptoms associated with MS differ extensively, and they are primarily determined by the location and size of the lesions in the person's brain and spinal cord (Rumrill, 2009). The nature, severity, and

number of symptoms related to MS vary widely among individuals, and the patterns in which the symptoms appear cannot be generalized from one person to another.

Multiple Sclerosis Symptoms

MS is usually characterized by a loss of strength in major muscle groups such as those of the arms and legs. One of the most common effects of MS is fatigue (Burks & Johnson, 2000; Schapiro, 2003), defined as an overwhelming sense of tiredness, lack of energy, and feelings of exhaustion in excess of what might be expected for the associated level of activity (Polman, Thompson, Murray, Bowling, & Noseworthy, 2006). Additional key symptoms of MS include mobility problems, spasticity, numbness and tingling in the extremities, general weakness, visual impairments, bowel and bladder dysfunction, sexual dysfunction, and cognitive problems (see Table 1).

Furthermore, several physiological symptoms are related to motor disturbances in people with MS, including spasticity (i.e., a disturbance in the coordination of muscle contraction and relaxation), and ataxia (i.e., a disturbance in mobility coordination) (Burks & Johnson, 2000; Schapiro, 2003, Rumrill, 2009). Ambulation, the act of walking and getting around, is often impaired by such symptoms of MS as balance problems, hyperextension of the

knees, and instability of the legs (Rumrill, 2009).

Numbness and tingling in the extremities among people with MS can range from "pins and needles" sensations to itching in an isolated area of skin or a more severe and painful condition termed trigeminal neuralgia (Smith & Schapiro, 2004).

Tremor in the extremities and head is another common physiological effect of MS, manifested in a wide range of movement from fine, less noticeable tremors to more obvious, gross oscillations (Schapiro, 2003). Visual impairments in individuals with MS are most often temporary conditions that present in blurred or double vision, although in some cases functional blindness may result (Rumrill, 2009). Bowel and bladder dysfunctions are frequent, frustrating, and often embarrassing effects of MS (Rumrill, 2009). Sexual dysfunction affects up to 85 percent of men and up to 74 percent of women diagnosed with MS (Foley & Werner, 2004).

In addition to MS impairing physiological symptoms, MS often has a negative impact of one's psychological functioning. Psychological problems related to MS can be divided into three categories: cognitive dysfunctions, affective disorders, and adjustmental issues (Rumrill, 2009). Although once considered symptomatic of only the

most severe cases of MS, cognitive dysfunctions have been established as a common symptom of all stages and types of disease. Smith and Schapiro (2004) and Polman et al. (2006) estimated that as many as 60-65 percent of people diagnosed with MS experience some degree of measurable cognitive change. These changes can affect attention, conceptual reasoning, executive function, and memory (Rumrill, 2009).

A sizeable proportion of the overall psychological impact of MS can be viewed in terms of affective disorders that accompany the illness (Rumrill, 2009). The most common affective symptoms include irritability, difficulty concentrating, anxiety, bipolar disorder, and depression (McReynolds & Koch, 2001). Approximately one-half of all people with MS experience at least one major depressive episode during the course of the illness (McReynolds & Koch, 2001). Another common psychological symptom of MS is pathological laughing and weeping (Rumrill, 2009). LaRocca states that a person with MS may break into laughter or begin to weep with slight or no provocation, regardless of his or her underlying mood state. Such emotional outbursts can be functionally disabling in and of themselves, making even basic tasks of daily living extremely difficult to perform (as cited in Rumrill, 2009).

In addition to the cognitive and affective symptoms of

MS, the wide-ranging physiological effects of the illness and its unpredictable course make the process of adjusting to such a debilitating disease a very difficult task (Rumrill, 2009). Kalb and Miller indicate that a number of factors influence one's overall psychological adjustment to MS and state that a primary determinant of adjustment is the perceived intrusiveness of the illness. This includes the cumulative effect of functional deficits, physical disabilities, stressful life events, the unique set of signs, symptoms, and treatment constraints associated with an individual's condition, life satisfaction, coping style, knowledge of MS, personality, and support systems (as cited in Rumrill, 2009).

