

CogniMOG-Study

SUPPLEMENT**Cognition in patients with myelin oligodendrocyte glycoprotein antibody-associated disease: A prospective, longitudinal, multicentre study of 113 patients (CogniMOG-Study)**

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eTable 1 Intraindividual longitudinal analyses of cognitive performance

	MOGAD patients (n=122)									
	Baseline vs. Follow-up period 1 (11-16 months)					Baseline vs. Follow-up period 2 (23-28 months)				
	Available <i>n</i>	Median		Standardized test statistic (<i>Z</i>)	<i>p</i>	Available <i>n</i>	Median		Standardized test statistic (<i>Z</i>)	<i>p</i>
	Baseline	Follow-up period 1				Baseline	Follow-up period 2			
PASAT	19	55.00	52.00	0.42	0.67	12	54.50	56.00	1.16	0.25
SDMT	52	59.00	62.00	2.05	0.04*	31	59.00	60.00	2.71	0.007**
MuSIC										
Immediate recall (list A)	40	14.00	15.00	1.29	0.20	22	14.00	17.00	3.20	0.001**
Immediate recall (list B)	40	6.00	6.00	0.11	0.91	23	6.00	6.00	-0.82	0.41
Delayed recall (list A)	40	6.00	7.00	3.03	0.002**	23	6.00	7.00	2.55	0.01*
Semantic fluency	40	14.00	14.00	1.58	0.11	23	13.00	12.00	1.24	0.21
Congruent speed ^a	41	21.00	21.00	-1.57	0.12	22	24.50	22.00	-2.09	0.04*
Incongruent - Congruent speed ^a	41	4.00	7.00	1.06	0.29	22	4.00	6.00	1.41	0.16

Abbreviations: MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; MuSIC = Multiple Sclerosis Inventory Cognition; *p* = uncorrected two-sided *p* value; PASAT = Paced Auditory Serial Addition Task; SDMT = Symbol Digit Modalities Test.

^a Higher value means worse performance.

* *p* < 0.05 ** *p* < 0.01

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eTable 2 Spearman's correlation coefficients at baseline: Demographic and clinical characteristics

	Age	Disease duration	EDSS: visual function	EDSS: motor function	FSMC	BDI-II
PASAT	-0.02	0.09	0.11	0.32	-0.25	-0.18
SDMT	-0.41*	0.02	-0.01	-0.03	-0.30	-0.15
MuSIC						
Immediate recall (list A)	-0.21	0.07	-0.16	0.25	-0.01	0.00
Immediate recall (list B)	-0.22	-0.01	-0.09	-0.04	-0.15	0.07
Delayed recall (list A)	-0.20	0.05	-0.29	0.25	0.15	0.29
Semantic fluency	0.12	-0.23	0.13	-0.10	-0.12	-0.17
Congruent speed ^a	0.25	-0.10	-0.07	0.14	-0.04	-0.16
Incongruent - Congruent speed ^a	0.13	0.05	0.13	-0.02	-0.04	-0.08

Abbreviations: BDI-II = Beck Depression Inventory-II; EDSS = Expanded Disability Status Scale; FSMC = Fatigue Scale for Motor and Cognitive Functions; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; MuSIC = Multiple Sclerosis Inventory Cognition; PASAT = Paced Auditory Serial Addition Task; SDMT = Symbol Digit Modalities Test.

^aHigher value means worse performance – Positive coefficients indicate negative influence of the factor on cognitive performance.

* $p_{Bon} < .05$ (Bonferroni corrected p value).

eTable 3 Cognitive performance of female compared to male patients at baseline

	Median		Standardised test statistic (Z)	p
	Female (n = 71)	Male (n = 51)		
PASAT	43.00	52.00	1.70	0.09
SDMT	60.00	55.00	-1.79	0.07
MuSIC				
Immediate recall (list A)	15.00	14.00	-1.64	0.10
Immediate recall (list B)	6.00	6.00	-0.55	0.58
Delayed recall (list A)	7.00	5.00	-1.95	0.05
Semantic fluency	14.00	14.00	0.48	0.63
Congruent speed ^a	21.00	25.00	1.38	0.17
Incongruent - Congruent speed ^a	6.00	4.00	-1.62	0.11

Abbreviations: MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; MuSIC = Multiple Sclerosis Inventory Cognition; p = uncorrected two-sided p value from Mann-Whitney test; PASAT = Paced Auditory Serial Addition Task; SDMT = Symbol Digit Modalities Test.

