Austin Journal of Musculoskeletal Disorders

Open Access

Austin Publishing Group

Research Article

Correlation of the Maximal Respiratory Pressures, Respiratory Airflow and Dysphagia in Patients with Acquired Autoimmune Myasthenia Gravis

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Received: May 15, 2016; **Accepted:** June 03, 2016; **Published:** June 06, 2016

Abstract

Introduction: Patients with Acquired Autoimmune Myasthenia Gravis (AAMG) have a frequent complaint of muscle fatigue, resulting in respiratory distress, associated or not to the signs and symptoms of dysphagia.

Objective: to characterize the measures of respiratory and appendicular muscle strength, expiratory and cough peak flow and relate to the degree of dysphagia in patients with AAMG.

Methods: We assessed 20 patients with a diagnosis of Acquired autoimmune myasthenia gravis, being 14 (70%) female and 6 (30%) male, with an average age of 38.71 and 50.16 years, respectively. The following procedures were performed: speech and swallowing evaluation and respiratory clinical evaluation. It was incorporated measures of maximum inspiratory pressure, maximum expiratory pressure, peak expiratory flow and peak cough flow.

Results: there was a statistically significant relationship between alteration of muscles of lips, tongue and buccinator and the severity of dysphagia. 70% of patients referred to dyspnoea, being that the averages of percentage of predicted of MEP and MIP, PFE were below 80% in patients with dysphagia. Significance was found in the correlation between measures of force and of respiratory airflow.

Conclusion: the strength of cough expiratory flow is correlated to the inspiratory and expiratory muscle force. The involvement of the orofacial musculature and reduced values of MIP, MEP and PFE were indicators of the deterioration of oropharyngeal dysphagia. Both measures of respiratory muscle strength are lower than predicted.

Keywords: Neuromuscular diseases; Myasthenia gravis; Deglutition; Deglutition disorders; Respiration; Muscle strength

Abbreviations

AAMG: Acquired Autoimmune Myasthenia Gravis; l/min: Liters/Minute; mg: Milligram; MIP: Maximal Inspiratory Pressure; MEP: Maximal Expiratory Pressure; PCF: Peak Cough Flow; PEF: Peak Expiratory Flow

Introduction

Neuromuscular diseases are a group of disorders that compromise the motor unit (i.e. the lower motor neuron of the cell body, its extension, the neuromuscular junction or muscular tissue [1-3] without cardiovascular, hormonal or metabolic implications [3]. Among the neuromuscular diseases that usually affect the stomatognathic system functions (breath, voice, speech, chew and swallow), the Myasthenia Gravis has a special importance [4].

The most frequent symptoms are strabismus, diplopia, ptosis, dysphagia, dysarthria, dysphonia, dyspnea and fatigue. Fatigue symptoms seem to be worse in the afternoon period and can be aggravated by physical exercise, infections and emotional factors. The most affected muscle groups are the oculomotor, orbicularis oculi muscles, masticatory and those dependent of the ninth and tenth cranial nerves [5].

Dysphagia may be the first or the only symptom of disease [6]. Bulbar alteration may be the only manifestation of Myasthenia Gravis, and the patients may have nasality changes, nasal reflux, and difficulty in food bolus control with possible bronchoaspiration [7].

The impairment of respiratory muscles is unsystematic, varying from dyspnea at rest until intense dyspnea on exertion [4]. The worsening of respiratory function can be related to the myasthenic crisis, where the patient presents a severe weakness compromising the proper airway functioning [8].

Characteristic muscle weakness of AAMG leads the patients to present respiratory disorders (i.e. dyspnea and respiratory accessory muscles use), and to monitor respiratory function, especially during daily living activities. For this reason the constant decline of the vital capacity, inspiratory muscles pressure, and loss of the upper airway integrity are commonly observed [9]. The impairment of respiratory function may involve, dysphagia worse, explained by pressure changes in laryngeal structures. Therefore, myoelastic component

Citation: Oda AL, Bolzan DW, Cruz CTV, Oliveira ASB and Raimundo RD. Correlation of the Maximal Respiratory Pressures, Respiratory Airflow and Dysphagia in Patients with Acquired Autoimmune Myasthenia Gravis. Austin J Musculoskelet Disord. 2016; 3(1): 1031.

alteration (by weakness and muscle fatigue) add to the aerodynamic component change (by pressure reduction in the airways) could influence a more severe dysphagia scenario. Oropharyngeal dysphagia is a highly debilitating condition and should be evaluated and treated in the course of the disease avoiding secondary complications (i.e. nutritional deficiency, dehydration and pulmonary complications due to tracheal aspiration) [4].

