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Myasthenia Gravis: A Review for Dental Hygienists

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Myasthenia Gravis (MG), an autoimmune disease causing fluctuating weakness in the voluntary muscles, leads to various degrees of neurological dysfunction. Typically exhibiting a slow but progressive course, the disease may become fatal when muscles of respiration fail. Appropriate dental hygiene management of patients with this disorder is contingent upon an understanding of disease etiology, clinical characteristics, pharmacological interventions as well as oral manifestations. With this information, dental hygienists will be better prepared to provide safe and effective treatment to patients with MG and may prevent a life threatening crisis from developing during dental hygiene care

Keywords: myasthenia gravis, patients with special needs, dental hygiene, neuromuscular disorder, autoimmune disorder

Introduction

Myasthenia Gravis (MG), the most common of the neuromuscular transmission disorders, affects both genders and all ethnic groups with an incidence rate of 7 per 100 000 people. Muscle weakness and fatigue characterize this autoimmune disorder and the oral pharyngeal area is commonly affected. With enhanced treatment interventions decreasing mortality, improved diagnostics, and the aging of the population, the incidence of this disease is increasing. The purpose of this article is to provide an overview of MG pathophysiology, clinical characteristics, treatment options, and strategies for appropriate dental hygiene management.

Characteristics

Two peak incidence ages for women, 20 to 40 and post 70 years of age have been reported.^{1,4} In men, the average age of onset is after age 50, but Myasthenia Gravis (MG) may appear at any age.^{4,5} The most distinctive feature of MG is weakness of voluntary muscles, made worse by use and reduction of weakness with rest.^{2,5,6} In most individuals, upper extremity weakness is more prevalent than lower extremity weakness. The highly variable clinical course is usually progressive and relapses and remissions can occur. Increased body temperatures, pregnancy, emotions, hormonal changes, medications that affect neuromuscular transmission, illness, and/or infections are associated with disease exacerbation.⁶⁻⁹ Persons with MG typically feel stronger in the morning with fatigue progressively getting worse toward evening. Regardless of the time of day, with prolonged exertion, affected muscles become fatigued and weak. Most commonly, the muscles of the eyes, neck, throat, tongue, and face are affected early in the course of the disorder.^{7,8} The weakness often becomes more generalized, spreading to other muscles innervated by the cranial nerves, including those that control breathing and extremity movements.^{9,10}

Onset of symptoms is often gradual starting with weakness in ocular muscles. The medial rectus muscles are the most severely affected.⁸⁻¹¹ Movement of the eye and eyelids are initially affected with the levator palpebrae, orbicularis oculi, and extraocular muscles becoming involved.^{2,6-9} As a result, the patients often experiences diplopia, ptosis and nystagmus. Asymmetrical ptosis, or drooping of the eyelid, is a hallmark sign of MG.⁹⁻¹² To compensate for ptosis, the frontalis muscle may be contracted, creating a worried or surprised look on affected persons. Because onset of ocular symptoms is often slow, many individuals may experience symptoms for years and not be aware they have MG.⁴ Problems when reading often is the impetus for individuals to seek medical care from an ophthalmologist.⁷ Symptoms remain localized to the ocular area in approximately 15% to 20% of persons with MG.¹ Typically, the disease does not become generalized if it remains ocular for 3 years. However, 2 years post diagnosis, almost all patients have unilateral or bilateral ocular involvement.¹³

Oral Manifestations

Approximately one-fourth of diagnosed Myasthenia Gravis (MG) patients have bulbar muscle involvement, so named for the nerves originating from the brain stem's bulb like portion.¹²⁻¹⁵ With bulbar involvement, muscle weakness causes problems with swallowing, choking, facial movement, holding up the head, and articulation. Weakness of the muscles of mastication is common and ability to eat becomes difficult. Patients may not be able to chew and swallow, making eating such an unpleasant experience that dehydration and malnourishment may result.¹⁰ With time, facial muscle involvement causes the patient to display a lack of facial movement. Smiling attempts result in a characteristic snarling or transverse appearance, and the corner of the mouth droops and may hang open.²

Palatal and pharyngeal muscle involvement cause speech difficulties including slurring, alteration of voice, and dysarthria. Myasthenic speech tends to sound nasal due to weakness of the soft palate and dysarthria results from lack of control and execution over speech muscles.^{4,11} As the laryngeal muscles are affected, voice alteration occurs with changes ranging from breathiness and softness to hoarseness.