As many as 60 to 65 percent of people diagnosed with MS undergo some degree of measurable cognitive change as estimated by Smith and Schapiro (2004) and Polman et al. (2006). These changes can affect attention, conceptual reasoning, executive function, and memory (Rumrill, 2009). The cognitive dysfunction aspect of MS is often difficult to detect since language skills and intellectual function are often intact (Barnes, 2010).

Treatment options

There is no cure for MS, but research indicates that early treatment of MS delays disability by decreasing the

injury to the nervous system caused by the disease (Vishnu, 2010). Treatment of MS can be categorized by treatment that changes the course of disease by modifying the number and severity of attacks or treatment addressing symptom management (Vishnu, 2010). During an MS attack, inflammation occurs in areas of the white matter of the central nervous system in random patches called plaques ("Multiple Sclerosis", n.d.). This is followed by destruction of myelin, the fatty covering that protects nerve cell fibers in the brain and spinal cord. When myelin is damaged, neurological transmission of messages may be slowed or blocked completely, resulting in diminished or lost function ("Multiple Sclerosis", n.d.).

In both treatment options, prescribed drugs are used to reduce the number and severity of attacks and to help manage the symptoms. The FDA approved six products for disease modifying treatments (Vishnu, 2010). These include Betaseron® (interferon beta-1b), Avonex® (interferon beta-1a), Rebif® (interferon beta-1a), Copaxone® (Glatiramer Acetate), Tysabri® (Natalizumab), and Novantrone® (Mitoxantrone) (Vishnu, 2010). Symptom specific management involves usage of many drugs. Muscle weakness, numbness and stiffness or spasticity is treated with muscle relaxants such as tizanidine, baclofen, benzodiazepines (diazepam),

and anticonvulsants (carbamazepine) (Vishnu, 2010). The use of baclofen and tizanidine demonstrate side effects such as drowsiness, dizziness, and fatigue. Side effects of carbamazepine include aplastic anemia and low white blood cell count (Vishnu, 2010). Fatigue is treated using amantadine hydrochloride or modafinil and the side effects include nausea, dizziness, and headaches. Balance and equilibrium difficulties are treated with benzodiazepines, clonazepam, propranolol, and mysoline. Side effects of their usage include drowsiness, confusion, and depression (Vishnu, 2010).

How MS Affects Patients and Significant Others

MS has many effects on patients and their significant others. MS is typically diagnosed in the second and third decade of life, when people are usually just beginning to become established in their careers and building homes and families (Burgess, 2010). The presentation, course, and severity of the symptoms experienced of MS vary greatly among individuals, as well as the impact of MS on individuals with MS and their families (Burgess, 2010).

The way in which the diagnosis of MS is communicated to the individual and the support provided have a great influence on the development of coping mechanisms (Johnson, 2003). Feelings of abandonment, isolation, anxiety,

depression, and anger are universal reactions for both the patient and significant others. Effective support at this life-changing time is critical (Johnson, 2003). Although there are common patterns of responses to a MS diagnosis, individual characteristics constitute a critical portion of how an individual handles the problem. While feelings of grief are common, some people also go through feelings of relief when they discover that the diagnosis is not something they would consider worse than MS, such as brain tumor or motor neuron disease (Johnson, 2003).

The needs of partners and family members may be overlooked at the diagnosis period. Bogosian, Moss-Morris, Yardley, & Dennison (2009) studied the impact of diagnosis on partners of people with MS. They found that feelings of anger, loss of control, and social isolation were typical. The incidence of depression among partners and caregivers of people diagnosed with MS is twice as high as that of healthy controls (Solari, Ferrari, & Radice, 2006). The importance of providing information and continuing support to partners and significant others should not be underestimated.

