ME&MGopen™ Digital Biomarkers Help Track Generalized Myasthenia Gravis Symptoms

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INTRODUCTION

Anti-acetylcholine receptor antibody-positive (AChR-Ab+) **generalized Myasthenia Gravis (gMG)** is a rare autoimmune disease causing **muscle fatigability and exertional weakness** resulting from post-synaptic neuromuscular junction damage[1,2].

Commonly affected muscles are essential for breathing, speaking and movement of the limbs or eyes. Patients experience a variety of day-to-day **fluctuating symptoms** thus it is **critical to collect real-world data** to better assess disease progression and optimize management[2,3,4].

Smartphone app-based platforms appear as a promising solution providing novel digital tests and biomarkers (dBMKs) for **tracking of daily disease fluctuations and at-home collection of patient data in between distant clinical visits[5,6,7].**

The decentralized clinical trial **ME&MGopen™ (NCT05566964)** collected digital biomarkers through its investigational software with the aim of enhancing patient engagement and characterizing the clinical relevance of novel digital tools.

OBJECTIVE

To assess digital biomarkers designed to measure gMG disease severity using the ME&MGopen™ app, and describe longitudinal real-world adherence and app's usability in a cohort of patients with gMG.

METHODS

This interim analysis includes the portion of participants with AChR-Ab+ gMG who completed the study by November 14, 2024.

The primary endpoints were to record adherence and app usability. The secondary endpoints were to explore associations between clinical questionnaires (MG-ADL and MG-QoL-15r) and ME&MGopen™ digital biomarkers.

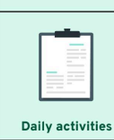
Name	My Eyelids	My Breathing	My Voice	My Arms	My Legs	MG-ADL	MG-QoL-15r
Test type	 Drooping eyelid	 Respiratory function	 Dysarthria	 Upper limb weakness	 Lower limb weakness	 Daily activities	 Quality of life
Mobile sensor	Camera	Microphone	Microphone	Accelerometer + Gyroscope	Accelerometer + Gyroscope	Touch Screen	Touch Screen

Figure 1. Description of tests and questionnaires in ME&MGopen™, a fully decentralized clinical trial. Participants, enrolled remotely, were asked to perform digital tests and answer clinically established questionnaires during the 360 days of the study.

RESULTS

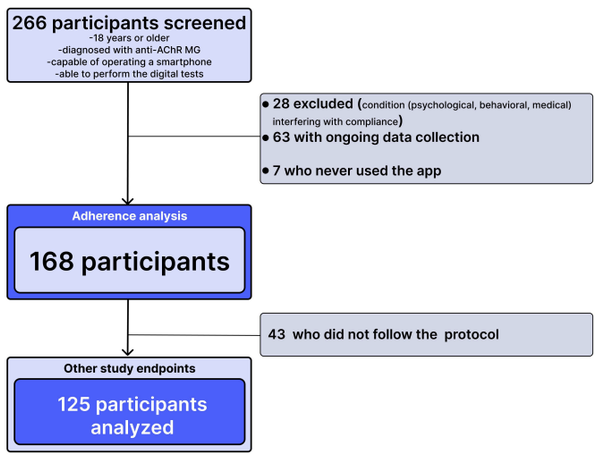


Figure 2. ME&MGopen™ interim analysis flowchart. Patients diagnosed with AChR-Ab+ gMG were enrolled and screened following this study inclusion and exclusion criteria.

Table 1. Baseline characteristics	
Number of patients, n (%)	125 (100)
Female	88 (70.4)
Male	37 (29.6)
Country of residence, n (%)	
Canada	8 (6.4)
United States	117 (93.6)
Age at disease onset, years (SD)	46.9 (21.0)
Disease duration, years (SD)	11.7 (13.0)
Need for caregivers, n (%)	
Yes	30 (24.0)
Thymectomy, n (%)	
Yes	65 (52.0)
MGFA disease class, n (%)	
Unreported	87 (69.6)
Class II	8 (6.4)
Class III	23 (18.4)
Class IV	7 (5.6)

Table 1. Baseline characteristics. This table summarizes the demographic and disease characteristic of patients who completed the study by the time of this interim analysis. All data is self-reported.

