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Oromandibular Dystonia:
Clinical Characteristics and Impact on Quality of Life

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Abstract Cover Page

Oromandibular Dystonia:

Clinical Characteristics and Impact on Quality of Life

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ABSTRACT

Oromandibular Dystonia: Clinical Characteristics and Impact on Quality of Life
By, Laura Scorr

Objective: To determine the clinical characteristics of oromandibular dystonia (OMD) and estimate the association between quality of life (QOL) and location of cranial dystonia.

Background: OMD and blepharospasm (BSP) are sub-types of cranial dystonia that occur in isolation or combination. BSP is characterized by spasms of the upper facial muscles, known to result in poor QOL. OMD affects the lower facial muscles causing jaw dysfunction and pain. Patients anecdotally report OMD to be particularly disabling. OMD is not well characterized in the literature, neglected on cranial dystonia rating scales, and often untreated. We hypothesized location of dystonia is associated with QOL.

Methods: Subjects include 200 patients with OMD, BSP, and combined cranial dystonia enrolled in the Dystonia Coalition database from 26 international sites. Demographics and clinical characteristics were collected via standardized questionnaires. Anxiety was assessed with Liebowitz Social Anxiety Scale (LSA), and QOL with SF-36. Descriptive statistical analysis was performed for sample characteristics. The association between location of dystonia and QOL was estimated with linear regression.

Results: Among 165 cases of OMD, 65% were female and average age of onset was 55±12 (range: 9-74). The pattern of dystonia was segmental in 48% of cases. Average LSA scores for OMD (32±26) and combined cranial dystonia (36±29) indicated social anxiety. Mean SF-36 QOL score for healthy subjects is 50±10, with lower scores indicating worse QOL. Average mental QOL scores for OMD, BSP, and combined cranial dystonia were 48±11, 50±9, and 43±12. Average physical QOL scores were 48±10, 46±12, and 44±8. Combined cranial dystonia was associated lower mental QOL scores compared to BSP (β=-7.89, p=0.03). OMD had a similar impact on QOL as BSP (β=-0.42, p=0.90).

Conclusions: OMD typically presents in the fifth decade as part of a segmental pattern and is more common in women. On average, patients with OMD had social anxiety and poor quality of life. The presence of combined cranial dystonia had a more negative impact on QOL than OMD or BSP alone. To improve QOL in cranial dystonia patients it will be essential to revise our clinical paradigm to include assessment and treatment for both OMD and BSP.

Cover Page

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INTRODUCTION

Dystonia is a chronic disabling neurologic disorder affecting more than 3 million people worldwide. Dystonia is characterized by involuntary muscle contractions leading to abnormal movements and postures. Although dystonia may affect any region, dystonia affecting the cranial region is particularly disabling. Blepharospasm (BSP) is a form of dystonia that affects the upper facial muscles causing excessive blinking and forced eye closure. Oromandibular dystonia (OMD) is a form of dystonia that affects the lower facial, masticatory, and lingual muscles. These forms of dystonia can occur in isolation or in combination. OMD is reported by patients to be particularly disabling because it interferes with the ability to eat and speak. However, due to the rarity of OMD, it has been largely neglected in the medical literature. As a result of poor characterization in the literature, this phenotype is not well recognized clinically, which leads to significant delays in diagnosis and treatment initiation. While patients report OMD to be particularly disabling, the presence of dystonia in this location is not captured on current cranial dystonia severity rating scales. This limits the ability of current scales to follow disease severity over time and makes it impossible to determine whether disability is mediated primarily by BSP, OMD, or the combination of the two.

The first aim of this study is to describe the clinical characteristics of OMD in a large cohort of patients. Since so little is known about this condition, publication of a careful characterization may lead to improved recognition and

decrease the time from symptom onset to treatment initiation. The second aim of this study is to estimate the association between location of dystonia (OMD, BSP, Combined) and QOL, as measured by the SF-36 mental and physical component scores. If location of dystonia were associated with quality of life, this would prompt revision of current severity scales to include assessment of lower facial dystonia. We believe the location of dystonia is associated with quality of life in patients with dystonia.

BACKGROUND

Dystonia is a movement disorder characterized by sustained or intermittent muscle contractions causing abnormal movements, postures, or both (1). Oromandibular dystonia (OMD) is a rare form of cranial dystonia that affects the lower facial, masticatory, and lingual muscles. This is particularly disabling because it interferes with the ability to eat and speak. Due to the rarity of this condition, it is not well characterized in the literature and is neglected in current dystonia severity rating scales.

