Supplementary materials for:

Sensory Entrained TMS (seTMS) enhances motor cortex plasticity

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Table S1. Demographics. *n*=20

Age, mean years (SD)	41.0 (14.5)
Sex	
Female, *n* (%)	10 (50.0)
Male, *n* (%)	10 (50.0)
Other or prefer not to state, *n* (%)	0 (0.0)
Handedness	
Left hand dominant, *n* (%)	1 (5.0)
Right hand dominant, *n* (%)	19 (95.0)
Ambidextrous, *n* (%)	0 (0.0)
Education	
GED or High School Diploma, *n* (%)	1 (5.0)
Some college, no degree, *n* (%)	0 (0.0)
Two year degree, *n* (%)	2 (10.0)
Four year degree, *n* (%)	10 (50.0)
Post graduate degree, *n* (%)	7 (35.0)
Employment	
Part-time, *n* (%)	6 (22.2)
Full-time, *n* (%)	7 (25.9)
Unemployed, *n* (%)	4 (14.8)
Retired, *n* (%)	1 (3.7)
Part-time student, *n* (%)	0 (0.0)
Full-time student, *n* (%)	2 (7.4)
Race	
White, *n* (%)	10 (37.0)
Black or African American, *n* (%)	3 (11.1)
American Indian or Alaska Native, *n* (%)	0 (0.0)
Asian, *n* (%)	6 (22.2)
Native Hawaiian or Other Pacific Islander, *n* (%)	0 (0.0)
Some other race or prefer not to state, *n* (%)	1 (3.7)

Table S2. Musical stimuli.

name	*artist*	*Groove rating**
Music	Leela James	101.1
Outa-Space	Billy Preston	90.9
Baby It's You	JoJo	79.7

**Groove ratings are from Janata et al. 2012 and are on a scale from 0 to 127*

Table S3. Comparison of MEP size to baseline. *Paired t-tests with baseline at each time point.*

protocol	time	*n*	*df*	*t*	*h**	*p*	Cohen's *d*		mean	std. dev.	std. err	95% CI
se-iTBS								base	1.07	0.04	0.009	[1.05 1.09]
	t0	**20**	**19**	**-6.82**	**1**	**0.000002**	**-1.52**		1.07	0.04	0.009	[1.39 1.70]
	t15	**20**	**19**	**-4.29**	**1**	**0.0004**	**-0.96**		1.07	0.04	0.009	[1.24 1.60]
	t30	**20**	**19**	**-4.23**	**1**	**0.0004**	**-0.95**		1.07	0.04	0.009	[1.24 1.60]
	t45	10[+]	9	-1.54	0	0.16			1.07	0.04	0.009	[1.07 1.26]
iTBS								base	1.07	0.06	0.01	[1.04 1.10]
	t0	**20**	**19**	**-4.18**	**1**	**0.0005**	**-0.94**		1.07	0.06	0.01	[1.16 1.36]
	t15	20	19	-2.47	0	0.02			1.07	0.06	0.01	[1.08 1.31]
	t30	20	19	-1.78	0	0.09			1.07	0.06	0.01	[1.05 1.28]
	t45	10[+]	9	0.46	0	0.65			1.07	0.06	0.01	[0.93 1.17]

**When corrected for 8 tests using the Bonferroni method, $\alpha = 0.006$ (=0.05 / 8)*

[+]Very small sample size

Table S4. Average percent increase in MEPs from baseline. *Post-iTBS compared with pre-iTBS.*

protocol	*0 min*	*15 min*	*30 min*	*45 min*
se-iTBS	54.58	42.17	36.67	16.79
iTBS	25.97	19.34	16.66	4.87

Table S5. Average percent increase in MEP modulation when using se-iTBS. *Compared with standard iTBS.*

time	*% increase*
t0	22.71
t15	19.13
t30	17.15
t45	11.37

Table S6. Nonparametric comparison of MEP modulation. *Wilcoxon signed rank tests at each time point.*

time	*n*	*df*	*h*	*p*
t0	**20**	**19**	**1**	**0.0009**
t15	**20**	**19**	**1**	**0.0005**
t30	**20**	**19**	**1**	**0.006**
t45	**10[+]**	**9**	**1**	**0.04**

Table S7. Comparison of baseline MEPs. *Paired t-test.*

time	*n*	*df*	*t*	*h*	*p*	Cohen's *d*		mean	std. dev.	std. err	95% CI
base	20	19	-0.26	0	0.80	-0.06					
							seTMS	1.07	0.04	0.009	[1.05 1.09]
							TMS	1.07	0.06	0.012	[1.04 1.10]

Table S8. Non-parametric comparison of baseline MEPs. *Wilcoxon signed rank test.*

time	*n*	*df*	*h*	*p*
base	20	19	0	0.82

Table S9. Comparison of ITC trough latencies. *Paired t-tests.*

Grouping	*n*	*df*	*t*	*h*	*p*	Cohen's *d*		mean	std. dev.	std. err	95% CI
by protocol	20	19	-1.39	0	0.18	-0.31					
							pre-se-iTBS	-172.05	44.44	9.94	[-192.85 -151.25]
							pre-iTBS	-151.70	42.40	9.48	[-171.55 -131.85]
by order	20	19	-0.36	0	0.72	-0.08					
							first	-164.60	43.32	9.69	[-184.88 -144.32]
							second	-159.15	45.81	10.24	[-180.59 -137.71]

Table S10. Nonparametric comparison of ITC trough latencies. *Wilcoxon signed rank tests.*

Grouping	*n*	*df*	*h*	*p*
by protocol	20	19	0	0.17
by order	20	19	0	0.70

***Table S11. Exploratory regressions**. Individual ITC metrics (trough timing, distance from -200 ms, ITC value at trough, y-intercept and slope of the fitted ITC line) do not predict MEP outcomes (plasticity at 0, 15, and 30 min; max and mean plasticity from se-iTBS; se-iTBS gain over standard iTBS). No significant relationships emerged (all p > 0.05, uncorrected). This null result likely reflects limited variability in trough-targeting quality across participants. If the group-based -200 ms timing already approximates individual troughs reasonably well, the predictor range would be compressed, reducing power to detect individual-difference effects. Additionally, ITC metrics derived from EEG carry inherent measurement noise, and even if reliably measured, the relationship between ITC metrics and MEP outcomes may not follow a simple linear pattern.*

Predictor	Outcome	R^2	*F*	*p*
ITC trough time	MEP plasticity at 0min	0.0379	0.631	0.439
ITC trough time	MEP plasticity at 15min	0.0773	1.34	0.264
ITC trough time	MEP plasticity at 30min	0.196	3.90	0.0657
ITC trough time	max plasticity from seTMS	0.0876	1.54	0.233
ITC trough time	mean plasticity from seTMS	0.127	2.33	0.146
ITC trough time	max seTMS gain over standard TMS	0.00199	0.0319	0.860
ITC trough time	avg seTMS gain over standard TMS	0.000828	0.0133	0.910
ITC trough distance from -200ms	MEP plasticity at 0min	0.0484	0.814	0.380
ITC trough distance from -200ms	MEP plasticity at 15min	0.141	2.64	0.124
ITC trough distance from -200ms	MEP plasticity at 30min	0.212	4.31	0.0544
ITC trough distance from -200ms	max plasticity from seTMS	0.158	3.01	0.102
ITC trough distance from -200ms	mean plasticity from seTMS	0.173	3.34	0.0863
ITC trough distance from -200ms	max seTMS gain over standard TMS	0.0437	0.731	0.405
ITC trough distance from -200ms	avg seTMS gain over standard TMS	0.0403	0.672	0.424
ITC value at trough	MEP plasticity at 0min	0.0541	0.916	0.353
ITC value at trough	MEP plasticity at 15min	0.00337	0.0541	0.819
ITC value at trough	MEP plasticity at 30min	0.0174	0.283	0.602
y intercept of fitted line	MEP plasticity at 0min	0.00134	0.0214	0.886
y intercept of fitted line	MEP plasticity at 15min	0.000818	0.0131	0.910
y intercept of fitted line	MEP plasticity at 30min	0.0000143	0.000229	0.988
slope of fitted line	MEP plasticity at 0min	0.0521	0.880	0.362
slope of fitted line	MEP plasticity at 15min	0.0140	0.227	0.640
slope of fitted line	MEP plasticity at 30min	0.102	1.81	0.197