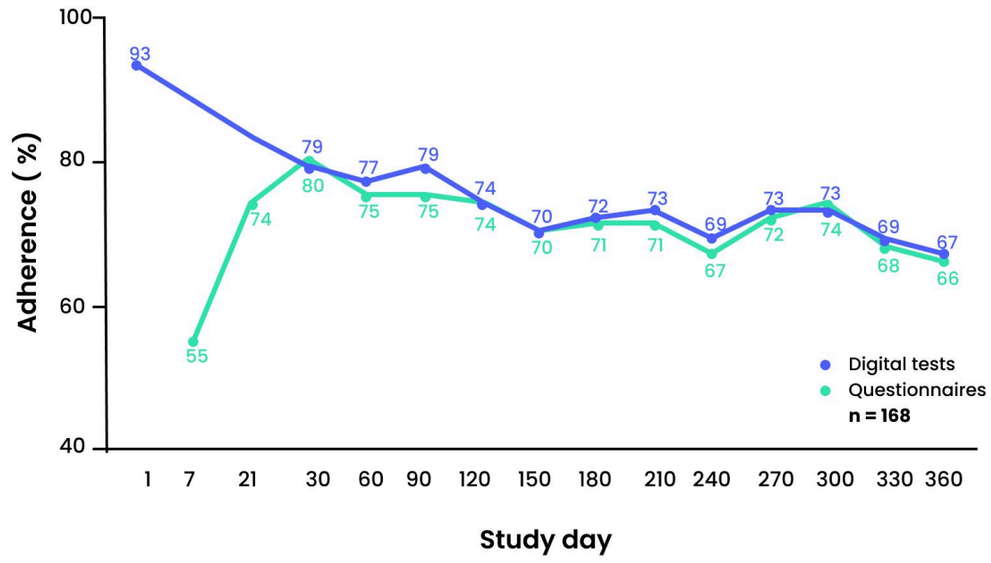


Figure 3. ME&MGopen™ participants maintained adherence after 360 days. Participants respected the study protocol and completed both clinical questionnaires and digital tests.

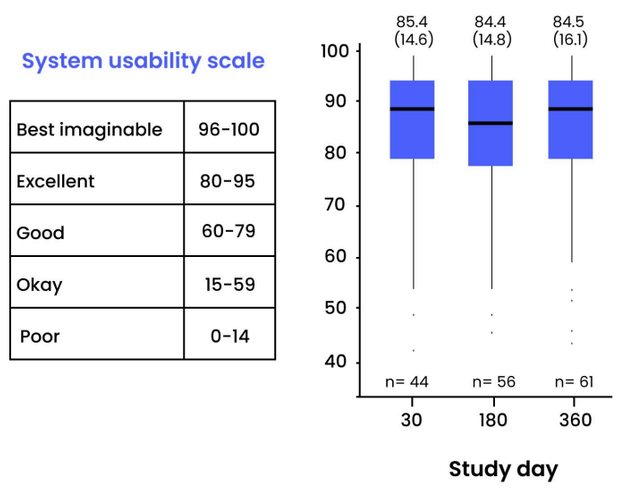


Figure 4. Participants reported ME&MGopen™ excellent software usability. The software allowed participants to efficiently and effectively complete their tests.

Table 2. Quality assessment of ME&MGOpen digital biomarkers				
	Parameter assessed	Number of evaluations, n (%)	Correlation with human annotations, R	Number of usable evaluations, n (%)
My Eyelids	MRD1*	1515 (100)	0.8	1283 (**84.7**)
My Breathing	MPT**	1527 (100)	0.99	1171 (**76.7**)
My Arms	Arm drop detection	1516 (100)	0.92	1117 (**73.7**)
My Legs	# sit-to-stand	1465 (100)	0.99	677 (**46.2**)
My Voice	dysarthia detection	1532 (100)	0.73	1403 (**91.6**)

Table 2. ME&MGopen™ digital biomarkers' quality assessments. Data collected through digital tests were evaluated to determine its quality. Values generated by the app were compared with human annotations and showed a strong correlation.
*MRD1- Margin to reflex distance 1
**MPT- Maximum phonation time

Table 3. Statistical significance between dBMK scores and subcategories of clinical MG questionnaires								
	MG-ADL subcategory					MG-QoL-15r subcategory		
	drooping eyelids	breathing score	brushing teeth/hair	arising from chair	talking	difficulties performing personal grooming	walking difficulties	speaking score
My Eyelids	p=0.019							
My Breathing		ns						
My Arms			p<0.001			p<0.001		
My Legs				p<0.001			p<0.001	
My Voice		p=0.001			p<0.001			p<0.001

Table 3. ME&MGopen™ digital biomarkers scores showed statistically significant association with scores from MG-ADL or MG-QoL-15r. Mixed models were used to assess the association between patients' digital tests scores and clinical questionnaire sub-item scores. Reported p-values show how these scores are related.

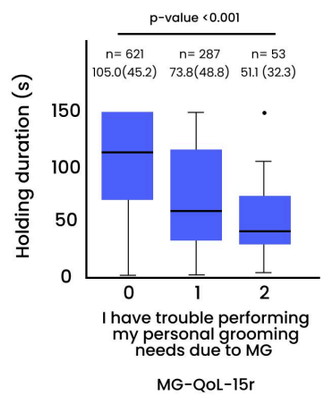


Figure 5 . My Arms results showed significant association with the upper limb sub component of the MG-QoL-15r score.

CONCLUSIONS

Long term adherence and usability support the app potential use in clinical setting and its value in **tracking the daily impact of patients' gMG symptoms**.

Preliminary results demonstrate associations of the app's digital biomarkers with current clinical assessments, highlighting **the importance of the ongoing validation study DOMYA (NCT05564936)**.

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