OMD is often idiopathic and can present as a focal dystonia, or as part of a segmental or generalized pattern of dystonia. Unfortunately, OMD has not been particularly well characterized in the literature and has been described mostly in case series of 20 or less patients. Idiopathic focal OMD is reported to be a rare disease, representing 3-5% of dystonia. Incidence is of idiopathic focal OMD is estimated at 3.3/1,000,000 and prevalence is estimated at 68.9/1,000,000 (2, 3). OMD is also reported to be more common in females, although reports vary on magnitude of the difference. Average age of onset is thought to be between 50-60 years old. The movement phenotypes of OMD are varied, but include jaw opening, jaw closing, jaw deviation, lingual protrusion, and mixed presentations. OMD may be task specific, occurring with speech and eating, or can be present at rest. Nearly half of patients have been reported to describe a precipitating event and a recent review showed that the majority of patients with this disorder have a sensory trick such as lightly touching their face which relieves their dystonic symptoms (4). Although OMD is well known to be a debilitating condition, it is

often unrecognized clinically or misdiagnosed as a form of temporomandibular joint disorder, leading to a delay in accurate diagnosis and treatment initiation. The average time from onset of symptoms to diagnosis in the most common forms of dystonia is 6 years, and this delay is believed to be even longer in OMD (5). Meanwhile, patients anecdotally report associated depression, anxiety, and decreased quality of life. There is a clear need to improve recognition of OMD to allow for more timely diagnosis and treatment initiation.

OMD is often seen in combination with blepharospasm, which is a more common form of cranial dystonia. Blepharospasm is characterized by spasms of the upper facial muscles. Spasms most characteristically involve the orbicularis oculi and nearby muscles leading to prolonged eye closure and difficulties with reading, driving, and other activities. Blepharospasm most often begins in the fifth or sixth decade of life, and is also more common in females (6). Spasm tends to worsen over time if untreated, and spreads to the lower face affecting the oromandibular region in 50% of cases (7). The most widely used tool for measuring the severity of spasms is the Jankovic Rating Scale (JRS), a five point clinical scale focused on the severity and frequency of eyelid movements. However, the utility of this scale in long-term studies for assessing severity is limited because it does not take into account spread to the oromandibular region. Nonetheless, long-term studies have shown patients with blepharospasm have progressive disability and poor health-related quality of life (8). Given the frequent co-occurrence of OMD with blepharospasm, patients with OMD are also likely to have poor health-related quality of life. Failure of current rating scales to

account for both upper and lower facial symptoms limits the ability to assess the impact of location of cranial dystonia on quality of life in published studies.

Our overall aim is to better define the clinical characteristics of OMD among patients with focal, segmental and generalized dystonia enrolled in the Dystonia Coalition database. The Dystonia Coalition is an NIH funded international multi-center collaboration aimed at advancing research for dystonia syndromes, and their database provides an opportunity to review the largest sample of patients with OMD yet described. By providing a better description of OMD, we hope to improve clinical recognition, diagnostic accuracy and decrease the time to treatment initiation. We also plan to examine whether depression and anxiety are associated with OMD, as these psychiatric conditions are recognized to be non-motor features of other forms of dystonia. The negative impact of OMD on quality of life has been reported only anecdotally thus far. In our study we aim to estimate the association between location of dystonia (OMD, BSP, Combined) and QOL, as measured by the SF-36 mental and physical component scores. If location of dystonia were associated with quality of life, this would prompt a shift in our clinical paradigm to improve quality of life outcomes. Current cranial dystonia severity scales would need to be revised to include assessment for both upper and lower facial dystonia, and treatment would need to be directed at alleviating both BSP and OMD.

METHODS

Research Goals

1. To describe the clinical characteristics of idiopathic OMD among patient evaluated at tertiary care centers internationally enrolled in the Dystonia Coalition database.
2. To estimate the association between QOL and location of dystonia (OMD, BSP, Combined) among patients evaluated at tertiary care centers internationally enrolled in the Dystonia Coalition database. Quality of life was measured by SF-36 mental and physical component scores.

Study Design

This is a cross-sectional study of patients with cranial dystonia (OMD, BSP, and Combined) enrolled in the Dystonia Coalition (DC) database.

Study Population

The DC enrolls dystonia patients evaluated at tertiary care centers internationally into their database project. For Aim 1, we analyzed data collected for all patients enrolled in the DC database with a diagnosis of OMD (n=165). For Aim 2, we analyzed data collected for all patients enrolled in the DC database with cranial dystonia who had completed the SF-36 assessment of QOL (n=82). The DC collects a more complete database of information, including SF-36, only for patients within 5 years of onset. Inclusion criteria for the Dystonia Coalition studies were diagnosis with primary dystonia and nasolaryngoscopic diagnostic confirmation in cases of laryngeal dystonia. Exclusion criteria were: any evidence

of a secondary cause for dystonia, less than 2 months since last botulinum toxin injection, significant medical or neurologic conditions that preclude completing the neurologic exam, and significant physical or other condition that would confound diagnosis or evaluation, other than dystonia or tremor. The Emory University Institutional Review Board and the Dystonia Coalition steering committee approved this study. Patients were consented at the time of enrollment and were provided the option of withdrawing their information from the database at any time.