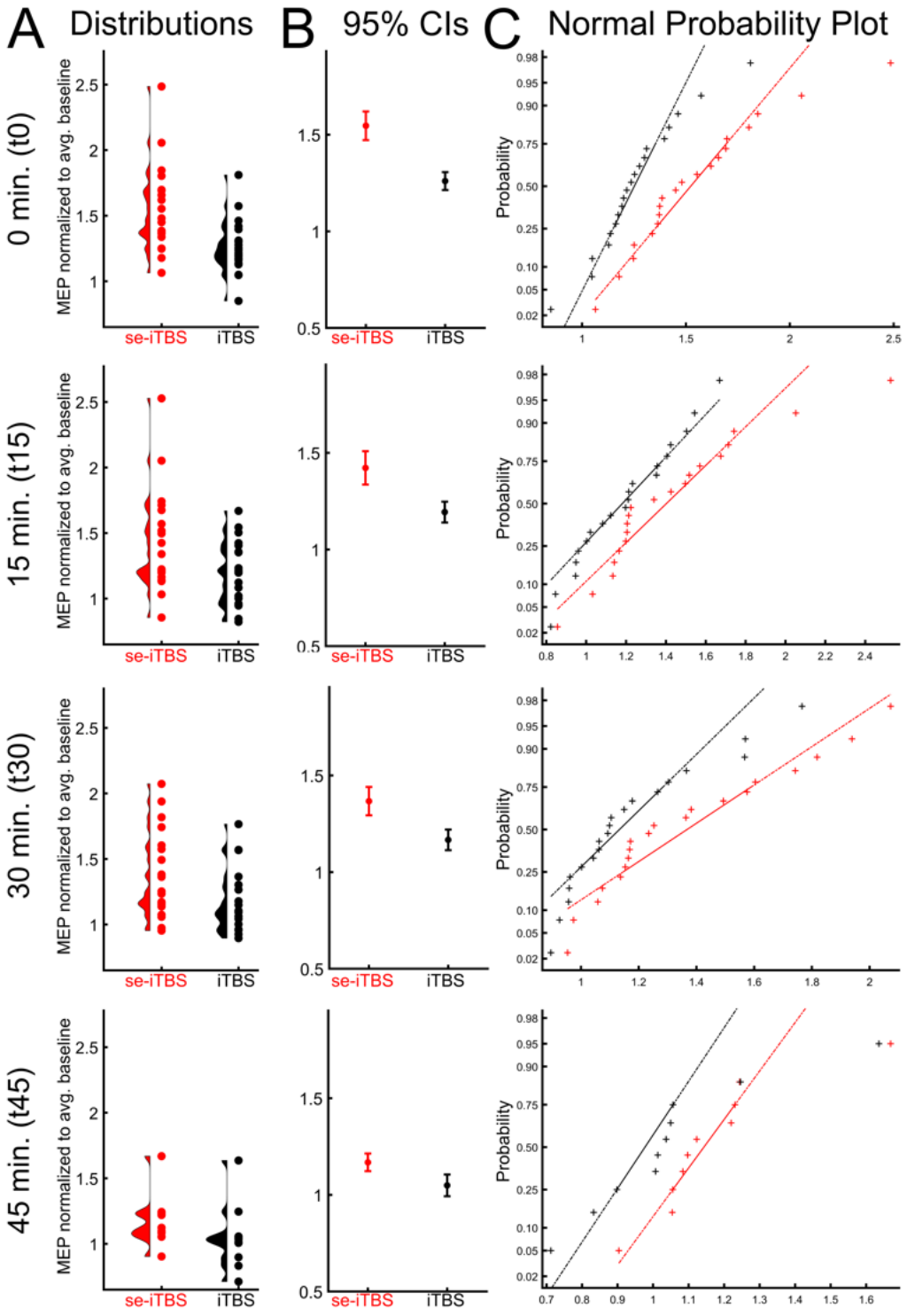

Figure S1. Review of statistical assumptions. MEP amplitudes used for paired samples *t*-tests comparing se-iTBS to iTBS within each time point: t0, t15, t30 and t45. MEP amplitudes are normalized to average baseline amplitude. A) Data distributions. B) 95% confidence intervals. C) Normal probability plots showing our data on the x-axis to the normal distribution on the y-axis. A straight line suggests normality.

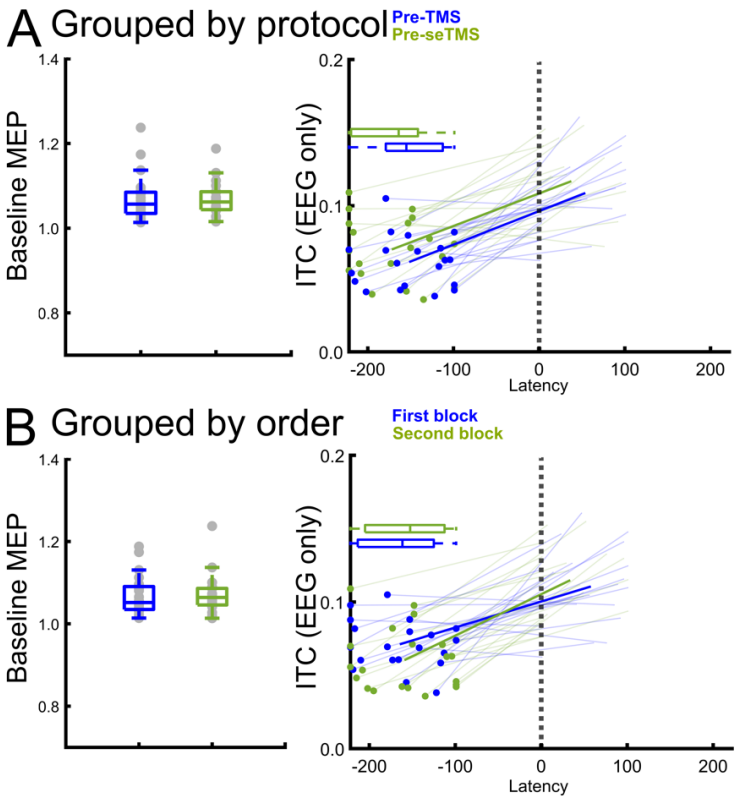

Figure S2. No differences between baseline MEPs or EEG latencies from the beat time. A) Grouped by protocol. Baseline normalized MEP amplitudes (left) and ITC trough latencies from EEG recordings (right) confirmed no differences prior to each protocol. B) Grouped by order. Baseline normalized MEP amplitudes and ITC trough latencies from EEG recordings confirmed no differences when grouped by the order they were recorded in the session. Paired samples *t*-tests confirmed that neither baseline MEPs nor ITC latencies were significantly different from each other (Tables S6-9)

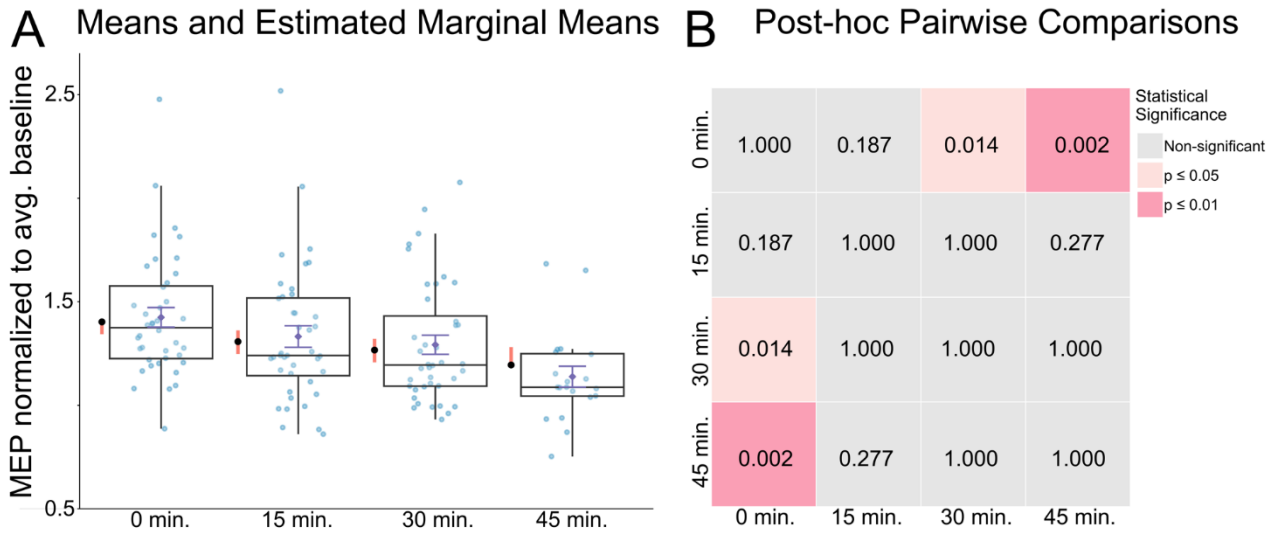

Figure S3. Linear mixed-effect model demonstrating modulation effect. The model revealed significant effects of protocol ($F(1,113) = 44.95$, $p<.0001$) and of time point ($F(3,113) = 5.70$, $p=.001$) but no protocol by time point interaction ($F(3,113) = 0.87$, $p=.46$). A) Normalized MEPs for each time point (blue) with box and whisker plots showing the means and standard error, and estimated marginal means are to the left (black) with lower and upper comparison limits (red). B) Post-hoc pairwise comparisons with Bonferroni correction indicated significant differences between time points 0 min and 30 min ($t(113) = 3.12$, $p = 0.01$), and between time points 0 min and 45 min ($t(113) = 3.72$, $p = 0.002$). These post-hoc results suggest that the MEP modulation effects reduced with time after the protocol and, because we did not find a protocol by time point interaction, we can interpret that this did not depend on which protocol was used. See Table 2 for test statistics for all post-hoc comparisons.