Generalized MG

In most persons with Myasthenia Gravis (MG), muscle weakness spreads from ocular and oropharyngeal muscles to the upper and lower extremities, resulting in a generalized form of MG. First affected are the upper extremities, with patients experiencing problems raising their arms over the head and rising from a sitting position. Due to specific weakness in the small muscles of the hand, performing fine motor tasks such as writing or performing oral self-care may become problematic.² Neck flexors, deltoids, hip flexors, and finger/wrist extensors are muscles most commonly affected in the generalized form. The most significant effect of MG results when there is weakness of the intercostal muscles and the diaphragm.⁶⁻¹⁰ Affecting 20% to 40% of persons with MG, respiratory muscle weakness can be life threatening resulting in a myasthenic crisis, an acute exacerbation of symptoms with respiratory failure.¹⁶ Shortness of breath and an inability to swallow, cough, and clear secretions often leads to respiratory distress, and requires ventilator support. Prior to effective pharmacological interventions, 40% of the mortality rate associated with MG was due to respiratory arrest.

Electromyography testing, edrophonium test, and antibody tests are used in conjunction with the clinical and neurological history and exam to support a diagnosis of MG.

Pathophysiology

Myasthenia Gravis (MG) is the best understood of the various autoimmune diseases and affects the neuromuscular junction postsynaptically.¹⁷ Acetylcholine, a protein on muscle cells required for muscle contraction, is a key player in the pathogenesis. Acetylcholine is normally stored at the terminal end of axons. It travels through the neuromuscular synapse, binds to acetylcholine receptor sites on the folds of postsynaptic motor end plates, depolarizes, and stimulates a muscle contraction.

In 85% of patients with MG, the pathophysiology involves the formation of antibodies to acetylcholine receptors (AChR). These antibodies cause an interrupted connection between the nerve and muscle. Acetylcholine receptor sites (AChRs) are a docking area for acetylcholine (ACh). The antibody attack blocks, alters, and reduces the number of acetylcholine receptor sites, preventing nerve impulse conduction along the normal pathway at normal conduction speeds. Research about the pathophysiology of MG reveals this immune dysfunction occurs in 3 ways, which primarily alter depolarization of muscle tissue at the postsynaptic membrane. These mechanisms include a complement-dependent destruction of ACh at the postsynaptic membrane, circulating antibodies with 2 binding sites, causing an enhanced rate of internalization and destruction of AChRs and antibodies to AChR invading and inhibiting the receptors directly.¹⁸ Therefore, due to a lack of ACh, normal impulse transmission is disabled because receptors at the myoneural junction cannot depolarize.^{7,8} In affected individuals, anti-ACh receptor antibodies may destroy up to 89% of receptor sites per neuromuscular junction.¹⁰

The thymus gland has also been implicated in the pathogenesis of MG but it is not known whether thymic changes play a primary or secondary role in disease pathogenicity.¹⁶ Approximately 90% of MG patients have altered function of this gland and 10% to 15% of patients have a thymic tumor.¹⁷ Thymoma, hyperplasia of the thymus, frequently occurs, but the relation to MG is not clear. The thymus may cause the autoimmune dysfunction through an overproduction or prolonged synthesis of thymic hormones.

Treatment

Treatment for Myasthenia Gravis (MG) primarily consists of 5 options, 3 of which are pharmacological interventions that may have an impact on dental hygiene care.¹⁸⁻²⁰ Treatment, however, is highly individualized since patients do not respond favorably to all options. Rate of disease progression, degree of functional impairment, age, and the distribution of muscle weakness all influence treatment choices.²¹

In general, cholinesterase (CHE) inhibitors are the first therapy of choice. These drugs inhibit breakdown of ACh so it can accumulate at the neuromuscular junction. Pyridostigmine bromide (Mestinon[®]) and neostigmine bromide (Prostigmin[®]) are the CHE inhibitors most commonly prescribed for MG.²² Optimal dosage varies amongst patients but improvements can be seen in 30 minutes to 40 minutes after taking, and last from 3 hours to 4 hours. Following prescribed, optimal dosage recommendations is very important as toxic amounts of CHE inhibitors may cause a cholinergic crisis, resulting in muscle weakness and possible respiratory collapse.

Most patients with MG will also require immunosuppressive therapy.¹⁷ Corticosteroids, often used in combination with pyridostigmine, are prescribed when patients do not respond to CHE inhibitors alone. Steroids may inhibit antibody formation, with prednisone being the corticosteroid of choice. Other immunosuppressive drugs such as azathioprine (Imuran) or cyclosporine (Sandimmune) may decrease the immune stimulus for ACh receptor antibody production. However, benefits must be closely weighed against side effects and enhanced risk of infection. These immunosuppressants may replace or be used in combination with steroids.