Data Collection

As part of enrollment in the Dystonia Coalition studies, all patients completed a 26-item questionnaire describing demographics as well as the clinical characteristics of their dystonic movements. A video exam was performed for each patient and a neurologist specializing in movement disorders evaluated each video to determine distribution of dystonia, areas affected, and severity as measured on the Global Dystonia Rating Scale (GDRS). The GDRS is a likert-type scale where each of 14 body regions is rated from 0-10, with 10 indicating maximum severity. Total scores range from 0-140. Subjects reported presence of sensory trick and prior treatments utilized. Clinical features of interest included distribution of dystonia (focal, segmental, general), areas affected (upper face, jaw, tongue, lower face), presence of task specificity, presence of sensory trick, and treatments utilized. In addition, patients within 5 years of onset also completed the SF-36 quality of life assessment, Beck Depression Inventory II

scale (BDI), and Liebowitz Social Anxiety scale (LSA). Data was collected in this manner to limit recall bias.

The SF-36 is a 36-question assessment of QOL. Primary outcomes from the SF-36 used for this study were Mental Component Score (MCS) and Physical Component Score (PCS) for quality of life. Each of these has possible scores ranging from 0-100, with a mean of 50 and standard deviation of 10. Higher scores indicate better QOL. The SF-36 has been validated in a wide range of chronic disease and has been used in the literature to assess QOL among dystonia patients (9, 10).

The BDI is a 21-question survey for depression with possible scores ranging from 0-63. Scores greater than 9 are indicative of depression. The LSA is a 24-item survey with possible scores ranging from 0-144. Scores greater than 30 indicate social anxiety. Both the BDI and LSA have demonstrated reliability and validity (11, 12). Both have been used previously in the literature to characterize psychiatric features of dystonia patients.

Sources of data

To characterize the clinical features of OMD, descriptive analysis was performed for age of onset, gender, location of dystonia, distribution of dystonia, severity of dystonia (GDRS score), task specificity, presence of sensory trick, and exposure to botulinum toxin treatment. To estimate the association between location of dystonia and quality of life, the primary outcome measures were SF-36 physical component score and mental component score. The exposure of interest was location of dystonia (BSP, OMD, Combined). Covariates that were

controlled for in multivariate analysis were age, gender, and distribution as a marker of severity. Distribution of dystonia indicates whether only one body region is affected by dystonia (focal), whether two contiguous body regions are affected by dystonia (segmental), or whether multiple body regions are affected by dystonia (generalized). Dystonia affecting multiple body regions is generally considered a more severe pattern of disease. Covariates analyzed in univariate analysis included age, gender, distribution, GDRS score, BDI score, and LSA score.

A small amount of missing data was identified, but did not vary by exposure or outcome, and was treated as missing at random.

Sample Size and Power

Query of the DC database identified 165 patients with OMD, and 82 patients with cranial dystonia (OMD, BSP, Combined) who had completed the SF-36 assessment for quality of life. Power analysis indicated that a sample of 74 participants was needed to detect a moderate effect for location of dystonia on QOL with an alpha level of 0.05 and a desired statistical power level of 0.8 with assumed standard deviation of 10.

Analytic Plan

To describe the clinical characteristics of OMD, descriptive analyses of demographic and clinical characteristics were completed for all patients with OMD (n=165). Demographics included age, sex and race. Clinical characteristics

included areas affected, distribution of dystonia, severity of dystonia as measured by GDRS, task specificity, and sensory trick.

To estimate the association between location of dystonia and quality of life, descriptive analyses of demographics, clinical characteristics, and QOL scores were completed for cranial dystonia patients (OMD, BSP, and Combined). Demographics again included age, sex, and race. Clinical characteristics included areas affected, distribution, severity, BDI score, and LSA score. QOL scores analyzed were the physical component score and the mental component score. The distribution of quality of life scores by location of dystonia was displayed in histograms. Comparisons between groups of interest were made using ANOVA and Chi-square tests.

Linear regression modeling was then used to estimate the association between QOL and location of dystonia (OMD, BSP, Combined). Univariate linear regression was performed to estimate the association between quality of life and demographic/clinical characteristics. Ultimately, two multivariate linear regression models were created. Model 1 was created to estimate the association between the location of dystonia and the physical component quality of life score (PCS). Model 2 was created to estimate the association between the location of dystonia and the mental component quality of life score (MCS). In each model age and gender were controlled for, as has been done in published literature assessing quality of life in patients with neurologic disease. Distribution of dystonia was also controlled for as a marker of severity.

All data analysis was performed with SAS version 9.4.

RESULTS

This study presents a cross-sectional analysis of demographics and clinical features among patients with OMD enrolled in the Dystonia Coalition database (Table 1). Among the 165 cases, 65% were female. Average age of onset was 55 ± 12 (range: 9-74). In this cohort, 84% of patients were Caucasian. The distribution of dystonia was most commonly segmental (48%), and less commonly focal (31%) or generalized (21%). Of the 165 cases of OMD, 79% had involvement of the jaw, 64% had involvement of the lower face, and 30% had involvement of the tongue. GDRS severity scores were moderate, with an average score of 6 ± 4 for the oromandibular region and an average total score of 18 ± 16. Among patients with a diagnosis of OMD, 60% reported having received botulinum toxin treatment.