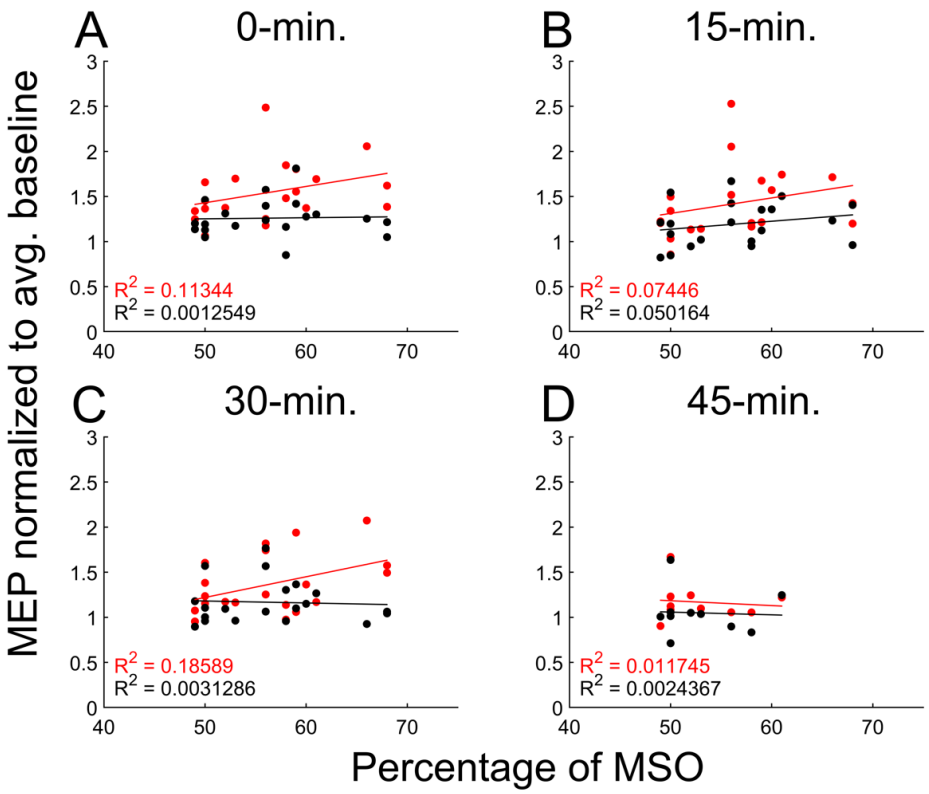

Figure S4. MEP modulation as a function of maximum stimulator output. The iTBS protocols were administered at 90% rMT for each participant. Simple linear regressions were used to check for systematic changes in MEP modulation with iTBS intensity when taken as a percentage of maximum stimulator output. No significant relationships were found, at 0-min (se-iTBS R^2 = 0.11, $F(2,18)$ = 1.15, p = 0.34; iTBS R^2 = 0.0012, $F(2,18)$ = 0.011, p = 0.99), 15-min (se-iTBS R^2 = 0.074, $F(2,18)$ = 0.72, p = 0.50; iTBS R^2 = 0.050, $F(2,18)$ = 0.48, p = 0.63), 30-min (se-iTBS R^2 = 0.18, $F(2,18)$ = 2.06, p = 0.16; iTBS R^2 = 0.0031, $F(2,18)$ = 0.028, p = 0.97), or 45-min (se-iTBS R^2 = 0.012, $F(2,8)$ = 0.048, p = 0.95; iTBS R^2 = 0.0024, $F(2,8)$ = 0.0098, p = 0.99).

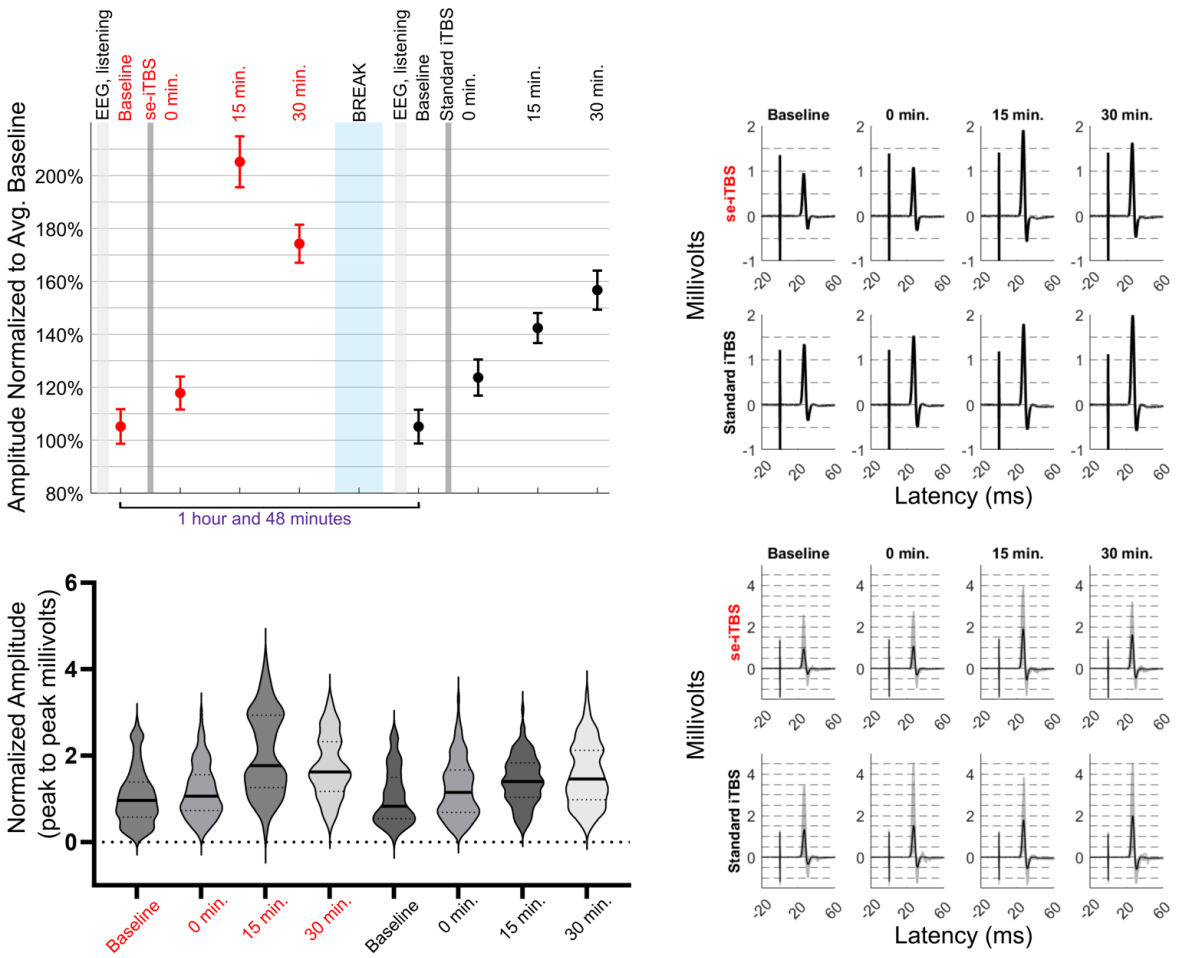

Figure S5. Participant 1 individual data.