^aHigher value means worse performance.

eTable 4 Cognitive performance of patients with different educational levels at baseline

	Median		Standardised test statistic (Z)	p
	Secondary school [9-10 years of school attendance] (n=49)	High school [12-13 years of school attendance] (n=54)		
PASAT	43.00	50.00	1.62	0.11
SDMT	55.00	63.00	3.38	< 0.001**
MuSIC				
Immediate recall (list A)	14.00	15.00	1.46	0.15
Immediate recall (list B)	5.00	7.00	3.10	0.002**
Delayed recall (list A)	5.00	7.00	2.05	0.04*
Semantic fluency	15.00	13.00	-1.78	0.07
Congruent speed ^a	24.00	21.00	-1.91	0.06
Incongruent - Congruent speed ^a	5.00	4.00	-0.24	0.81

Abbreviations: MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; MuSIC = Multiple Sclerosis Inventory Cognition; p = uncorrected two-sided p value from Mann-Whitney test; PASAT = Paced Auditory Serial Addition Task; SDMT = Symbol Digit Modalities Test.

^a Higher value means worse performance.

*p < 0.05 **p < 0.01

eTable 5 Regression coefficients for raw values of PASAT at baseline

	MOGAD patients (n=45)						
	B	SE B ^b	95% CI for B ^b		β	p ^b	p _{Bon} ^b
			LL	UL			
Demographic characteristics							
Age	-0.04	0.13	-0.36	0.22	-0.05	0.78	> 0.99
Education [Secondary school (9-10 y.) vs. High school (12-13 y.)]	3.46	2.89	-2.49	10.29	0.16	0.24	> 0.99
Clinical characteristics							
Optic neuritis	1.90	3.75	-4.81	8.98	0.09	0.59	> 0.99
Myelitis	3.07	3.24	-3.34	10.35	0.15	0.34	> 0.99
Brainstem or cerebellar syndrome	-3.09	4.40	-10.89	5.22	-0.13	0.48	> 0.99
Cerebral lesions	-8.07	3.35	-14.73	-1.22	-0.35	0.02	0.13

adj. $R^2 = 0.11$, $F(6,38) = 1.88$, $p = 0.11$.

Abbreviations: B = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; p = uncorrected two-sided p value; p_{Bon} = Bonferroni corrected p values; SE B = Standard error of B; UL: upper limit. Education based on the German educational system.

^b Confidence intervals, standard errors and p-values were determined by BCa bootstrapping with 1000 samples.

eTable 6 Regression coefficients for raw values of SDMT at baseline

		MOGAD patients (n=97)						
		<i>B</i>	<i>SE B</i>	95 % CI for <i>B</i>		β	<i>p</i>	<i>p</i> _{Bon}
				LL				
Demographic characteristics								
	Age	-0.35	0.08	-0.50	-0.20	-0.41	< 0.001	< 0.001**
	Education	7.84	2.15	3.57	12.11	0.32	< 0.001	0.002**
	[Secondary school (9-10 y.) vs. High school (12-13 y.)]							
Clinical characteristics								
	Optic neuritis	1.94	2.52	-3.07	6.93	0.07	0.44	> 0.99
	Myelitis	3.29	2.38	-1.44	8.02	0.13	0.17	> 0.99
	Brainstem or cerebellar syndrome	3.06	2.70	-2.31	8.42	0.11	0.26	> 0.99
	Cerebral lesions	-8.85	2.37	-13.57	-4.14	-0.33	< 0.001	0.002**

adj. $R^2 = 0.32$, $F(6,90) = 8.68$, $p = < 0.001$.