Cross-sectional analysis was also performed for the demographic and clinical features among all patients with cranial dystonia (OMD, BSP, Combined) (Table 2). All forms of cranial dystonia were more common in females and had similar age of onset in the late fifth to early sixth decade. In this cohort, the majority of patients were Caucasian. The most common distribution of dystonia focal (89%) among patients with BSP, and was segmental among patients with OMD (48%) and combined cranial dystonia (50%). Average total GDRS scores were higher for patients with OMD (7±5) and combined cranial dystonia (16±7), than for patients with BSP (5±3). Average LSA scores for patients with OMD (32±26) and combined cranial dystonia (36±29) were consistent with presence of social anxiety, defined as LSA score > 30. On average, BDI scores for patients with OMD (8±9), BSP (7±8), and combined cranial dystonia (9±7) were not

indicative of depression, as defined by BDI score >9. Botulinum toxin therapy was received by 68% of patients with BSP, 70% of patients with OMD, and 50% of patients with combined BSP and OMD. There was no significant difference of exposure to treatment by location of dystonia (p=0.53).

Average physical component QOL scores were lowest for patients with combined cranial dystonia (44±8) and highest for patients with OMD (48± 10) (Figure 1). All physical component QOL scores were below the published norm of 50, indicating worse quality of life. Mental component quality of life scores were normal for BSP (50±9), but low for OMD (48±11) and combined cranial dystonia (43±12) (Figure 2). Patients with combined cranial dystonia had average mental component QOL scores of 43±12, which is significantly below the expected norm (Figure 3).

Univariate linear regression revealed no significant association between location of dystonia and physical component quality of life score (Table 3). Age, gender, distribution and severity of dystonia as measured by GDRS were not significantly associated with physical component QOL score. Patients identifying as black had physical component QOL scores that were 10 points lower on average, indicating significantly worse physical QOL (β=-10.25, p=0.02). Location of dystonia was associated with mental QOL score among patients with combined cranial dystonia, who had mental QOL scores on average 7 points lower, indicating worse mental quality of life (β=-6.71, p=0.04). Mental quality of life improved 0.34 points for each year older a patient was, indicating worse mental quality of life for younger patients with cranial dystonia (β=0.34, p<0.01). GDRS severity score was associated with worsened mental QOL, such that each

point higher on the GDRS score was associated with a 0.6-point lower mental component quality of life score (β=-0.60, $p<0.01$). Each point higher on the BDI scale for depression was associated with a 1-point lower mental and physical component quality of life score ($p<0.01$). Each point higher on the LSA scale for anxiety was associated with a 0.28 and 0.14-point lower score for mental and physical component quality of life score, respectively ($p<0.01$). Reported exposure to botulinum toxin therapy was not associated with quality of life scores.

Multivariable regression was performed to estimate the association between quality of life and location of dystonia (Table 4). Age, gender, and race were controlled for, because these demographics are typically controlled for in assessing quality of life among patients with neurologic disease. Distribution of dystonia was controlled for as a marker of severity. There was no significant difference in physical component QOL score by location of dystonia. There was no significant difference in mental component QOL score for patients with OMD compared to those with BSP. However, patients with combined OMD and BSP had an average mental component QOL score 8 points lower than those with BSP alone, indicating significantly worse QOL in this combined group ($p=0.03$).

DISCUSSION

In this study we analyzed the clinical characteristics of 165 patients with OMD from an international multicenter database. This is by far the largest cohort of patients with OMD yet described. As previously reported, OMD tends to occur in the 5th decade and is more common in women. While OMD appears to be more frequent in Caucasians based on analysis of the DC database, this may be a reflection of access to care and/or enrollment bias. There is no known biologic reason that this condition would be more common in Caucasians.

Interestingly, OMD most commonly was present as part of a segmental pattern of dystonia involving a contiguous body region such as the neck. Previous reports have described OMD primarily as a focal dystonia. This finding draws attention to the need to carefully evaluate patients with cervical dystonia for dystonia in the oromandibular region. Given our finding that OMD commonly occurs in combination with other forms of dystonia and previous reports that 50% of patients with BSP have spread of dystonia to the oromandibular region, it is possible that the oromandibular region is particularly sensitive to dystonia spread. Future studies are needed on the natural history of OMD to assess likelihood of progression of dystonia to other body regions.

Patients with all forms of cranial dystonia had similar demographic and clinical characteristics. Age of onset, sex, and reported race were not significantly different by location of dystonia. Patients with combined BSP and OMD were more likely to have a generalized distribution of dystonia and, thus, higher GDRS severity scores. Average BDI scores were not consistent with depression for any

of the three groups. However, average LSA scores were consistent with social anxiety for patients with OMD and combined dystonia. This suggests that the presence of dystonia in the oromandibular region may have a greater influence on social functioning than BSP, as anecdotally reported by patients.