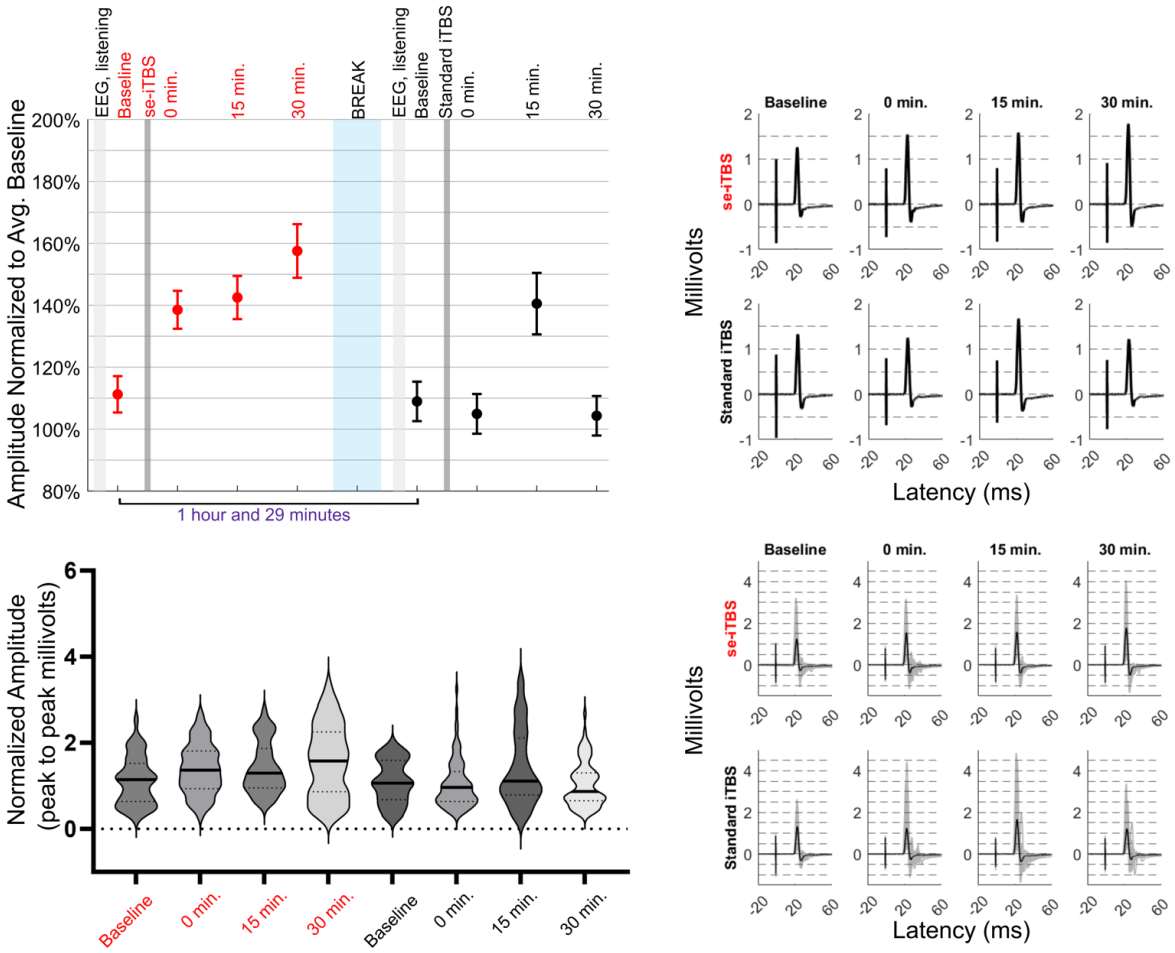

Figure S6. Participant 2 individual data

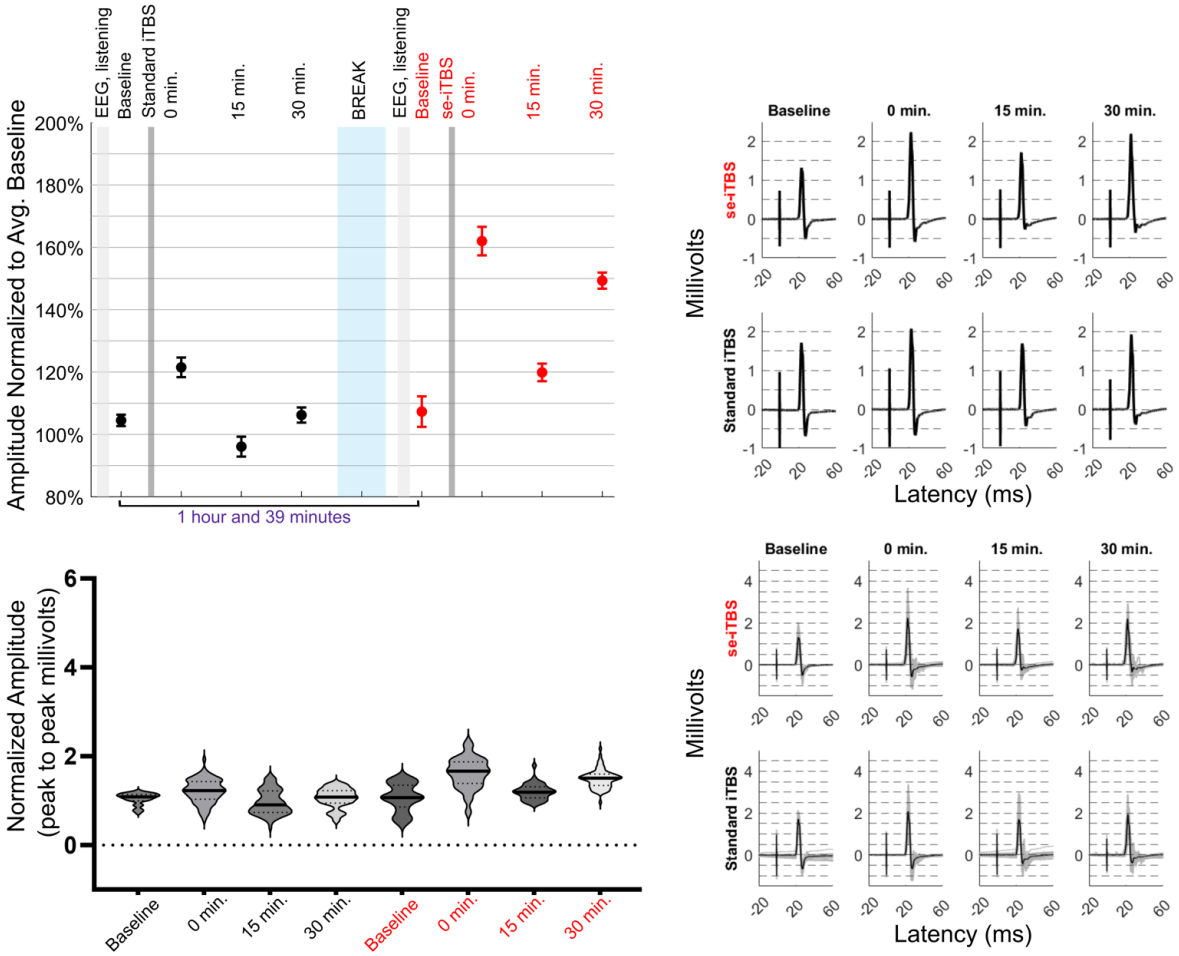

Figure S7. Participant 3 individual data

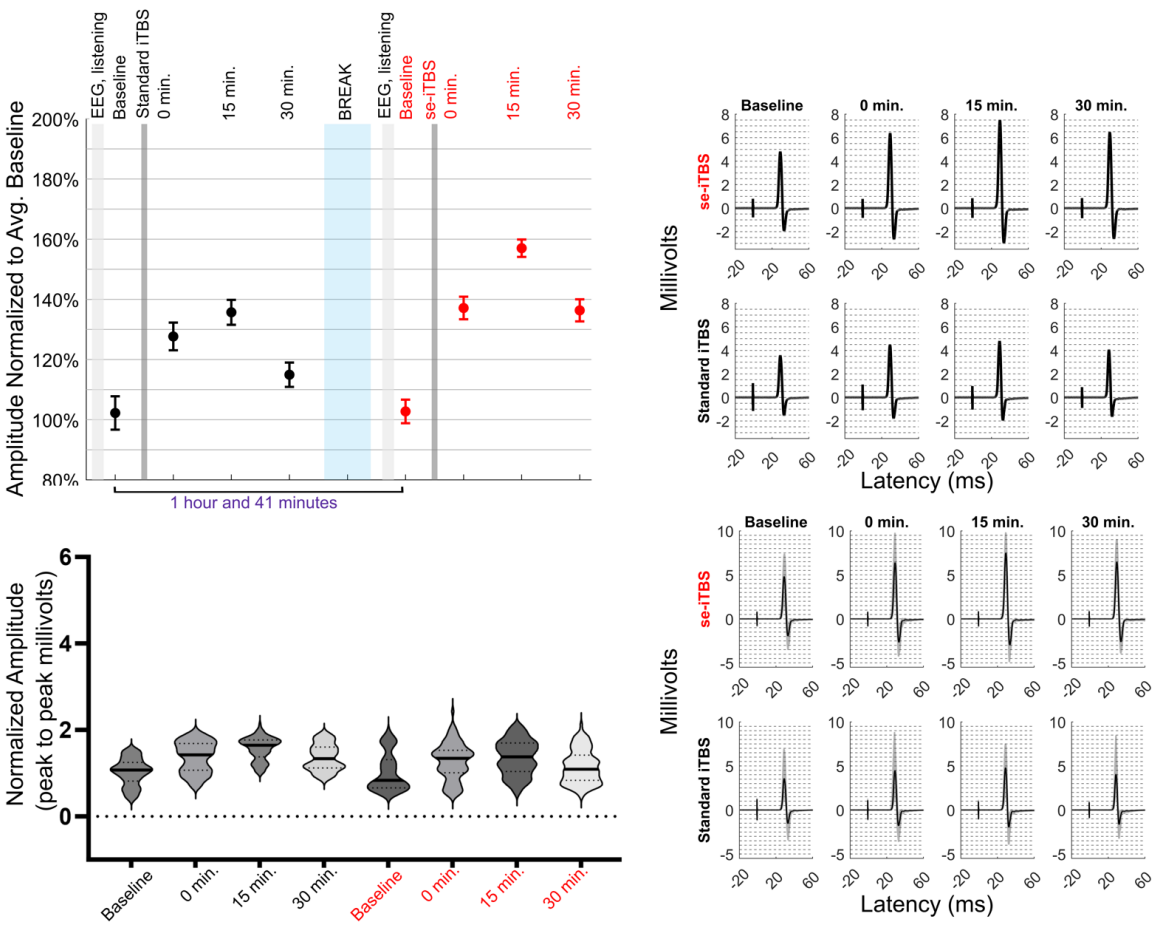

Figure S8. Participant 4 individual data