Swallowing

Swallowing is a complex sensorimotor function that incorporates activity from multiple muscle groups in the

upper aerodigestive tract (Crary, Carnaby, & Groher, 2006). Countless diseases and conditions affect this basic organic function. Therefore, understanding the normal swallow is one of the keys to beginning to develop a therapeutic plan for the patient with impaired deglutition. Swallowing is a complex neurophysiologic process requiring over 40 pairs of muscles (Bass, 1997) in four basic phases. The first phase is the oral preparatory phase. Food is put into the mouth, chewed, and moistened with saliva. Muscles and nerves function together to keep food in the mouth and prepare it for swallowing. The second phase is the oral phase. The food is moved from the mouth to the pharynx or back of the throat. The soft palate elevates to keep the food out of the nose and the back of the tongue pushes the food back into the throat. The tongue and palate are very important to this phase. The third phase is the pharyngeal phase. The food moves into the esophagus from the pharynx. Breathing stops during this part of swallowing in order to prevent food from entering the airway (aspiration). The fourth phase, the esophageal phase, is the movement of food through the esophagus to the stomach (see Table 2).

Dysphagia

Dysphagia is defined as the subjective awareness of swallowing difficulty during passage of a solid or liquid

bolus from the mouth to the stomach (Sheltman, 2007). When patients experience dysphagia, their symptoms can range from mild discomfort in the mouth or throat when swallowing to an inability to eat. In some patients, dysphagia is localized in the phases of deglutition related to the mouth, throat, or pharynx, or esophagus while other patients may have more complex and extensive damage. Dysphagia, if unnoticed and untreated, can lead to insufficient oral intake, malnutrition, dehydration, inability to take required oral medications, aspiration pneumonia, and death (Terrado, Russell, & Bowman, 2001). The diagnosis of swallowing disorders is established through clinical examination and instrumental examination.

Swallowing dysfunctions are regularly observed in patients with MS and have been calculated to occur in 33% to 43% of the cases (Thomas & Wiles, 1999). The effect of dysphagia in patients with MS lowers the quality of their life in addition to creating a potential risk of aspiration and subsequent bronchopneumonia, a frequent cause of morbidity and death in the late stages of MS (Sadovnick, Eisen, Ebers, & Paty, 1991).

Dysphagia in MS is possibly due to a combination of several potential factors, such as involvement of the corticobulbar tracts, cerebellar and brainstem

dysfunctions, lower cranial nerves paresis, and cognitive impairment (Calcagno, Ruoppolo, Grasso, De Vincentiis, & Paolucci, 2002). Poorjavad et al. (2010) studied the prevalence of different types of swallowing disorders among MS patients with mild to moderate disability and found that pharyngeal stage disorders were the most common observed impairment.

Assessment of Dysphagia

Dysphagia decreases the quality of life in patients with MS, and increases the risk of dehydration and aspiration. These complications may be avoided with a timely swallowing assessment and management plan (Poorjavad et al., 2010). Diagnosis of dysphagia can be supported not only by case history findings, but also by functional tests and instrumental tests such as a videofluoroscopic swallow study (VFSS) or a fiberoptic endoscopic examination of swallowing (Bergamaschi et al., 2008). Evaluations of swallowing function can be conducted using various methodologies depending on the stage(s) of the swallow one needs to assess and on the clinician's purpose (McCullough, 2004). Evaluation approaches of oral, pharyngeal, and cervical esophageal function in medical settings typically include clinical swallowing examination (CSE), videofluoroscopic swallow study (VFSS) otherwise known as

the modified barium swallow study (MBSS), and fiberoptic endoscopic examination of swallowing (FEES) (McCullough, 2004). These evaluation approaches include both direct and indirect visualization procedures, as follows.

The CSE allows a limited examination of a patient's muscle function, sensation, and airway protective functions (Murray, 1999). This direct inspection allows the clinician to develop a profile of health, disability, or probable risk for disability. Oral motor and feeding abilities background information can be gathered with the CSE (McCullough, 2004). During the CSE, oral structures and functions, laryngeal function, posture and movement of client, alertness, awareness, ability to follow directions, auditory and visual acuity, and strength of voluntary cough are observed. The patient is then observed swallowing secretions and, provided that was performed adequately, small amounts (less than 5 cc) of material of various consistencies (Christiansen, 2009). Observation of oral bolus control and laryngeal elevation during swallowing is performed. Voice quality after swallowing is noted for signs of wetness, which may indicate inadequate bolus clearance and possible aspiration. Presence of coughing, choking, or gagging is noted and, if severe, may be grounds for limiting or terminating the clinical/bedside swallowing

examination (Christiansen, 2009). Findings from the clinical examination are combined with information gathered during the historical data collection and interview session (Murray, 1999).