Average physical component quality of life scores were below normal, indicating impaired quality of life, for all types of cranial dystonia. This finding is clinically significant because it indicates that BSP and OMD have an equal effect on quality of life and warrant equal attention on rating scales used for clinical evaluation. Average mental component quality of life scores were normal for BSP, but below normal for OMD and combined cranial dystonia. The score for combined cranial dystonia was significantly lower than the other groups, indicating that this manifestation of dystonia is particularly emotionally disabling. This again underscores the importance of evaluating for presence of OMD on cranial dystonia rating scales, as this combination has a particularly strong influence on quality of life. When controlling for age, gender, race, and distribution of dystonia, patients with combined cranial dystonia had mental component quality of life scores 8 points lower than patients with blepharospasm alone ($p=0.03$). The magnitude of this difference is clinically significant, similar to the difference observed in patients with more common disabling conditions such as multiple sclerosis and Parkinson's disease (13). The finding that this association remained significant when controlling for the presence of dystonia in other body regions suggests that this combination may be particularly disabling.

Depression and social anxiety were also associated with decreased quality of life scores. The likelihood of meeting criteria for lifetime diagnosis of

depression or anxiety is as high as 91% in some forms of dystonia, compared to 35% in the general population(14). Furthermore, several lines of evidence suggest that mood disorders are a function of the disease process in dystonia, rather than a coincidental condition or emotional reaction to motor symptoms. Both human and animal studies suggest disturbances in the serotonin neurotransmitter system implicated in mood disorders are also affected in dystonia(15). However, current dystonia assessment scales do not screen for mood disturbances and there are no guidelines for the treatment of mood disorders in this population. Our finding that depression and social anxiety are significantly associated with quality of life indicates the need to adapt clinical practice to screen for and treat mood disturbances in dystonia. Future studies may be aimed at determining which medications are most effective in treating the mood abnormalities in patients with dystonia. Research in this area may expand our knowledge of how serotonergic circuitry contributes to the clinical manifestation of mood and motor symptoms in dystonia and provide novel treatment targets.

Unfortunately, the cross-sectional nature of the DC database provided limited information on treatment strategies for OMD. There is no consensus on the best treatment for OMD. The gold standard treatment for other forms of dystonia, including BSP, is botulinum toxin injections. However, there has been significant debate in the literature regarding the therapeutic efficacy of this strategy for OMD. Interestingly, 60% of OMD patients in this cohort reported having received botulinum toxin in the past and there was no difference in exposure to botulinum toxin by type of cranial dystonia. This suggests that the majority of patients evaluated at tertiary care centers receive a trial of botulinum

toxin. However, the database did not include any information on dosing, location of injection, or success of this therapy. Further research is needed to confirm therapeutic response to botulinum toxin in cases of OMD and to define the best therapeutic dosing and injection patterns.

The cross sectional design of this study limits the ability to assess causality. Quality of life scores are not available before the onset of dystonia, so we cannot perform a within subject analysis of change in quality of life at this time. Additionally, the SF-36 may not fully capture the impact of OMD on QOL. The advantage of the SF-36 is that it is a commonly used measure of quality of life with published data for patients with other forms of dystonia and neurologic disease. This allows our findings to be interpreted in comparison to other published data. However, the SF-36 is not disease specific and may underestimate the impact of OMD on quality of life because the questions are not specific to tasks affected by OMD such as eating and speaking. Recently, an OMD specific QOL questionnaire has been developed, called the OMDQ-25. This would be a useful scale for future studies of OMD, though it would limit the ability to compare the impact of OMD to other forms of dystonia.

Another limitation of this study is that the majority of patients were enrolled at tertiary care centers. This may introduce a selection bias such that only patients with more severe disease present to tertiary care centers. Data from more common forms of dystonia, suggest that there is a lag of several years from onset of dystonia symptoms until diagnosis and treatment initiation. Anecdotally patients in our clinic have reported that for years prior to identifying their disease as a movement disorder, primary care physicians and dentists have diagnosed

them with psychogenic disease or temporomandibular joint disorder. The DC database only captures patients who are correctly referred to a movement disorders clinic, but there may be a large subset of patients incorrectly diagnosed in dental and primary care clinics who were not represented in this analysis. As with other movement disorders, such as PD, minorities may be less likely to be referred to a movement disorders clinic, which would explain why the proportion of minorities in our analysis was lower than expected. Future studies with examination of patients in TMJ clinics by a movement disorder specialist may provide further insight into the true prevalence of this condition.

A particular strength of this study is that the cohort analyzed is by far the largest cohort of OMD patients reported. Previous reports have been single center cohorts of 15-20 patients. Our analysis provides valuable information on the clinical characteristics of patients diagnosed with OMD, which has been largely neglected in the literature. Additionally, the use of a multicenter international database minimizes the idiosyncrasies often present in single center analyses. This is also the first study to examine quality of life and psychiatric features in patients with OMD, further expanding our knowledge of the disease.

Future directions include investigating the natural history of OMD to determine the likelihood of progression or remission of symptoms. To better track dystonia severity over time, it will be necessary to develop a modified cranial dystonia scale for severity that takes into account the presence of both upper and lower facial dystonia. Additionally we must adapt the clinical assessment of these patients to include screening for mood disturbances, such as depression and anxiety, which were found to be major determinants of quality of

life in this population. Finally it is critical to clarify the best treatment strategy for OMD given the results of this analysis showing its negative impact on quality of life. Prospective controlled trials are needed to evaluate the efficacy of botulinum toxin treatment.