Abbreviations: *B* = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; *p* = uncorrected two-sided *p* value; *p*_{Bon} = Bonferroni corrected *p* values; *SE B* = Standard error of *B*; UL: upper limit. Education based on the German educational system.

p*_{Bon} < 0.05 *p*_{Bon} < 0.01

eTable 7 Regression coefficients for raw values of MuSIC Immediate recall (list A) at baseline

		MOGAD patients (n=75)						
		<i>B</i>	<i>SE B</i> ^b	95 % CI for <i>B</i> ^b		β	<i>p</i> ^b	<i>p</i> _{Bon} ^b
				LL				
Demographic characteristics								
	Age	-0.04	0.03	-0.09	0.01	-0.18	0.09	0.56
	Education	0.74	0.74	-0.67	2.36	0.11	0.33	> 0.99
	[Secondary school (9-10 y.) vs. High school (12-13 y.)]							
Clinical characteristics								
	Optic neuritis	-0.38	0.74	-1.93	1.12	-0.05	0.62	> 0.99
	Myelitis	1.37	0.91	-0.41	3.11	0.21	0.15	0.87
	Brainstem or cerebellar syndrome	0.14	0.70	-1.10	1.83	0.02	0.84	> 0.99
	Cerebral lesions	-0.59	0.96	-2.43	1.26	-0.09	0.55	> 0.99

adj. $R^2 = 0.02$, $F(6,68) = 1.28$, $p = 0.28$.

Abbreviations: *B* = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; *p* = uncorrected two-sided *p* value; *p*_{Bon} = Bonferroni corrected *p* values; *SE B* = Standard error of *B*; UL: upper limit. Education based on the German educational system.

^b Confidence intervals, standard errors and *p*-values were determined by BCa bootstrapping with 1000 samples.

eTable 8 Regression coefficients for raw values of MuSIC Immediate recall (list B) at baseline

		MOGAD patients (n=75)						
		<i>B</i>	<i>SE B</i>	95 % CI for <i>B</i>		β	<i>p</i>	<i>p</i> _{Bon}
				LL				
Demographic characteristics								
	Age	-0.03	0.01	-0.06	0.00	-0.23	0.05	0.28
	Education	0.91	0.41	0.10	1.73	0.25	0.03	0.17
	[Secondary school (9-10 y.) vs. High school (12-13 y.)]							
Clinical characteristics								
	Optic neuritis	0.11	0.48	-0.85	1.07	0.03	0.83	> 0.99
	Myelitis	0.98	0.43	0.13	1.83	0.27	0.03	0.15
	Brainstem or cerebellar syndrome	0.11	0.48	-0.85	1.07	0.03	0.82	> 0.99
	Cerebral lesions	-0.19	0.42	-1.02	0.65	-0.05	0.66	> 0.99

adj. $R^2 = 0.15$, $F(6,68) = 3.25$, $p = 0.007$.

Abbreviations: *B* = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; *p* = uncorrected two-sided *p* value; *p*_{Bon} = Bonferroni corrected *p* values; *SE B* = Standard error of *B*; UL: upper limit. Education based on the German educational system.

eTable 9 Regression coefficients for raw values of MuSIC Delayed recall (list A) at baseline

		MOGAD patients (n=75)						
		<i>B</i>	<i>SE B</i>	95 % CI for <i>B</i>		β	<i>p</i>	<i>p</i> _{Bon}
				LL				
Demographic characteristics								
	Age	-0.04	0.02	-0.08	0.00	-0.23	0.05	0.31
	Education	0.66	0.55	-0.44	1.76	0.14	0.24	> 0.99
	[Secondary school (9-10 y.) vs. High school (12-13 y.)]							
Clinical characteristics								
	Optic neuritis	-0.11	0.65	-1.40	1.18	-0.02	0.86	> 0.99
	Myelitis	1.34	0.58	0.19	2.48	0.28	0.02	0.14
	Brainstem or cerebellar syndrome	-0.10	0.65	-1.40	1.19	-0.02	0.87	> 0.99
	Cerebral lesions	-0.14	0.56	-1.26	0.98	-0.03	0.80	> 0.99

adj. $R^2 = 0.10$, $F(6,68) = 2.32$, $p = 0.04$.