The VFSS is considered the gold standard for thoroughly assessing oral, pharyngeal, and cervical esophageal stages of swallowing (McCullough, 2004). The VFSS method is considered an ideal tool by many practicing SLPs because it allows visualization of the bolus flow and structural movement throughout the upper aerodigestive tract in real time (Martin-Harris, 2007). The VFSS also permits detection of the presence and timing of aspiration (i.e., entry of ingested material below the level of the true vocal folds into the trachea) and assists in identifying the physiologic and often treatable causes of the aspiration (Martin-Harris, 2007). Limitations of this method are difficulties related to patient transportation and concerns associated with ingestion of the radiation. Furthermore, it is rather unnatural because it examines swallowing function in ideal conditions with upright posturing and coaching and uses boluses that only loosely approximate normal food and liquid intake (McCullough, Rosenbek, Robbins, Coyle, & Wood, 1998).

FEES is the second most commonly applied instrumental

technique for the assessment of oropharyngeal swallowing function. They go on to state that the FEES permits visualization of pharyngeal and laryngeal dynamics prior to and following the swallow, allowing for inferences of swallowing function to be made based on the presence of residue, and permitting the detection of aspiration (Martin-Harris, 2007). However, there are several limitations to this type of exam. Many of the essential physiologic components known to contribute to the synergy of a safe and efficient swallowing mechanism are obstructed during this endoscopic exam (Langmore et al., 1998). The oral cavity cannot be viewed because of the pharyngeal position of the scope. Additionally, the dynamics of the pharynx, larynx, and cervical esophagus are eliminated at the very height of the swallow because the tip of the endoscope opposes structures during superior-anterior movement of the hyolaryngeal complex (Martin-Harris, 2007). Also, the examiner is unable to view the bolus clear through the esophagus (Mendell & Logemann, 2002). Each of the examinations described has strengths and weaknesses, and data to define those strengths and weaknesses are continually emerging.

Management of Dysphagia in Multiple Sclerosis

The literature on swallowing problems in patients with

MS is rather scarce. Dysphagia often develops in mildly impaired MS patients, and becomes a frequent finding in MS patients with moderate to severe disability (Bogaardt et al., 2009). Dysphagia in patients with MS presents problems with various consistencies of food. Patients with a mild stage of MS are likely only to develop problems with swallowing fluids, whereas patients with a more advanced stage also develop problems with swallowing solid foods (De Pauw, Dejaeger, D'hooghe, & Carton, 2002). Currently, the treatment options for restoring and maintaining swallowing function in patients with MS are rather limited (De Pauw, Dejaeger, D'hooghe, & Carton, 2002). When managing dysphagia, the individual's team aims to maintain adequate nutrition, hydration, and ingestion of oral medications while preventing aspiration. Generally strategies to improve feeding and swallowing include diet modification, adjustment of the environment, and patient education on compensatory techniques to use during meals or whenever swallowing (Terrado et al., 2001).

Diet modification or restrictions are determined by the viscosity or volume of the bolus the patient aspirates. The National Dysphagia Diet (NDD) provides a progressive system of textural standards for solid and liquids for use in dysphagia management (Terrado et al., 2001). The NDD

includes four levels for liquids and four for semi-solid food textures (Terrado et al., 2001). The levels of liquids are thin, nectar-like, honey-like, and spoon-thick. Thin liquids are low viscosity liquids that include clear liquids, milk, most liquid nutritional supplements, water, tea, coffee, soda, beer, wine, broth, ice cream, plain gelatin, clear juice, and frozen yogurt (Terrado et al., 2001). Nectar-like liquids are medium viscosity liquids including nectars, vegetable juices, and milkshakes without thickeners (Terrado et al., 2001). Honey-like liquids have a consistency of honey and typically involve the use of a commercial thickener added using package instructions to bring any beverage to this level of thickness. Spoon-thick liquids are high viscosity liquids that are too thick for a straw. Commercial thickeners similar to pudding can be added to any beverage to obtain this level of thickness (Terrado et al., 2001).