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TABLES

Table 1: Characteristics of oromandibular dystonia patients enrolled in the Dystonia Coalition database from 2011-2016.

Characteristics	**Mean ± SD/Percent** N=165
Age of Onset (years)	55 ±12
Sex	
Female	65%
Male	34% (n=57)
Race	
White	84% (n=139)
Black	12% (n=19)
Other	4% (n=7)
Areas Affected	
Jaw	79% (n=131)
Perioral	64% (n=106)
Tongue	30% (n=50)
Distribution	
Focal	31% (n=51)
Segmental	48% (n=79)
Generalized	21% (n=35)
GDRS Severity[1]	
Lower face, jaw, tongue	6 ± 4
Total	18 ± 16
Botulinum Toxin Treatment[2]	60% (n=99)

[1]Global Dystonia Rating Scale (GDRS) is a standardized measure of dystonia severity
[2]Botulinum toxin treatment is standard of care for many forms of dystonia. Proportion represents patients who reported having received this therapy.

Table 2: Characteristics of cranial dystonia patients enrolled in the Dystonia Coalition database from 2011-2016.

	Oromandibular Dystonia N=27	**Blepharospasm** N=35	**Combined** N=20	**p-value**
Age (years)	57 ± 10	60 ± 11	59 ± 10	0.52
Gender				0.88
Female	66% (n=23)	67% (n=18)	60% (n=12)	
Male	34% (n=12)	33% (n=9)	40% (n=8)	
Race				0.13
White	85% (n=23)	86% (n=30)	70% (n=14)	
Black	11% (n=3)		15% (n=3)	
Other	4% (n=1)	14% (n=5)	15% (n=3)	
Distribution				<0.01
Focal	44% (n=12)	89% (n=31)	40% (n=8)	
Segmental	48% (n=13)	11% (n=4)	50% (n=10)	
Generalized	7% (n=2)		10% (n=2)	
GDRS total score[1]	7 ± 5	5 ± 3	16 ± 7	<0.01
Botulinum toxin[2]	70% (n=19)	68% (n=23)	50% (n=10)	0.53
BDI Score[3]	8 ± 9	7 ± 8	9 ± 7	0.71
LSA Score[4]	32 ± 26	24 ± 25	36 ± 29	0.23
Mean SF-36 QOL[5]				
Mental Component	48 ± 11	50 ± 9	43 ± 12	0.08
Physical Component	48 ± 10	46 ± 12	44 ± 8	0.58

[1] Global Dystonia Rating Scale (GDRS) is a standardized measure of dystonia severity
[2] Botulinum toxin treatment is standard of care for many forms of dystonia. Proportion represents patients who reported having received this therapy.
[3] Beck Depression Inventory II (BDI) is a standardized measure of depression
[4] Liebowitz Social Anxiety Survey (LSA) is a standardized measure of social anxiety
[5] SF-36 Quality of Life Survey is a standardized measure of quality of life

Figure 1: Distribution of SF-36 physical component quality of life scores by location of dystonia.