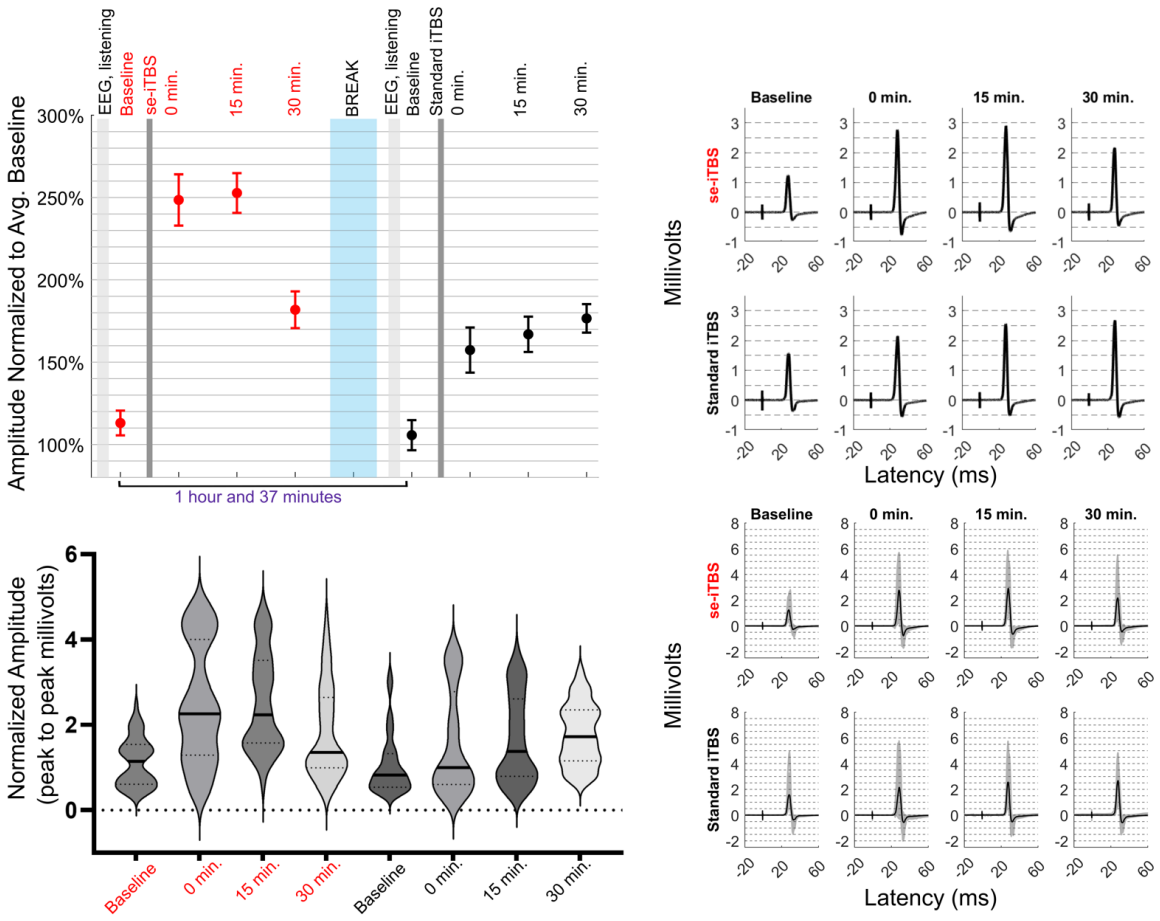

Figure S9. Participant 5 individual data

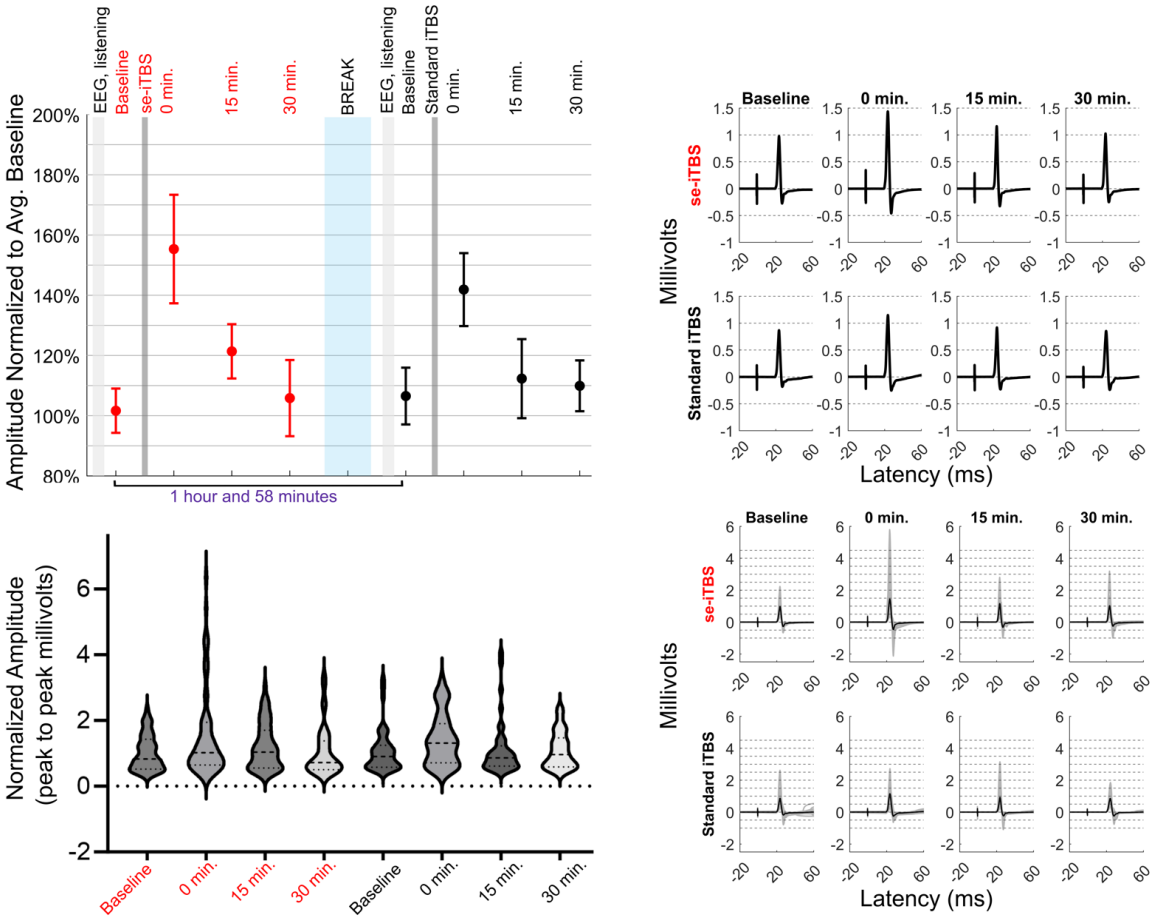

Figure S10. Participant 6 individual data

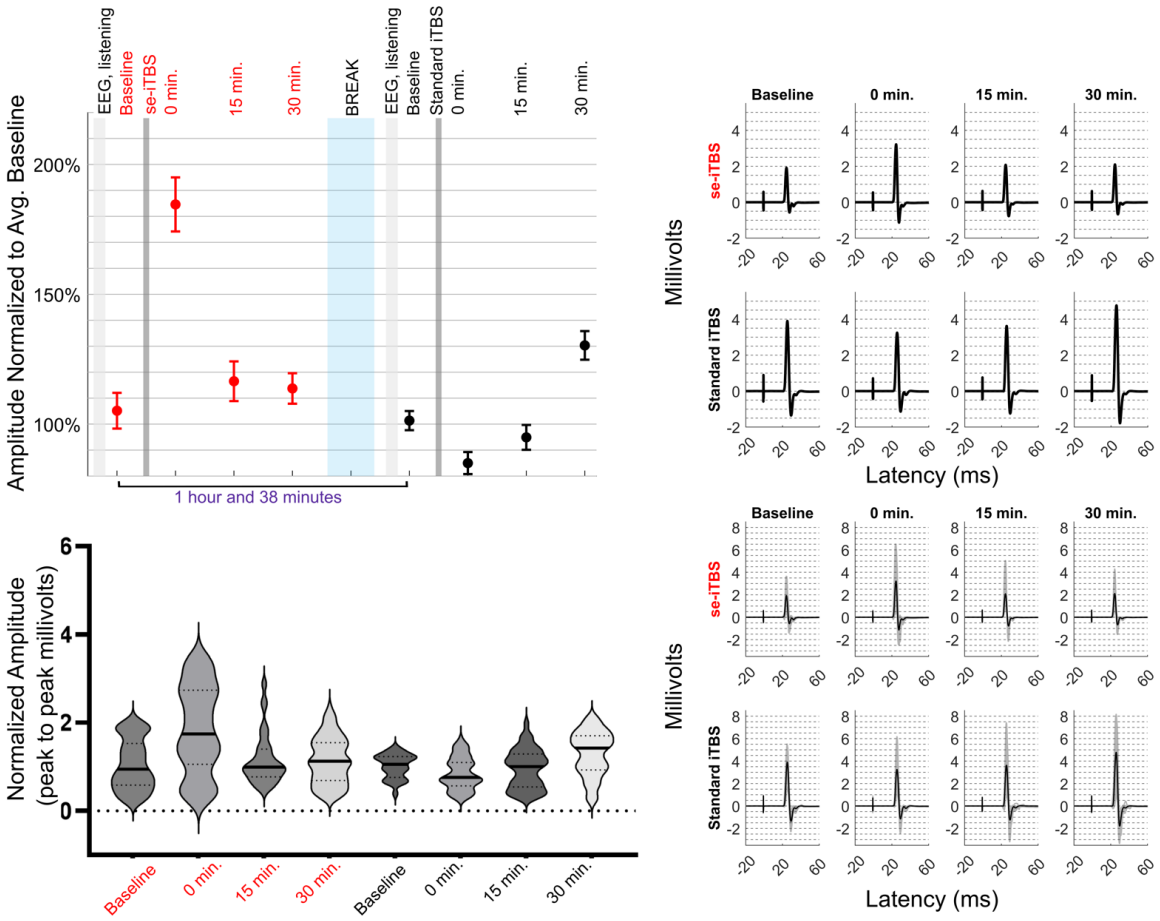