Abbreviations: *B* = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; *p* = uncorrected two-sided *p* value; *p*_{Bon} = Bonferroni corrected *p* values; *SE B* = Standard error of *B*; UL: upper limit. Education based on the German educational system.

eTable 10 Regression coefficients for raw values of MuSIC Semantic fluency at baseline

		MOGAD patients (n=75)						
		<i>B</i>	<i>SE B</i>	95 % CI for <i>B</i>		β	<i>p</i>	<i>p</i> _{Bon}
				LL				
Demographic characteristics								
	Age	0.01	0.03	-0.05	0.08	0.05	0.67	> 0.99
	Education	-1.00	0.94	-2.88	0.88	-0.12	0.29	> 0.99
	[Secondary school (9-10 y.) vs. High school (12-13 y.)]							
Clinical characteristics								
	Optic neuritis	1.08	1.11	-1.14	3.29	0.12	0.34	> 0.99
	Myelitis	-0.09	0.99	-2.06	1.88	-0.01	0.93	> 0.99
	Brainstem or cerebellar syndrome	1.09	1.11	-1.13	3.30	0.12	0.33	> 0.99
	Cerebral lesions	-4.17	0.97	-6.10	-2.25	-0.48	< 0.001	< 0.001**

adj. $R^2 = 0.19$, $F(6,68) = 3.92$, $p = 0.002$.

Abbreviations: *B* = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; *p* = uncorrected two-sided *p* value; *p*_{Bon} = Bonferroni corrected *p* values; *SE B* = Standard error of *B*; UL: upper limit. Education based on the German educational system.

p*_{Bon} < 0.05 *p*_{Bon} < 0.01

eTable 11 Regression coefficients for raw values of MuSIC Congruent speed^a at baseline

		MOGAD patients (n=72)						
		<i>B</i>	<i>SE B</i> ^b	95 % CI for <i>B</i> ^b		β	<i>p</i> ^b	<i>p</i> _{Bon} ^b
				LL				
Demographic characteristics								
	Age	0.12	0.06	0.01	0.22	0.23	0.08	0.47
	Education	-1.86	1.16	-4.15	0.74	-0.13	0.13	0.80
	[Secondary school (9-10 y.) vs. High school (12-13 y.)]							
Clinical characteristics								
	Optic neuritis	0.30	1.96	-3.80	4.41	0.02	0.88	> 0.99
	Myelitis	-0.44	2.30	-5.64	4.55	-0.03	0.88	> 0.99
	Brainstem or cerebellar syndrome	1.82	2.01	-2.14	5.49	0.12	0.38	> 0.99
	Cerebral lesions	3.42	2.25	-0.38	7.83	0.23	0.18	> 0.99

adj. $R^2 = 0.05$, $F(6,65) = 1.66$, $p = 0.14$.

Abbreviations: *B* = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; *p* = uncorrected two-sided *p* value; *p*_{Bon} = Bonferroni corrected *p* values; *SE B* = Standard error of *B*; UL: upper limit. Education based on the German educational system.

^aHigher value means worse performance - Positive coefficients indicate negative influence of the factor on cognitive performance.

^bConfidence intervals, standard errors and *p*-values were determined by BCa bootstrapping with 1000 samples.

eTable 12 Regression coefficients for raw values of MuSIC Incongruent - Congruent speed^a at baseline