Thymectomy, the surgical removal of the thymus gland, improves symptoms in some individuals but the response is unpredictable.¹⁷ This therapy is limited to individuals under the age of 60 who are medically stable and those individuals with a thymoma.²³

When patients with MG are in a critical situation such as a myasthenic crisis or in preparation for surgery, plasmapheresis is a recommended therapy. This treatment involves plasma exchange where AChR antibodies are removed from the circulating plasma. Positive effects are fast but transient, and until other medications can be effective, provide short-term relief of symptoms.^{21,22}

Dental Hygiene Considerations

Promotion of maximum wellness and prevention of complications is the treatment paradigm for Myasthenia Gravis (MG).¹² Consultation with the patient's physician to determine if the patient's MG is stable and controlled should be conducted prior to any dental treatment.^{24,25} Patients with uncontrolled MG would most likely need treatment in a hospital setting. Because any infection, including those of dental origin may cause disease exacerbation and lead to a myasthenic crisis, control of dental and periodontal infections is critical. Dental hygienists should play an integral role in educating patients with MG on the importance of adopting preventive and therapeutic interventions that will promote oral wellness. Oral musculature dysfunction and weakness of the hand muscles, causing poor motor control, are common findings that may increase the risk of oral infection.

Several modifications in dental hygiene treatment planning are necessary to ensure a safe and effective appointment. Important educational topics for the patients are listed in Table I.

Table I
Dental Hygiene Discussion Topics for Patients with
Myasthenia Gravis *

- Importance of avoiding exacerbation of MG by obtaining regular and frequent recare appointments to prevent oral infection
- Scheduling dental hygiene appointments in the mid morning
- Avoiding drugs that can cause muscle weakness and exacerbate MG
- Taking anticholinesterase drugs on time, as ordered by the MD, and 1/1/2 hour s before the dental hygiene appointment
- Alertness to signs of myasthenic crisis and cholinergic crisis
- Necessity of prompt treatment of oral disease and infection
- Use of adaptive and powered self care aids for plaque biofilm removal
- Stress reduction strategies

Adapted from Armstrong S, Schumann L. Myasthenia gravis: diagnosis and treatment. *J Am Acad Nurs Pract* 2003; 15 (2):72-78.

A thorough review of the patient's medications is critical to prevent serious complications during dental hygiene care. Patients taking anticholinesterase medications may experience serious reactions with other medications used in dentistry creating a health crisis. (Table II) When patients need local anesthetic agents for periodontal debridement, ester-type anesthetics such as procaine (Novacaine) should be avoided. These types of anesthetic agents are metabolized slower due to hydrolysis by plasma cholinesterase, which increases the risk of a toxic reaction.^{25,26} Amide type of local anesthetic such as lidocaine and mepivacaine are recommended. Before prescribing any antibiotics, consultation with the patient's physician is warranted, as a wide array of antibiotics have been found to cause muscle weakness. In general, aminoglycosides, ciprofloxacin, erythromycin, clindamycin, and tetracycline should be avoided.²⁷ Penicillin and erythromycin do not cause neuromuscular blocking and can be safely prescribed.²⁶

Table II
Drugs to Be Avoided or Used with Caution in
Persons with Myasthenia Gravis²⁴⁻²⁷

Drug Type	Drug
Local anesthetic	Procaine
Antibiotics	Tetracycline Streptomycin Neomycin Bacitracin Tetracycline
Calcium Channel Blockers	Nifedipine
Anti-Inflammatory Drugs	Corticosteroids
Beta Blockers	Propranolol
Antidysrhythmic	Procainamide Quinine Quindine
Biologic Response Modifier	Alpha Interferon
Sedatives/Hypnotics	Barbiturates Morphine Benzodiazepines

Patients should receive dental hygiene care at the time of day when CHE inhibitor medication has maximum effectiveness, typically within 1 and 1 ½ hours after taking.^{25,26} As stress may cause disease exacerbation leading to a myasthenic crisis, a stress free as possible appointment is imperative. Effective pain management, soothing music, elimination of extraneous noises, aromatherapy, and anticipatory guidance may promote relaxation and less stress during dental hygiene care. In some situations, use of sedatives may be helpful. For patients experiencing articulation problems, having a caregiver or loved one in the treatment area may facilitate enhanced communication and provide re-assurance to the patient.

Because of weakened oral pharyngeal musculature, many patients are at high risk for pulmonary aspiration.¹⁶ Ultrasonic scaling devices and air polishers are therefore, contraindicated. During the appointment mouth props are a useful adjunct due to oral musculature fatigue and use of high speed suction is imperative to prevent oral debris from being aspirated. Ocular involvement requires avoidance of the dental light in patients' eyes as much as possible and dark protective-type lenses that will facilitate less eye strain for the patient during the appointment.