The levels of semi-solid and solid foods are: pureed, mechanically altered, mechanically soft, and regular (Terrado et al., 2001). Pureed food is homogenous, consistent, and pudding-like, requiring very little chewing ability. Mechanically altered food is cohesive, moist, semi-solid foods; requiring some chewing ability. Mechanically soft food is soft-solid foods that require

more chewing ability. Finally, regular food is when all foods are allowed (Terrado et al., 2001). The textures of foods play a vital role when managing dysphagia. Often times the ability to process specific textures is decreased by oral-preparatory and oral-stage deficits. Inadequately chewed food may impair digestion in the lower portion of the digestive system as well as provide opportunities for aspiration or air-way obstruction (Terrado et al., 2001). The goal of an accurate assessment and correct selection of diet textures is to improve nutritional intake as well as swallowing safety.

When the dysphagia diet is prescribed, patients may exhibit a negative reaction. Their enjoyment of food may disappear and they may avoid socialization at meal-times. In order to persuade patients to eat sufficient amounts of food to meet nutrition and hydration requirements, items should be flavorful and appear appetizing. Therefore, special attention to food preparation for correct textures and seasonings as well as plate presentation is important (Terrado et al., 2001).

The mealtime environment should be pleasant and set up to maximize concentration and attention on the task of feeding and swallowing. Any distractions such as television, radio, or other environmental stimuli should be

adjusted to maximize attention to feeding. Conversation during meals should be minimized. Staff, family members, or other visitors should be taught to limit conversation where the patient may be expected to respond between sips or bites (Terrado et al., 2001). Speaking requires the expulsion of air through an open airway; if the individual with dysphagia attempts to speak with food or liquid in the mouth, or is distracted from using compensatory strategies, the risk of aspiration is increased (Terrado, et al., 2001). Therefore, conversation during meals should be limited and verbal cueing for swallowing to the patient should be provided. Patients who are emotionally labile (e.g., talking, humming, laughing, or crying inappropriately during meals) are at risk for aspiration and need reminders to stop these behaviors while swallowing. When patients are placed on aspiration precautions, they should not be left alone during meals (Terrado, et al., 2001). It is essential to provide good oral hygiene (i.e., brushing the teeth, gums, palate, and tongue) before and after meals to reduce the bacteria in the mouth that, if aspirated with the foods, liquids, or saliva, increase the risk of aspiration pneumonia (Terrado et al., 2001).

Psychosocial issues

The psychosocial impact of swallowing disorders is a critical component and should be addressed in a treatment plan (Terrado et al., 2001). Dysphagia represents a major disruption in the social aspect of meals, such as eating with friends or family, eating in restaurants, attending social events that involve meals, or holiday gatherings. Eating is no longer a simple, pleasant activity but a stressful and possibly challenging task. Individuals with dysphagia may be embarrassed by their impairments or self-conscious of their lack of autonomy for such a basic function (Terrado, et al., 2001). To avoid public discomfort, they will often choose to eat alone. Caregivers should encourage self-feeding whenever possible. Various assistive devices such as rubber mats or other non-skid surfaces to keep plates in place, broad-based cups and high-rimmed plates to prevent spills, and thick-handled utensils facilitate self-feeding (Terrado et al., 2001).

Compensatory strategies are used to improve the symptoms of dysphagia. These techniques generally require the patient to position the head and body to control the flow of foods or liquids, modify the consistency and volume of food, and modify the rate at which food is given. The chin tuck and effortful swallow are two specific

compensatory strategies for patients with MS (Restive, Marchese-Ragona, & Patti, 2006). A chin tuck is total flexion of the cervical spine with chin down to chest. Patients are often asked to "look at the belly button" to help ensure proper head position when swallowing a bolus. Unless otherwise indicated, the patient should always sit upright at 90 degrees with the head in neutral position. The patient should remain sitting upright or the head of the bed kept elevated for 30 to 45 minutes after eating (Terrado et al., 2001). Postural adaptations are generally used short term until the patient's swallow function returns or until there is significant improvement after therapy. If there is permanent neurologic or structural damage, these adaptations are used long term to reduce incidence of aspiration (Terrado et al., 2001).