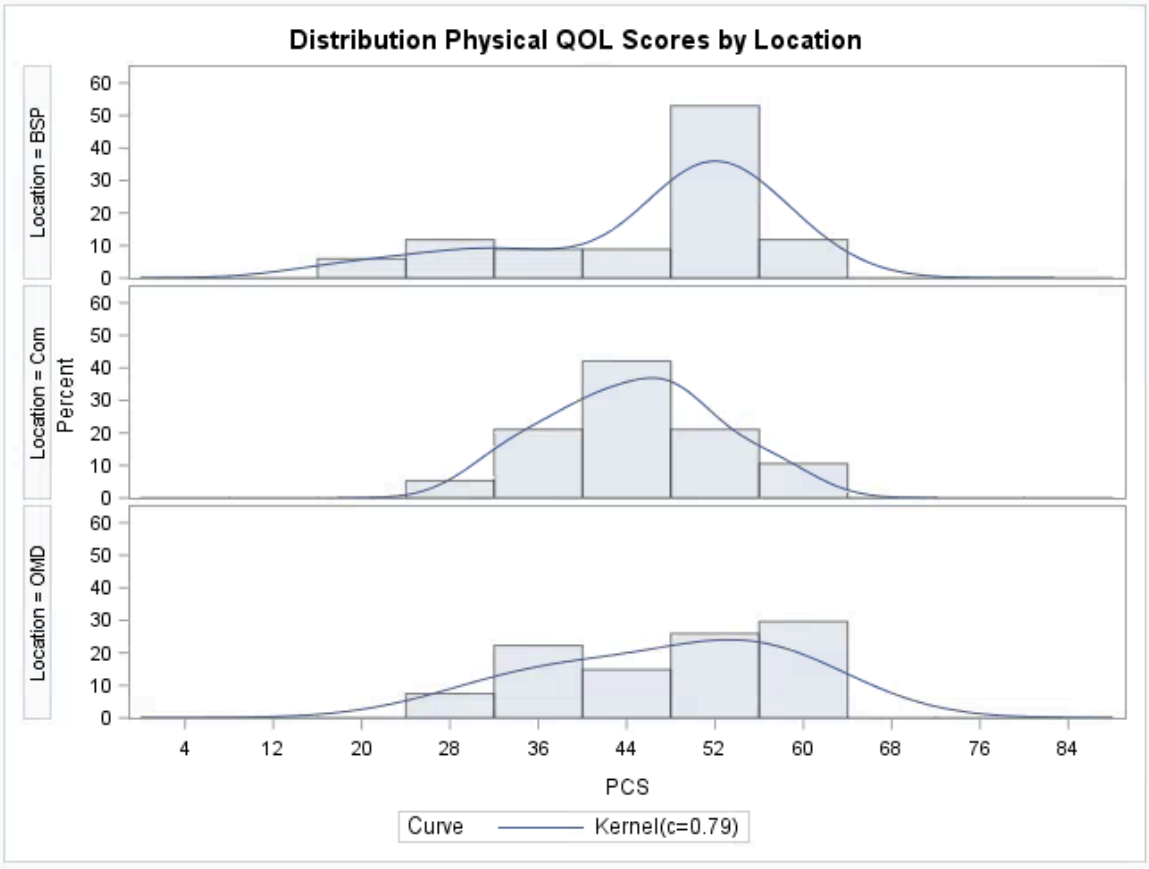

Figure 2: Distribution of SF-36 mental component quality of life scores by location of dystonia.

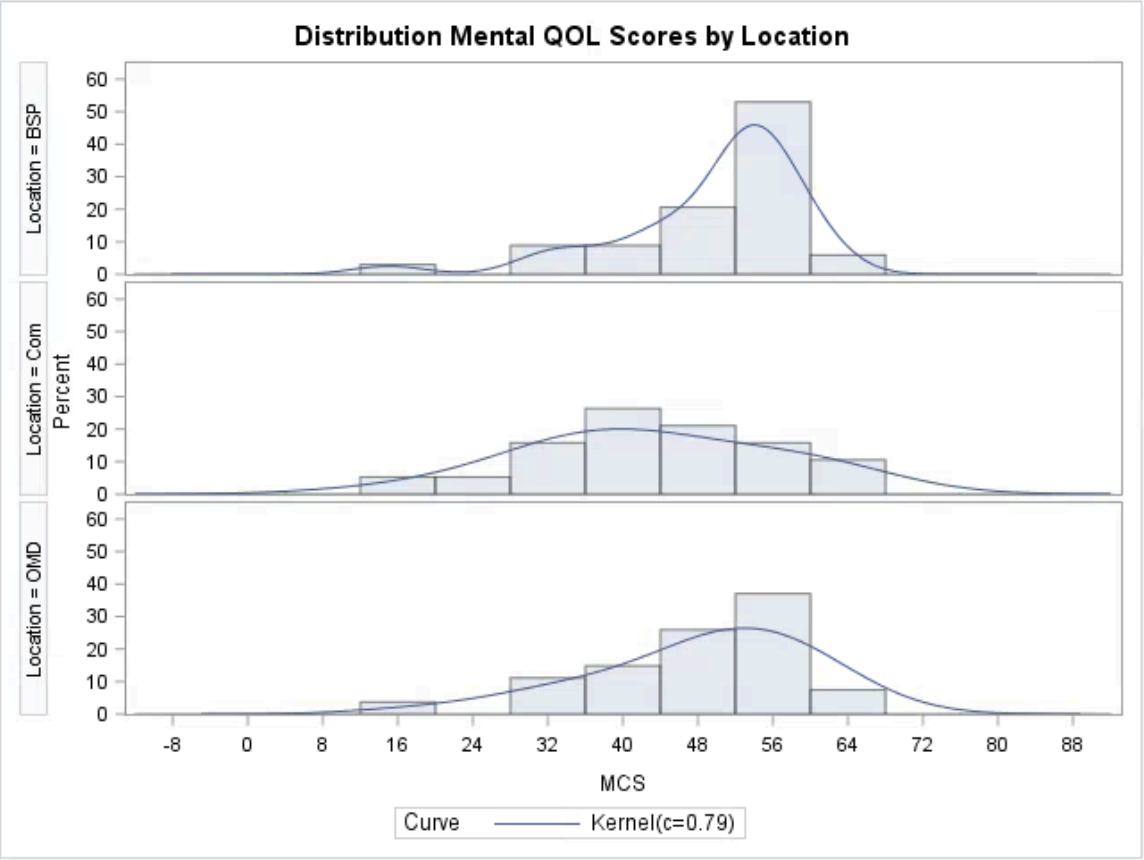

Figure 3: Distribution of SF-36 mental component quality of life in combined cranial dystonia compared to expected normal distribution.