Figure S11. Participant 7 individual data

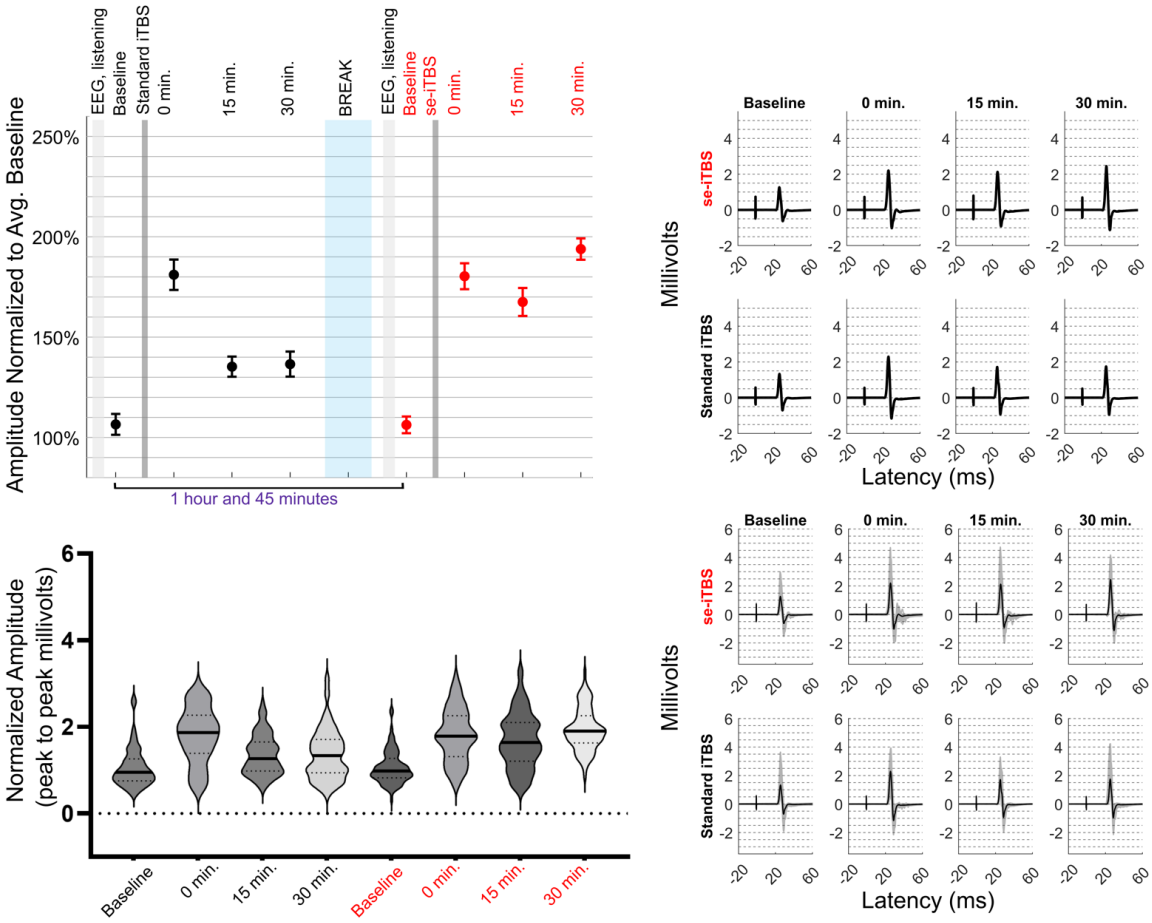

Figure S12. Participant 8 individual data

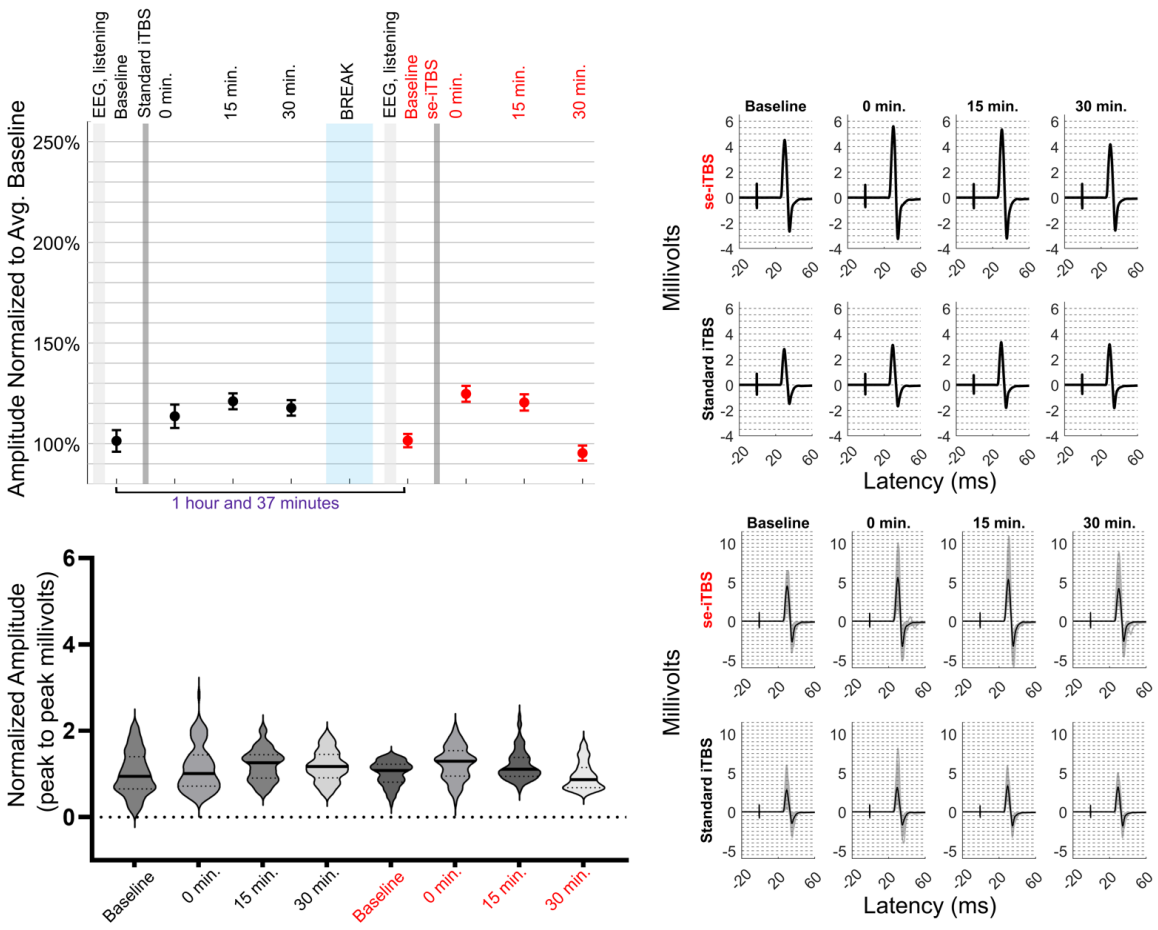

Figure S13. Participant 9 individual data

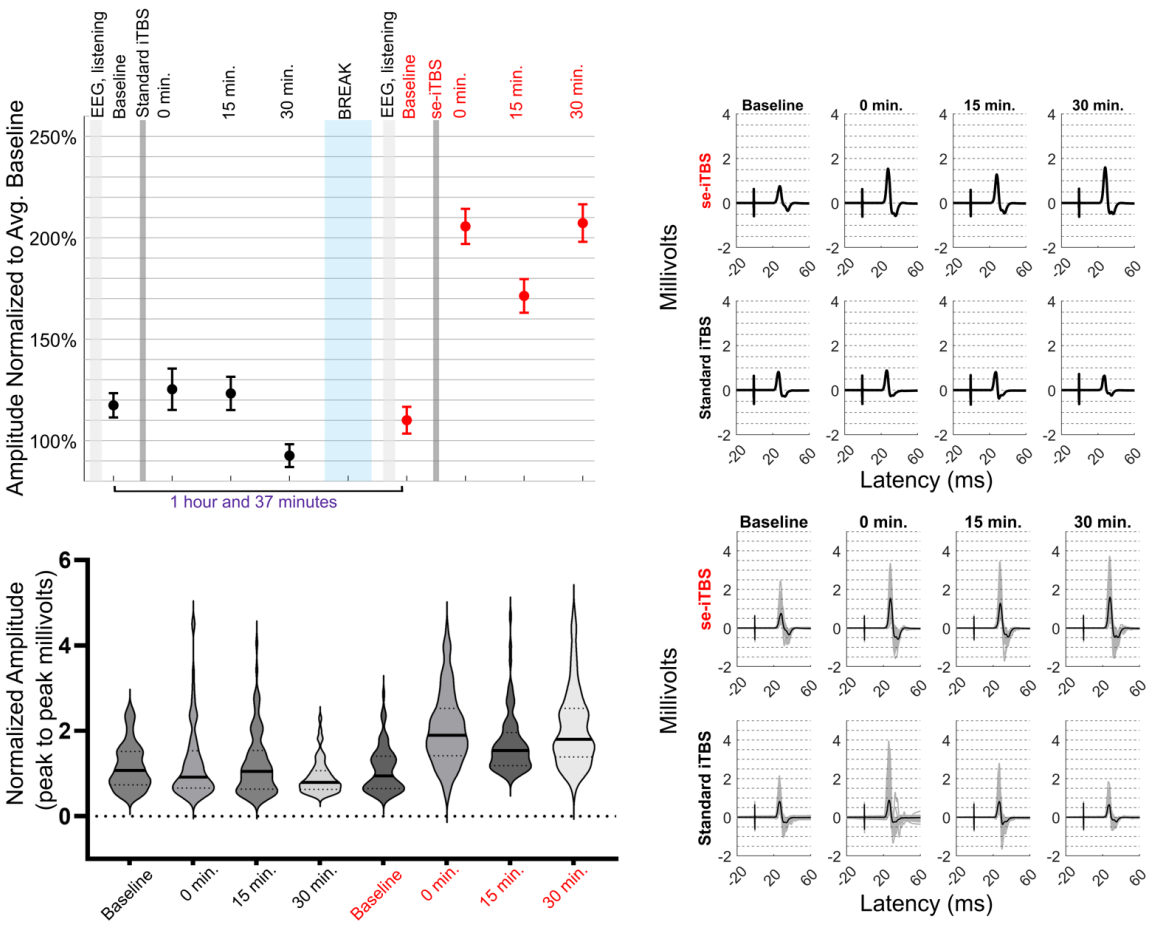