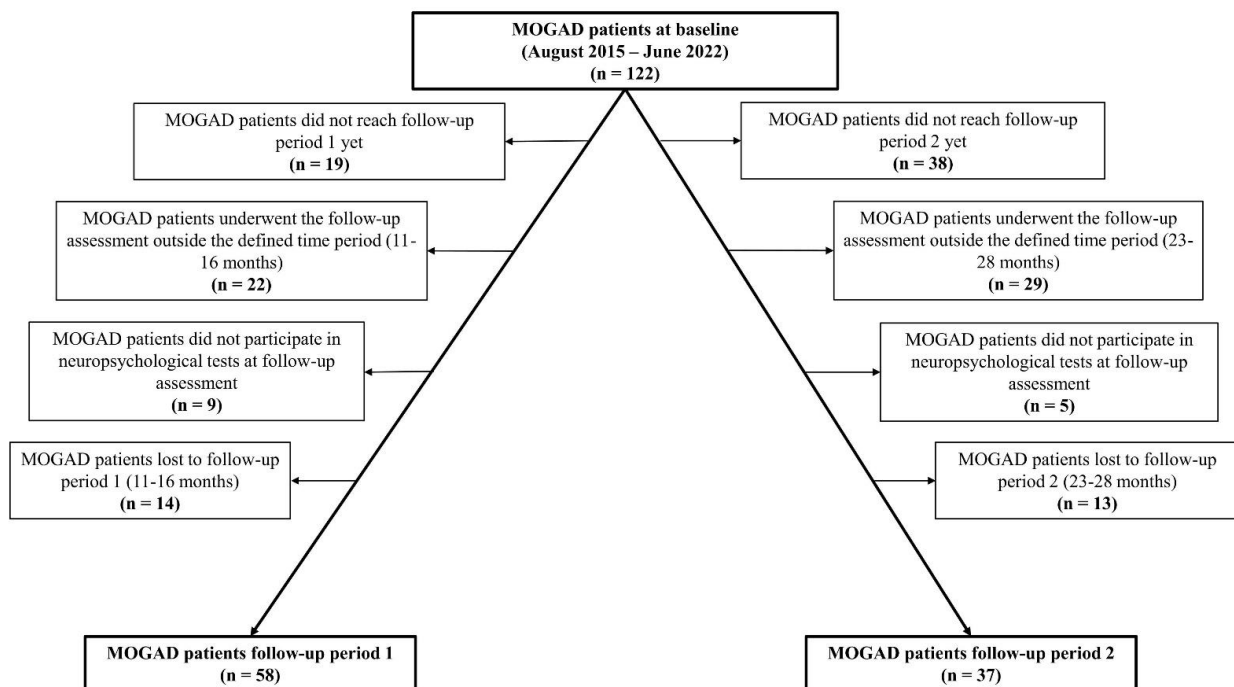
	MOGAD patients (n=74)						
	<i>B</i>	<i>SE B</i> ^b	95 % CI for <i>B</i> ^b		β	<i>p</i> ^b	<i>p</i> _{Bon} ^b
			LL	UL			
Demographic characteristics							
Age	0.16	0.10	-0.01	0.33	0.26	0.16	0.95
Education [Secondary school (9-10 y.) vs. High school (12-13 y.)]	-0.69	1.50	-4.05	2.78	-0.04	0.66	> 0.99
Clinical characteristics							
Optic neuritis	0.07	2.82	-5.82	5.42	0.004	0.98	> 0.99
Myelitis	-4.73	3.19	-12.99	1.36	-0.26	0.21	> 0.99
Brainstem or cerebellar syndrome	5.01	2.90	0.07	9.61	0.25	0.15	0.90
Cerebral lesions	1.21	2.55	-2.95	6.16	0.07	0.68	> 0.99

adj. $R^2 = 0.11$, $F(6,67) = 2.44$, $p = 0.03$.

Abbreviations: *B* = Regression coefficient; β = Standardized coefficient beta; CI = confidence interval; LL = lower limit; MOGAD = myelin oligodendrocyte glycoprotein antibody-associated disease; *p* = uncorrected two-sided *p* value; *p*_{Bon} = Bonferroni corrected *p* values; *SE B* = Standard error of *B*; UL = upper limit. Education based on the German educational system.

^a Higher value means worse performance - Positive coefficients indicate negative influence of the factor on cognitive performance.

^b Confidence intervals, standard errors and *p*-values were determined by BCa bootstrapping with 1000 samples.

**eFigure 1** Participation of MOGAD patients from the CogniMOG-Study in follow-up assessments