The aim of this study was to evaluate and characterize the respiratory and peripheral muscles strength, expiratory peak flow, and peak cough flow, and establish a possible correlation of these variables to the dysphagia degree in these patients with AAMG.**5.**

Materials and Methods

This study was conducted at outpatient research sector in neuromuscular diseases of the Federal University of São Paulo, Brazil. The local institutional ethics committee approved this study. All patients were informed, and written consent was given prior to inclusion.

Patients

A total of 20 patients of both genders, with diagnosis of ocular, bulbar or generalized forms of acquired autoimmune myasthenia Gravis were prospectively included.

Congenital Myasthenia Gravis or other diagnoses served as our primary exclusion criteria. Patients with acute or chronic respiratory diseases, smokers and age below 18 years old were also excluded.

Patients underwent a respiratory evaluation with data MIP, MEP, PEF and PCF. In addition, a clinical assessment was carried out, with emphasis on chewing and swallowing functions, according to the protocol used in Neuromuscular Disease Research Sector UNIFESP38.

Study design

The general patient data were obtained from the medical file of the aforementioned Research Sector in Neuromuscular Diseases.

All patients were submitted to an initial clinical assessment. The anatomical and functional aspects of the neck, face and speech organs were evaluated by the observation of the posture configuration, mobility, tension and force in rest, spontaneous and guided movement. Muscle groups of lips, tongue, buccinator, masticatory and soft palate were evaluated.

Patients were also submitted to a respiratory evaluation. In addition, a clinical assessment was carried out, with emphasis on chewing and swallowing functions, according to the protocol used in Neuromuscular Disease Research Sector of the Federal University of São Paulo [10].

Chewing function evaluation

We observed the lips posture, strength, amplitude, speed and direction of movement; cut and food lateralization; associated movements and masticatory efficiency. Moldy french bread was used for evaluation, due to the proper consistency to the observation of the aforementioned items.

Swallowing function evaluation

Swallowing was evaluated in relation to the process efficiency, and the following criteria was observed: sealing lip; posture, mobility and driving force of the tongue; containment of the food bolus in the oral cavity; associated movements; waste accumulation in the oral cavity; laryngeal elevation; nasal reflux; presence of coughing during or after swallowing; "wet" voice after swallowing, and coordination swallowing and breathing. In addition to the complaint referred to the stasis in laryngeal-pharyngeal and esophageal region were evaluated. Swallowing was evaluated in four distinct stages:

- Saliva: patients was observed in situations of rest, spontaneous and directed movement; in relation to saliva accumulation in oral vestibule and/or corners of the mouth, previous leak of saliva and presence of cough or choke with their own saliva.

- Thickened liquid: by administration of water in measures of 1, 3, 5 and 10 ml, offered in a disposable cup and spoon.

- Paste: by administration of natural yogurt (consistent type), in measures of 1, 3, 5 and 10 ml, offered to the patient in a disposable spoon.

- Solid: by administration of Moldy french bread.

After the aforementioned evaluation, the findings were classified as normal (0), mild (1), moderate (2), severe (3), and deep (4) according to the criteria proposed by Chiappetta and Oda. The severity classification table includes areas of evaluation focused on the oral (oral contention of food/saliva, trituration, lateralization, accommodation and ejection food bolus, and the presence of residues in the oral cavity), pharyngeal phase (laryngeal elevation, nasal reflux, residues in pharyngeal recess, laryngeal penetration, tracheal aspiration) and esophageal phase (decrease of rhythm and peristaltic contraction force).

Respiratory evaluation

For respiratory assessment, we measured the maximum inspiratory pressure; maximum expiratory pressure, peak expiratory flow and peak cough flow.

In the present study, the tests were performed with facial mask to avoid bias and minimize the possible air leak around the nozzle secondary to the mouth orbicularis muscles weakness.