Figure S14. Participant 10 individual data

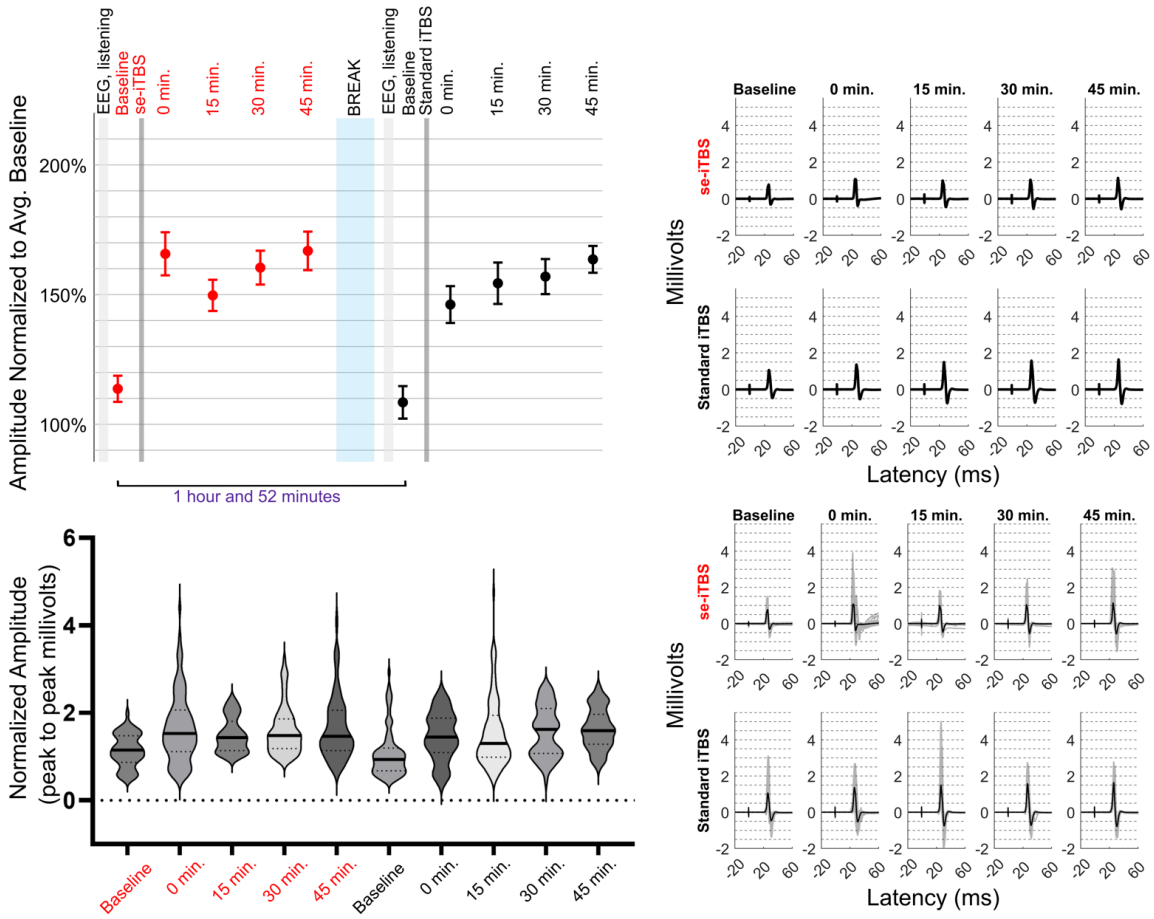

Figure S15. Participant 11 individual data

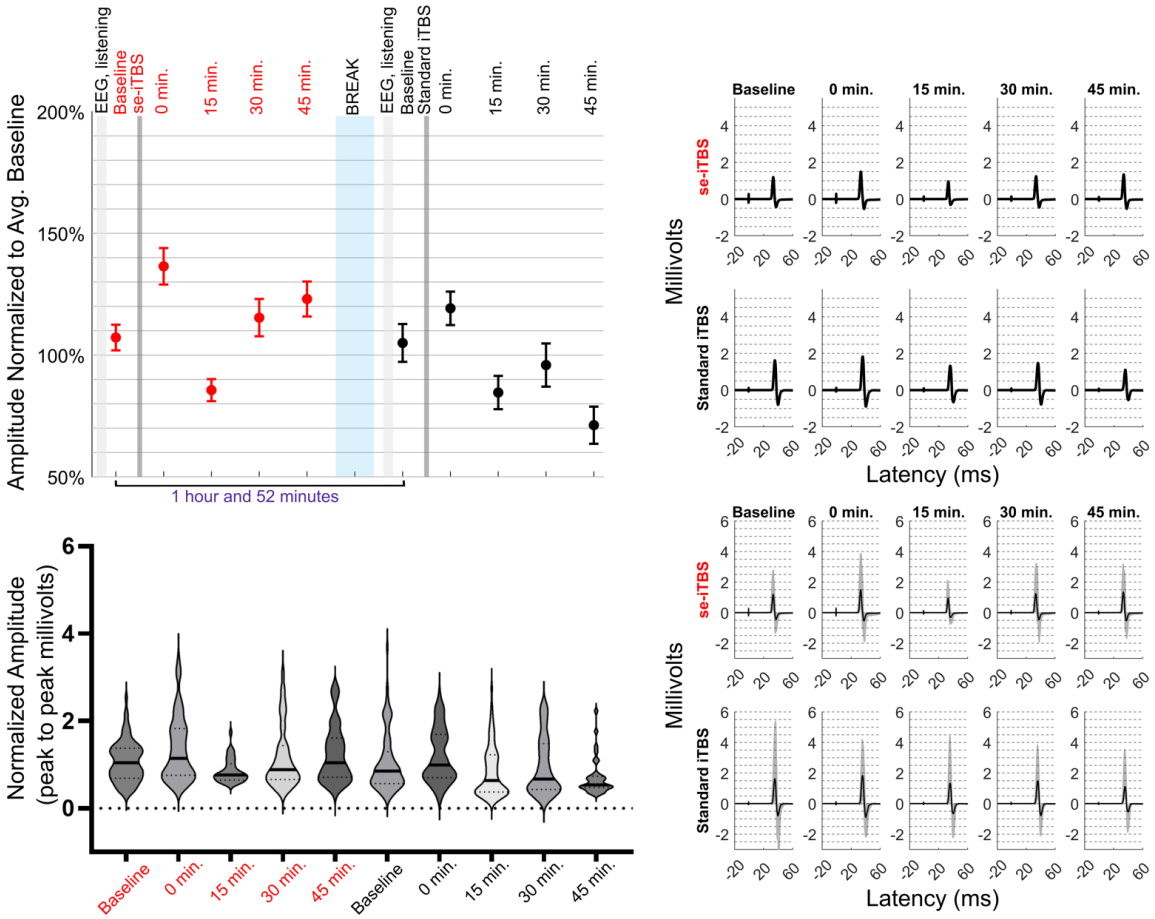

Figure S16. Participant 12 individual data