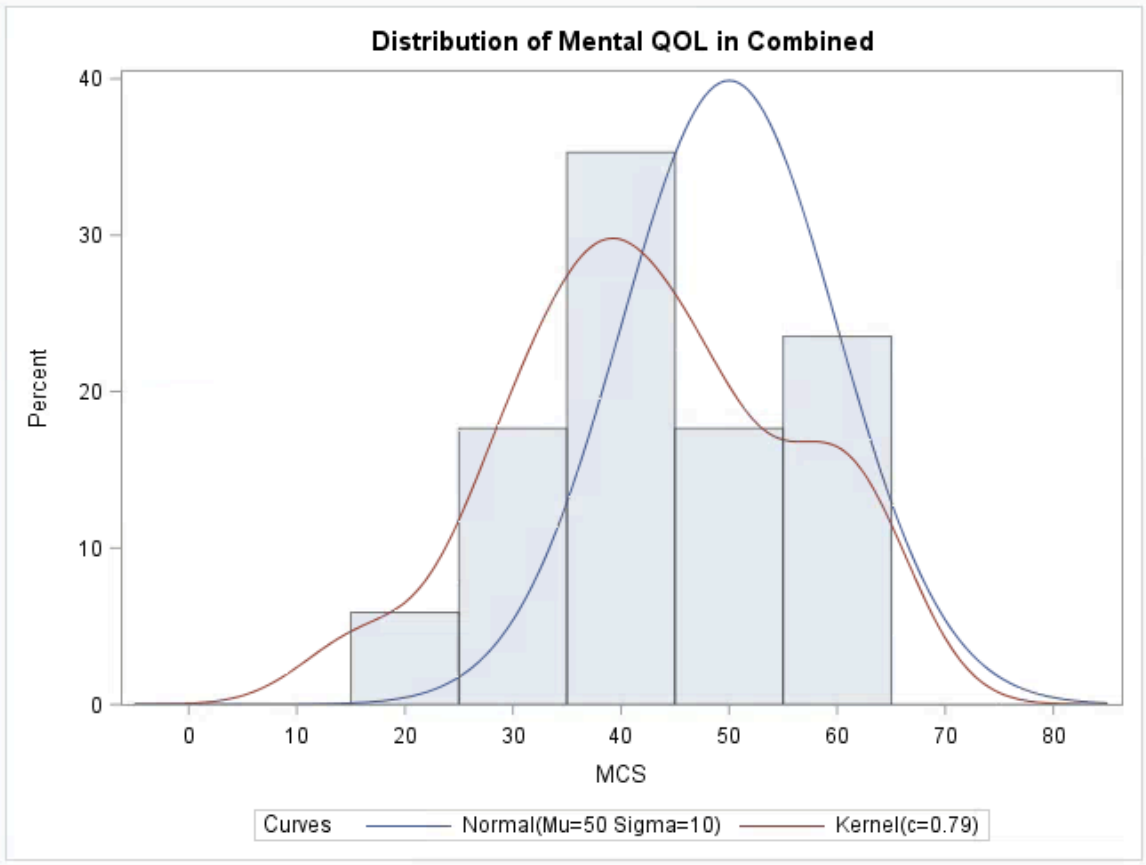

Table 3: Univariate linear regression analysis SF-36 quality of life scores of patients with cranial dystonia enrolled in the Dystonia Coalition database 2011-2016.

Demographic and clinical variables	Mental Component Score			Physical Component Score		
	β	95% CI	p-value	β	95% CI	p-value
Areas Affected						
Combination	-6.71	-13.3, -0.33	0.04	-1.63	-7.34, 4.13	0.58
OMD	-0.58	-6.50, 5.34	0.84	1.56	-3.62, 6.74	0.55
BSP *						
Age	0.34	0.12, 0.57	<0.01	0.04	-0.18, 0.26	0.72
Gender						
Female	0.87	-4.27, 6.02	0.74	1.55	-3.12, 6.22	0.52
*Male**						
Race						
Black	0.97	-8.28,10.22	0.84	-10.25	-18.55, -1.95	0.02
Other	-5.28	-12.99, 2.43	0.18	3.12	-3.79, 10.04	0.36
*White**						
Distribution						
Segmental	-1.24	-6.53,4.04	0.64	4.03	-0.76, 8.82	0.10
Generalized	-10.36	-21.77, 1.02	0.07	-3.64	-13.96, 6.68	0.49
*Focal**						
GDRS Score	-0.60	-0.96, -0.24	<0.01	-0.03	-0.39, 0.31	0.83
Botulinum toxin	2.11	-2.62, 7.84	0.42	2.01	-2.78, 8.12	0.40
BDI Score	-0.58	-0.84, -0.31	<0.01	-0.60	-0.91, -0.29	<0.01
LSA Score	-0.15	-0.23, -0.07	<0.01	-0.02	-0.12, 0.07	0.62

* Indicates Reference Group

Table 4: Multivariate linear regression analysis SF-36 quality of life scores of patients with cranial dystonia enrolled in the Dystonia Coalition database 2011-2016.

Location of Dystonia	Mental Component Score			Physical Component Score		
	β	95% CI	p-value	β	95% CI	p-value
Combined	-7.89	-15.27, -0.52	0.03	-0.85	-7.61, 5.90	0.80
OMD	-0.42	-7.18, 6.33	0.90	3.76	-2.42, 9.95	0.23
BSP*						

* Indicates reference group

Controlled for age, gender, race, and distribution of dystonia