A manovacuometer (Gerar®) graduated in cm H_2O (0-155), were used to evaluate the Maximum Inspiratory Pressure (MIP) and Maximal Expiratory Pressure (MEP). The measures were performed at Functional Residual Capacity (FRC) with the patients confortable sitting. The tests were performed according to the standards of the American Thoracic Society (ATS) [12]. The predicted values were calculated according to a previously described equation [13].

To Peak Expiratory Flow (PEF) and Peak Cough Flow (PCF) evaluation, we used a peak flow meter (Mini-Wright Airmed®) graduated in L/min (60-850). This equipment was coupled to a mask without exhalation valve. Patients were instructed to maintain the sitting position and perform a maximal inspiration effort until to total lung capacity and perform a strong and fast expiration, with maximum expiratory effort possible, keeping the lips open to avoid resistance to the air flow (PEF), and with a strong and unique cough (PCF) through the mask.

The maneuvers (PFE and PCF) were repeated three times and the

Table 1: Characterization of the sample in relation to age and gender.

Variables	Female	Male	Total
	N (%)	N (%)	N (%)
Gender	14 (70)	6 (30)	20 (100)
Age*	38,71±9,72	50,16±18,59	42,15±13,58

Abbreviations: N: Number. %: percentage. (*)Values expressed as mean and standard deviation.

Table 2: Characterization of the sample in relation to diagnostic time and disease duration.

	Median (25-75)	Mininum Value	Maximum Value
Diagnostic time	8,5 (1-48)	0	228
Disease duration	87 (24-162)	9	276

Abbreviations: (25-75): percentil 25% and 75% of Median, %: percentage.

highest measure value was selected for analysis. If the last measure was the largest value, the procedure was repeated up to a maximum of five times.

In all cases, to avoid air leak, the examiner helped the patient in relation to the mask positioning and fixing. Measures with air leak were discarded. Patients were instructed to avoid trunk flexion or neck, as well compensatory movements during the procedure.

Statistical analysis

Continuous data were described as mean and standard deviation, and compared by Analysis of Variance for Not Repeated Measures with Gabriel's post-test. Continuous data of different variables were correlated using Pearson correlation test and the degree of linearity (r) and significance (p) were evaluated.

Categorical data were represented by absolute frequency (n) and relative (%) and compared using Pearson's chi-square test. For all study alpha risk <5% was considered.

Results

This study evaluated 20 patients. Demographic data related to sex, age, referred disease and diagnostic time are described in (Tables 1 and 2).

We considered as diagnostic time the interval between the symptoms initiation and the diagnostic conclusion. The relationship of swallowing disorders severity; disease duration and referred diagnosis time are presented in (Table 3). Of the 20 patients evaluated, 9 (45%) had episodes of myasthenic crisis, 6 (30%) had a single crisis during the clinical course of the disease, 2 (10%) had two crisis, and 1 (5%) presented three crisis episodes. Four patients (20%) underwent to thymectomy surgical procedure.

With regard to medical treatment 17 patients (85%) were using anticholinesterase (60 mg), ranging from 0.5 to 6 tablets a day; 16 (80%) used corticosteroids, ranging from 5 to 60 mg/day and 6 (30%) used immunosuppressant (50mg), ranging from 2 to 5 tablets per day.

Table 3: Relationship between severity of deglutition disorders and diagnostic time.

		Severity of Deglutition Function		
		Normal	Mild	Moderate
Diagnostic time	Average±SD	4,25±3,50	30,40±38,62	81±109,48
(months)	Median	4,5	9	16,50

Abbreviations: SD: Standard Deviation.

Table 4: Characterization of the sample in relation to evaluation of the stomatognathic system muscles and the distribution on the severity of specific muscle groups.

	Normal		Mild		Moderate		Severe	
	N	%	N	%	N	%	N	%
Lips	8	40	7	35	4	20	1	5
Tongue	5	25	6	30	8	40	1	5
Buccinator	7	35	6	30	3	15	4	20
Masticatory muscles	7	35	6	30	7	35	0	0
Soft palate	13	65	7	35	0	0	0	0

Abbreviations: N: absolut number, %: percentage.

Table 5: Relationship between history of symptoms during the diseaseand evaluation of the stomatognathic system muscles.