Dental hygienists must be knowledgeable about patient signs suggesting a myasthenic or chlorogenic crisis.²⁸ A patient's first complaint of dyspnea at rest must be taken seriously. Symptoms that may seem minor can quickly escalate to a life threatening respiratory condition. The inability to swallow, speak or maintain an open airway, double vision, tachycardia, dysphagia, and profound muscle weakness are key signs of a myasthenic crisis.²⁹ Often due to increasing muscle weakness,

patients increase their dosage of acetylcholinesterase medication not understanding that excessive doses will not relieve fatigue, but lead to increased muscle weakness and possible respiratory failure. Signs of a cholinergic crisis include abdominal pain, diarrhea, excessive pulmonary secretion and respiratory distress.^{29,30} Hence, reminding patients to take their medication exactly as prescribed is very important. Dental hygienists must be prepared to maintain an open airway and call for emergency assistance if these types of symptoms are displayed by a patient with MG.

Each of the 3 drug regimens used in treating MG have side effects that may alter dental hygiene care. Patients on long term corticosteroid involvement need to be medically evaluated for possible premedication due to immune suppression. Patients should also be evaluated for adrenal insufficiency, which would require supplemental glucocorticoid medication prior to treatment.³¹ In addition, osteoporosis is a common side effect of long-term corticosteroid therapy and may lead to oral bone loss. Bone density screening tests should be recommended to patients on long-term corticosteroid therapy.¹⁸

Antibiotic premedication may be necessary for those patients taking cyclosporine or azathioprine due to immune suppression resulting from these drugs.^{26,31} An increased incidence of fungal infections may also be encountered as well as a slower recovery from periodontal debridement due to prolonged wound healing. Another consideration is that anticholinergic drugs may cause excess salivation and drooling, leading to excessive supragingival calculus formation. Use of tartar control toothpaste might be recommended to facilitate control of excess calculus deposition supra-gingivally. Anticholinergic drugs to control the excess salivation must be avoided.

In order to provide compassionate and quality care, dental hygienists must realize that energy conservation is critical to the well being of patients and plan hygiene appointments accordingly.³² Ensuring that patients have a handicapped parking space or one close to the office will facilitate less patient fatigue. Mid-morning appointments are an ideal time to schedule appointments, as muscle weakness will not be as pronounced as later in the day and the patient will have more time to conserve energy while getting ready. Because short appointments are necessary, having patients' complete medical history forms before they arrive and use of a hygiene assistant will promote efficiency and is highly advisable.

Dental hygienists must be cognizant that disease status often influences self-care practices. Patients will experience times when oral self-care is better than others depending on disease remission and exacerbation affecting fatigue levels and oral-pharyngeal and hand muscle weakness. Having realistic expectations about what a patient can accomplish and being encouraging at all times is an important strategy for providing compassionate and quality care.^{32,33} To control oral infection, frequent re-care should be encouraged with the interval time shortened from 3 months to 2 months if self care ability is compromised for an extended time period. Powered toothbrushes and flossing devices may facilitate effective self-care practices and conserve energy. Alternative manual toothbrush head designs such as the Surround R toothbrush can be recommended if finances preclude the purchase of powered devices. The Surround tooth brush R has bristles designed to surround the teeth to remove plaque biofilm from the facial, lingual, and occlusal surfaces simultaneously, reducing the number of brushing strokes required. For some patients, extending or enlarging the toothbrush handle may prove helpful. Although antimicrobial rinses can minimize oral infections, the oral musculature dysfunction experienced by many MG patients may limit rinsing ability. As a result, caution is advised when recommending mouth rinses. For some patients, toothettes dipped in chlorhexidine or antimicrobial oral rinses used in an oral irrigation device may provide some antimicrobial benefits if rinsing is not possible. For patients with ocular involvement, modifying written materials to large dark print will facilitate readability of take home information.

Conclusions

Myasthenia gravis (MG) is characterized by muscle weakness, often in the oral area resulting from decreased acetylcholine receptors at the neuromuscular junction. Nerve impulse transmission becomes blocked, resulting in weakness of the voluntary muscles. Dental hygienists must be prepared to make several adjustments in dental hygiene care when working with MG patients to ensure a safe and effective appointment. In particular, they must be alert to symptoms of emergency situations that can arise, particularly myasthenic and cholinergic crisis', which will require 911 assistance and ventilator support. Dental hygienists must also be cognizant of treatment and oral self-care modifications needed due to muscle weakness in the oral pharyngeal area, potential medications that can increase muscle weakness in patients with MG, as

well as medications often prescribed for MG patients that may cause immune suppression resulting in a need for pre medication.

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Notes

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