The effortful swallow increases the tongue driving force by causing exaggerated retraction of the tongue. This helps to get food past the valleculae. The patient is directed to squeeze hard with his throat and neck muscles during the swallow (Logemann, 1997). Specific swallowing techniques change the swallow physiology to reduce the risk of food or liquids passing below the vocal folds and entering the trachea (Emick-Herring & Wood, 1990). Using these techniques, the patient can voluntarily protect the

airway before the pharyngeal swallow is triggered, thus minimizing aspiration (Terrado et al., 2001).

Meals should be visually pleasing and attractive to stimulate smell, taste, appetite and salivary production (Martin, Holt, & Hicks, 1981). If a patient is intimidated by large servings or becomes fatigued before completing meals, the patient may prefer eating small amounts of food at frequent intervals. These patients are more likely to finish foods presented in attractive small size portions, developing a greater sense of satisfaction and achievement, particularly at the beginning of a feeding program (Terrado et al., 2001). Additionally, food bites should be large enough to require chewing but small enough to manage. For the majority of patients, providing medium-sized bites (15 ml or 1 teaspoonful) is sufficient to trigger the pharyngeal swallow. However, for patients with oral stage impairments, a spoon, with a 1/4 to 1/3 teaspoonful bolus, is placed firmly on the center of the tongue, and then the patient removes the bolus with the lips (Terrado et al., 2001). The pressure of the spoon on sensitive areas of the tongue aids mouth closure and propulsion of the bolus backward (Groher, 1997). To promote optimal nutrition, more solid foods should be offered first; liquids should not be used to "push" down the solids since moving food too

quickly may increase the potential for aspiration (Terrado et al., 2001).

Patients and family members need ample education and support to understand and follow diet and swallowing recommendations vital to the safety of the patient with dysphagia. For example, showing the patient and family members a videotape about the instrumental test helps them understand why changes in diet or modifying the method of swallowing can be helpful. At times, patients and family members may choose not to follow diet and swallowing recommendations. Patients have the right to refuse dysphagia management but they should be well informed about that decision's potential consequences (malnutrition, aspiration, and death).

Conclusion

In conclusion, the objective of this research paper was to describe dysphagia in MS. The impact of MS on the individual and their families were examined. Next, the stages of a normal swallow were explained, including symptoms of dysphagia. Therefore, current literature regarding symptoms, assessment, and management of dysphagia associated with MS were explored. Additionally, the effects of dysphagia on MS were discussed, including the cause of dysphagia when related to MS and possible compensatory

strategies that can be utilized. Finally, strategies to improve feeding and swallowing for individuals with MS and dysphagia were discussed. Further research is warranted to display recent advancements made in therapy with regard to dysphagia and MS.

Table 1 Common Symptoms of Multiple Sclerosis as described by Merck & Co., Inc. (2010).	
Part of the Body	Examples
Nerves (affecting sensation)	Numbness, Tingling, Reduced sense of touch, Pain or Burning, Itching
Eyes	Double vision, Partial blindness and pain in one eye, Dim or blurred vision, Inability to see while looking straight ahead, Uncoordinated eye movements
Muscles and coordination	Weakness and clumsiness, Difficulty walking or maintaining balance, Tremor, Uncoordinated movements, Stiffness, unsteadiness, unusual fatigue
Mood	Mood swings, Inappropriate elation or giddiness, Depression, Inability to control emotions
Brain	Subtle or obvious mental impairment, Memory loss, Poor judgment, Inattention

Table 2	
Phases of the normal swallow as described by Mizuko, Hatten, Kamarek, Piette, & Stone (2010).	
Phase of Swallow	Example
Oral Preparatory Phase	Food is manipulated in mouth and masticated (chewed) if necessary in order to reduce food to consistency that can be swallowed.
Oral Phase	Tongue propels food posteriorly until pharyngeal swallow is triggered.
Pharyngeal Phase	Bolus (cohesive ball of food) is transported through pharynx.
Esophageal Phase	Esophageal peristalsis carried bolus from upper esophageal sphincter (UES) through esophagus to lower esophageal sphincter (LES).

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