	Deglutition Evaluation					
History of symptoms	Normal		Mild		Moderate	
Mastication*	**N**	**%**	**N**	**%**	**N**	**%**
Present	1	5	9	45	6	30
Absent	3	15	1	5	0	0
Deglutition**						
Present	2	10	10	50	6	30
Absent	2	10	0	0	0	0

(*)Chi-square test p=0,08. (**)Chi-square test p=0,012.
Abbreviations: N: number. %: percentage. *: p<0,05.

The results of the evaluation of the stomatognathic system muscles and the distribution on the severity of specific muscle groups in patients with Myasthenia Gravis are showed en (Table 4).

We observed that the tongue muscles are most often affected by muscle weakness, followed by masticatory and orbicularis muscles of the lips. Accordingly, the swallowing function is the most changed, in both frequency and gravity, since the aforementioned muscles participating in the oral phase of swallowing (Table 5).

Although chewing matches to the preparatory oral phase of swallowing, it was treated separately in this table, in consideration to the higher frequency of mastication changes occurrence as a signal and also as a symptom in patients with AAMG (Table 6).

In relation to respiratory flow and strength measurements, we observed that the values related to the percentage of the expected values of PEF, MIP and MEP, defined according to age and gender are lower than expected (Table 7).

Table 8, shows that the measurements of respiratory strength, expiratory flow and cough decrease in proportion that the severity of dysphagia increases, showing that respiratory muscle strength interferes with the intensity of the flow measures and the deterioration of the swallowing function.

Discussion

This study of oropharyngeal dysphagia in individuals with AAMG was able to demonstrate how the stomatognathic system structures influence the swallowing process, and how this function is intrinsically related to respiratory mechanics and breathing function.

Table 6: Relationship between the evaluation of the stomatognathic system muscles and deglutition severity.

	Deglutition Severity					
Evaluation	Normal		Mild		Moderate	
Lips*	N	%	N	%	N	%
Normal	4	20	4	20	-	-
Mild	-	-	5	25	2	10
Moderate/Severe	-	-	1	5	4	20
Tongue**						
Normal	4	20	1	5	-	-
Mild	-	-	3	15	3	15
Moderate/Severe	-	-	6	30	3	15
Buccinator***						
Normal	4	20	2	10	1	5
Mild	-	-	4	20	2	10
Moderate/Severe	-	-	4	20	3	15
Masticatory muscles						
Normal	3	15	3	15	1	5
Mild	1	5	4	20	1	5
Moderate/Severe	-	-	3	15	4	20
Soft palate						
Normal	4	20	7	35	2	10
Mild	-	-	3	15	4	20
Moderate/Severe	-	-	-	-	-	-

(*)Chi-square test p=0,040. (**)Chi-square test p=0,050. (***)Chi-square test p=0,024.
Abbreviations: N: number. %: percentage. *: p<0,05.

Table 7: Characterization of the sample in relation to respiratory evaluation and muscular strength.

Variables	Average ± SD	Minimun Value	Maximun Value
PEF	353±96,46	150	520
PEF (% of predicted)	75,17±15,85	36,67%	100%
PCF	401±96,73	210	620
MIP	- 79,25±25,40	-115	-25
MIP (% of predicted)	80,56±25,32	26,12	127,33
MEP	82,25±32,86	20	160
MEP (% of predicted)	79,97±25,55	24,55	118,94

Abbreviations: SD: Standard Deviation, MIP: Maximal Inspiratory Pressure; MEP: Maximal Expiratory Pressure; PCF: Peak Cough Flow; PEF: peak expiratory flow, %: Percentage.

These findings provide a better comprehension of the changes found in the swallowing process, as well the relationship between swallowing and breathing. The results of this study allow us to reflect about the patient's AAMG rehabilitation and the integrated care of the multidisciplinary team, focused on the evaluation and treatment of oropharyngeal dysphagia.

The AAMG is a neuromuscular junction disease that may occur in any age group. Some authors show a greater commitment in females between 20 and 40 years old [1,14] and higher prevalence in men around 50 years old [14]. Similar results were found in our study. The

Table 8: Relationship between dysphagia severity and respiratory results ofstrength and flow.

Deglutition	MIP	MEP	PCF	PEF
	% of predicted (average)	% of predicted (average)	Average	% of predicted (average)
Normal	83,25	98,04	495	84,56
Mild	79,89	77,69	386	73,37
Moderate	79,87	70	363	71,93
P	0,015*	0,011*	0,078	0,019*

ANOVA: Analysis of Variance for Repeated Measures.
Abbreviations: p: significance; MIP: Maximal Inspiratory Pressure; MEP: Maximal Expiratory Pressure; PCF: Peak Cough Flow; PEF: Peak Expiratory Flow; %: percentage, *: p<0,05.

average of our population was 38.71 years old for women and 50.17 years old for men. There are conflicting results in literature. However other studies indicate a greater impairment in males, between 70 and 80 years old [15,16].

Various publications, report that women are more often affected than men until the fourth decade, ranging from 2:1 to 4:1 [1,4,14,17-22]. In accordance to others studies, our data revealed a predominance of women in relation to men, in a ratio of approximately 2:1.

Time for diagnosis could be understood as the interval between the symptoms initiation and the diagnostic conclusion; whereas could be defined as the interval between the symptoms initiation and the day of the clinical evaluation.

Previous investigations [1,23] demonstrated that the time for diagnosis could vary from 1 to 516 months, and 24 hours to 960 months, respectively. These data are in agreement with the elevated variability found in our study, 0 to 228 months related to the time for diagnosis. The diagnosis of AAMG is based on patient's clinical history added to the physical examination, and tests that assess the neuromuscular function [18], but in some cases is difficult in perform the diagnosis can cause complications for the patient.

Although no data in literature makes this correlation directly, we observed that the higher the time for diagnosis, the higher dysphagia severity. This data reinforces the idea that the proper treatment can be conducted only to the light of the patient's diagnosis. Treat the patient of a palliative form implies in clinical course with a higher incidence of complications, as dysphagia.

A myasthenic crisis is characterized by respiratory failure due muscle weakness exacerbation, requiring mechanical ventilation. Studies advocate that the need for ventilation occurrence is smaller in the higher part of the population diagnosed with AAMG, ranging from referrals from 8% to 27% [23], and 15 to 20% [15,24]. These data are in disagreement with our study. We observed among our patients 9 (45%) episodes of myasthenic crisis, 6 (30%) a single crisis during the clinical course of the disease, 2 (10%) two crisis, and 1 (5%) three crisis episodes.

Even though the literature reports emotional factors, physical trauma and fever [25] as triggering factors of the myasthenic crisis, pulmonary infections could be considered the main factors for their initiation [3]. In addition, the earlier and more severe the impairment of the respiratory muscles, the worst the complications and the myasthenic crisis [26]. Thus, we emphasize the importance of the

oropharyngeal dysphagia treatment in order to prevent aspiration pneumonia that can present of relapsing form, when cause was not completely eliminated [27].

The fatigue and fluctuating muscle weakness are the main features of the disease [1,2,28-30], but the symptoms initiation is varied and may be present initially by ocular, bulbar or generalized alterations, alone or in combination. Evidences indicate that the vocal changes can be one of the first and only signs of AAMG [14,31].

In an attempt to make a characterization of the sample relative to the stomatognathic system muscles, we performed a clinical examination of some muscle groups (lips, tongue, buccinator, masticatory and soft palate). We noted that the tongue muscles are the most frequently affected by muscle weakness, followed by masticatory and orbicularis muscles of the lips. Accordingly, the swallowing function is the most altered, in both frequency and gravity, since the aforementioned muscles participate of the swallowing oral phase.

The description of the facial muscles commitment, soft palate, lips, tongue, larynx, pharynx, masticatory muscles, cervical and breathing was performed in a previous study, in order to characterize the bulbar abnormalities found in patients with AAMG [32].The weakness of the buccinators muscles, risorius, and zygomatic major and minor could be associated with the facial muscles paresis, resulting in a tendency of smile verticalization; with consequent impairment of facial expression [33,34].

The orofacial muscle disorders compromised the functions of chewing and swallowing (80%), and muscle weakness was the determining factor of these disorders. The symptoms of bulbar nature (dysarthria, dysphagia, dysphonia and dyspnea) are often described with the clinical findings and have always been attributed to the weakness of the muscle structures involved, with the typical characteristic of fluctuating symptoms [35].

The masticatory muscles, especially the masseter and temporal, are also responsible for mandibular lifting motion [36]. Due to the weaknesses observed in these muscles, associated with the weakness of the orbicularis muscles of the lips, the implications for the AAMG patient may involve the predominance of an oral breathing, distortion of bilabials phonemes, or even anterior food and saliva escape, featuring oral phase swallowing disorders.

Clinical examination data, enabled to define the severity of the swallowing disorders [11]. A careful clinical evaluation needs to consider the performance of swallowing, as well the elements that act as a cause and consequence; pulmonary status, nutritional status and feed pleasure for each individual, making it possible to identify and classify the neurogenic dysphagia [37]. These data were very important to define the therapeutic approaches adopted.

We verify that 80% of patients had swallowing disorders by clinical examination that was considered mild in 50%, and moderate in 30% of the cases. The literature proposes a dysphagia classification in AAMG patients according to the choking presence [38], muscle strength and performance in chewing activities, swallowing, speech and breathing criterion [10,39]. The patients of our study were ambulatory and were not hospitalized. This fact can justify the absence of severe or profound dysphagia degrees in our sample.

Swallowing is described as a function characterized by a dynamic process characterized by a sequence of complex events, interrelated between them [40-42]. The swallowing process is divided didactically in stages: anticipatory phase, divided into oral preparatory and oral phase itself, pharyngeal phase and esophageal phase.

The preparatory oral phase of swallowing is the stage that prepares and qualifies the food bolus. Chewing is the initial stage of preparation, in which food is crushed and humidified. Concomitantly, the body qualifies the food bolus, in relation to its volume, consistency, density and degree of humidification.

Myasthenic patients may experience a significant reduction in maximum bite force, reducing the maximum electromyographic activity of lifters and depressors jaw muscles, and also masticatory inefficiency [43].

The weakness and masticatory fatigue were reported by 80% of patients. And these are symptoms often described in literature [10]. Patients with reduced maximum tongue strength tend to swallow more slowly [43], which can compromise the necessary synchrony for swallowing process.

The swallowing oral phase itself is characterized by the organization and food bolus ejection of the oral cavity to the pharynx. During this phase, the food bolus is placed on the tongue, to start the ejection to the oropharynx, initiating the involuntary phase of swallowing.

The pharyngeal phase is the involuntary phase of swallowing; characterized by a dynamic that directs the pressure flow and muscle adjustments made, such as the lip seal, the elevation of the palate and the pharyngeal constriction, preventing the dissipation of this pressure, helping to protect the airways.

The palate veil alterations in patients with AAMG can be impeditive for the intraoral pressure maintenance, causing hypernasality, articulatory imprecision, and also nasal reflux [44].

In AAMG, the more muscles involved are: tongue, larynx lifts and constrictor of pharynx, according to an electrophysiological evaluation [27]. The larynx changes can generate a dysphonia, with floating character that gets worse with sustained emission; the loss-adduction of the vocal folds leads an air leak during phonation, resulting in a breathy voice quality; with the fatigue of tensor of the vocal folds, the pitch can be lowered and become monotonous, the sentences are short and the cough is weak [32].Bulbar disorders such as dysphagia are so frequent in patients with AAMG, but little valued both by doctors and by patients themselves, and this disorder is attributed to involved muscles weakness [4,16].

Neuromuscular disorders may result in respiratory failure and, in some cases, may be the first symptom [22]. The respiratory muscles may also be affected by weakness. This impairment can be expressed by a rapid shallow breathing or for a reduction in maximum voluntary ventilation [3,25]. The degree of respiratory compromise depends of the disease severity, at the beginning can be observed in 1% to 4% of patients with AAMG, in advanced stages of the disease appears between 60% to 80% [2,26]. In our patients, 70% had dyspnea in different levels of effort, and 20% presented associated orthopnea; similar results were found in previous study [45].

To evaluate respiratory muscle strength, we decided to use the air mask and not the nozzle, due a minimally necessity of the facial muscle strength preservation to contain the device well positioned [26]. The frequent involvement of the orbicularis muscle of the lips in patients with AAMG [4,27] would compromise the proper sealing during the examination and may generate false positive results.

Evidences suggest that the use of mask shows no interference in the results of MIP. In the case of the MEP, the authors suggest that the use of the mask may have low values due to possible air leaks, However, the mask use could be associated possibly a lesser air leak in our population if compared to the nozzle [46]. Some authors [46,47] speculate that when the mask is used there is more chance of occurring air leakage during the procedure, especially in the MEP measures; however, when the sealing is adequate, the values are significantly higher than the measurements obtained by the nozzle [46].

In our study the measures were performed with extreme caution in order to prevent air leakage.

Patients with AAMG usually present respiratory muscles weakness, restrictive ventilatory pattern [2], and deterioration of maximal respiratory pressures could occur progressively, with or without concomitant fall FVC [22].

In agreement with other studies [2,22], 35% of the our sample showed a reduction greater than 80% of the predicted value of the MIP and 45% reduction greater than 80% of the predicted value of the MEP.

We observed a good correlation among the maximal respiratory pressures deterioration and the increased severity of dysphagia; favoring the risk of aspiration. Therefore, there is a statistically significant relationship between swallowing and breathing changes.

In our findings, the more serious swallowing disorders, the greater the impairment of respiratory muscle strength. Likewise in relation to the lung flows. This decline in the measures is due to weakness of the respiratory muscles, fatigue and reduced lung compliance [48].

The results of the respiratory evaluation showed a strong correlation of the respiratory muscles strength with the expiratory flow measures and cough. The muscles weakness promotes a decrease of the inspired and exhaled volumes. We also observed a good correlation between MIP and MEP, both of them presented below of the predicted, indicating that the weakness characteristic of the disease affected the inspiration and forced exhalation, so important during cough, and also for airway protection [49].

The MEP values below 40cm H_2O favors the accumulation of secretion in the laryngopharyngeal region. This stasis associated with reduced strength of cough secondary to a difficulty to generate expiratory flow, can increases the risk of occurrence of tracheal aspiration and thus to possible respiratory infections [50].

Effective cough is important for proper protection of the airways in case of laryngeal penetration or tracheal aspiration [51-56]. The cough starts with inspiratory movement with wide vocal fold abduction, so the greater the inspiratory phase, the greater the effectiveness of cough [49]. In the compression phase, there is a glottal closure associated with activation of the diaphragm and the muscles of the abdominal and thoracic wall, in order to expel air from the airways. In the expiratory phase of cough, the folds abduct of an abrupt form, with air outlet at high speed, with a simultaneous lifting of the soft palate, preventing communication with the nasal cavity, clearing the airway secretions and inhaled particles [57]. The weak cough results in retention of secretions in laryngeal level and in inferior airways [32].

Aspiration pneumonia caused by episodes of tracheal aspiration is one of the most frequent complications of the oropharyngeal dysphagia. Dysphagia, can provide triggering and aggravating factors, such of musculoskeletal nature and breathing; which implies in a multifactorial reasoning to understand this clinical entity, especially in patients with AAMG. Respiratory issue is a factor that deserves special attention, since the respiratory fatigue in high intensity can trigger myasthenic crisis [58,59].

Consider the pathophysiology of the base disease of dysphagia patient, integrating knowledge of related areas, in clinical evaluation and treatment, not only adds value to the diagnosis, but also prevents respiratory and nutritional complications [60] secondary to dysphagia, with a possible worsening of the disease. The better comprehension of this scenario applied to AAMG is very important in the rehabilitation of these patients, since the detection and early dysphagia treatment in patients with AAMG are essential, in terms of prevention, diagnosis and treatment. The development of an interprofessional strategic planning certainly enhances the potential rehabilitation of this patient.

Conclusion

The oropharyngeal dysphagia in patients with AAMG is correlated with the orofacial and respiratory muscular components, translated by measurements of strength and flow. The cough strength and expiratory flow are correlated to the strength of inspiratory and exhalation muscles. The reduction of MIP values, MEP and PEF were indicators of the oropharyngeal dysphagia worsening. In this study both respiratory muscle strength measurements were below of the predicted.

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Citation: Oda AL, Bolzan DW, Cruz CTV, Oliveira ASB and Raimundo RD. Correlation of the Maximal Respiratory Pressures, Respiratory Airflow and Dysphagia in Patients with Acquired Autoimmune Myasthenia Gravis. Austin J Musculoskelet Disord. 2016; 3(1): 1031.