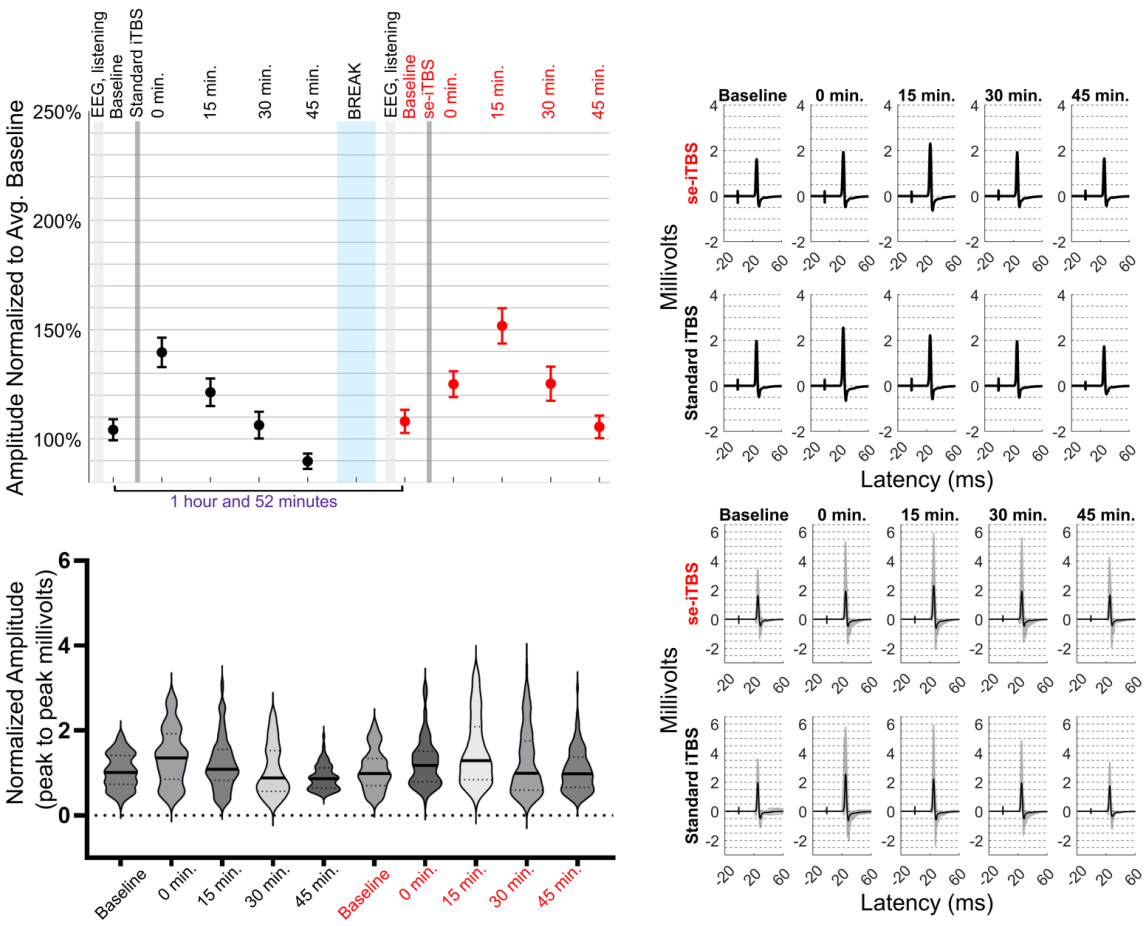

Figure S17. Participant 13 individual data

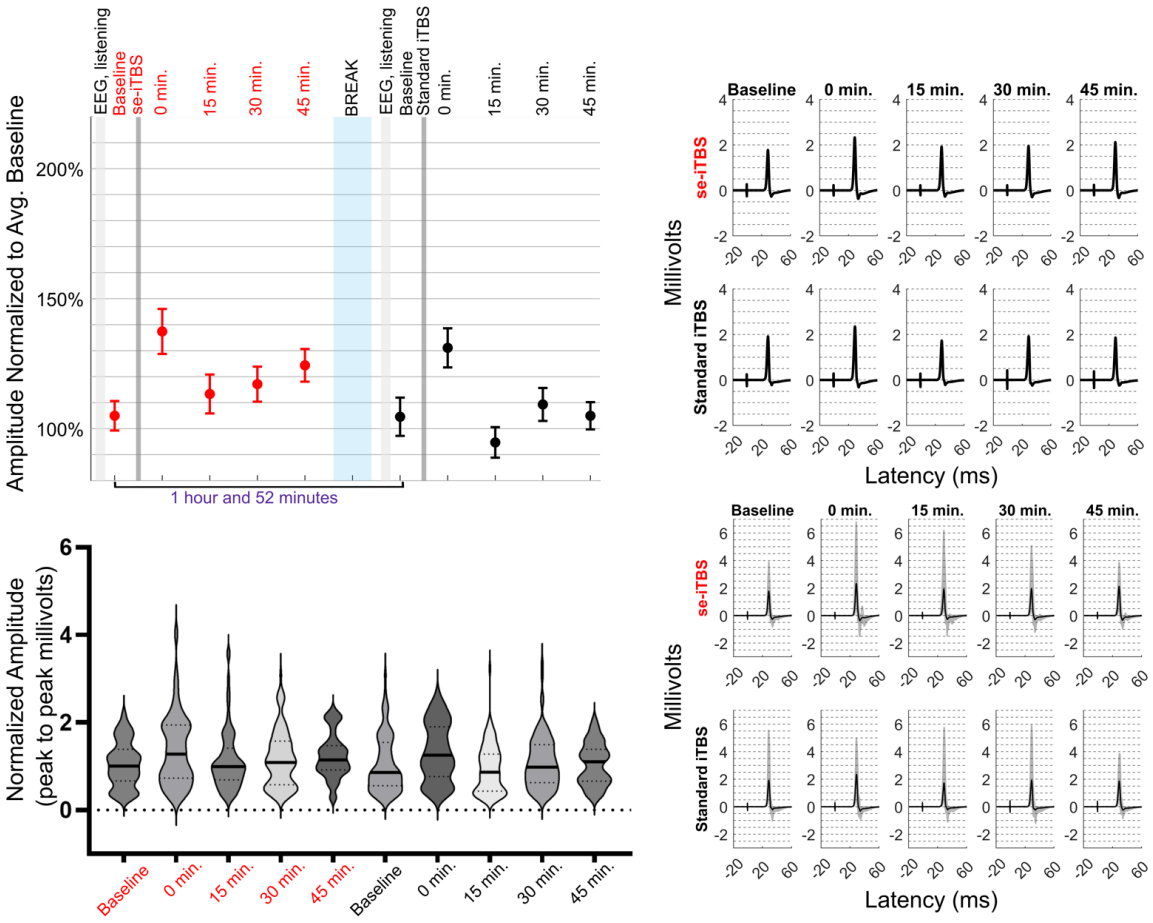

Figure S18. Participant 14 individual data

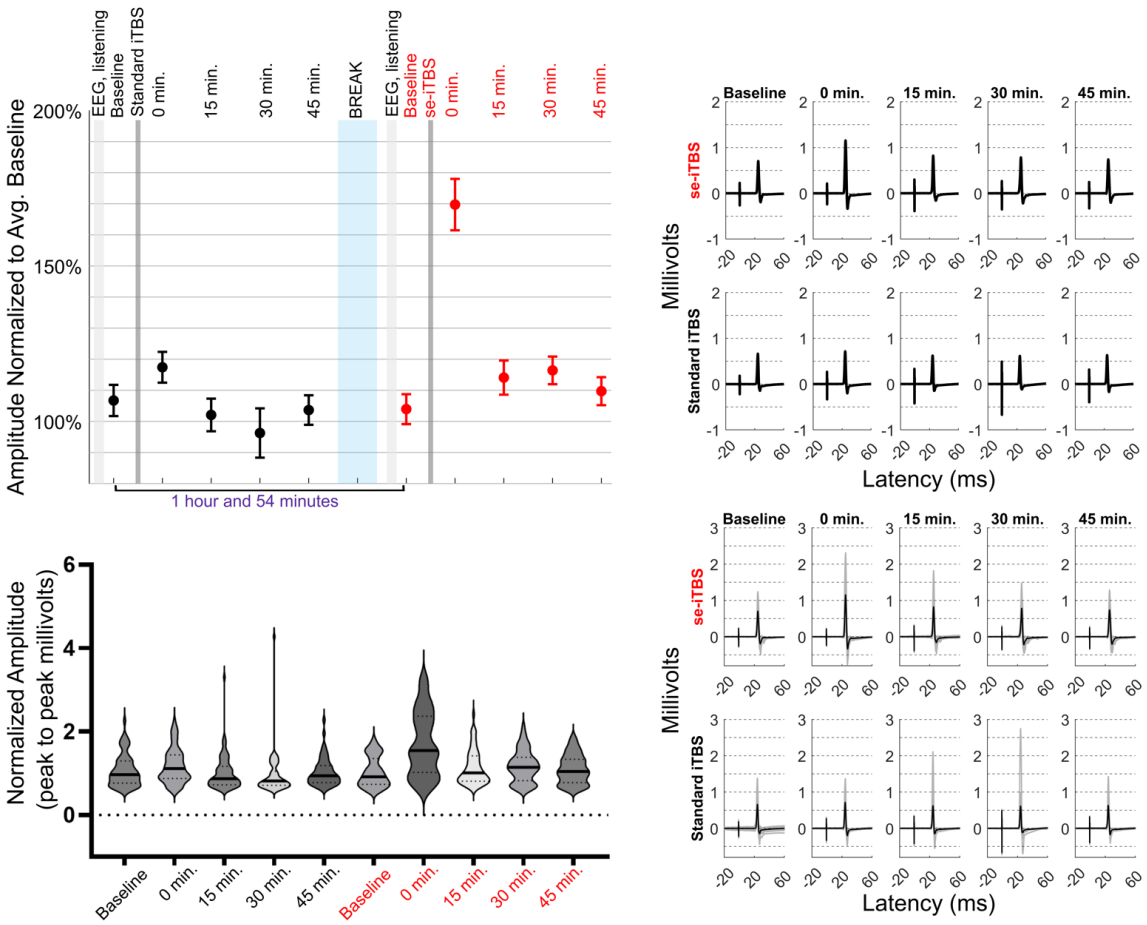

Figure S19. Participant 15 individual data

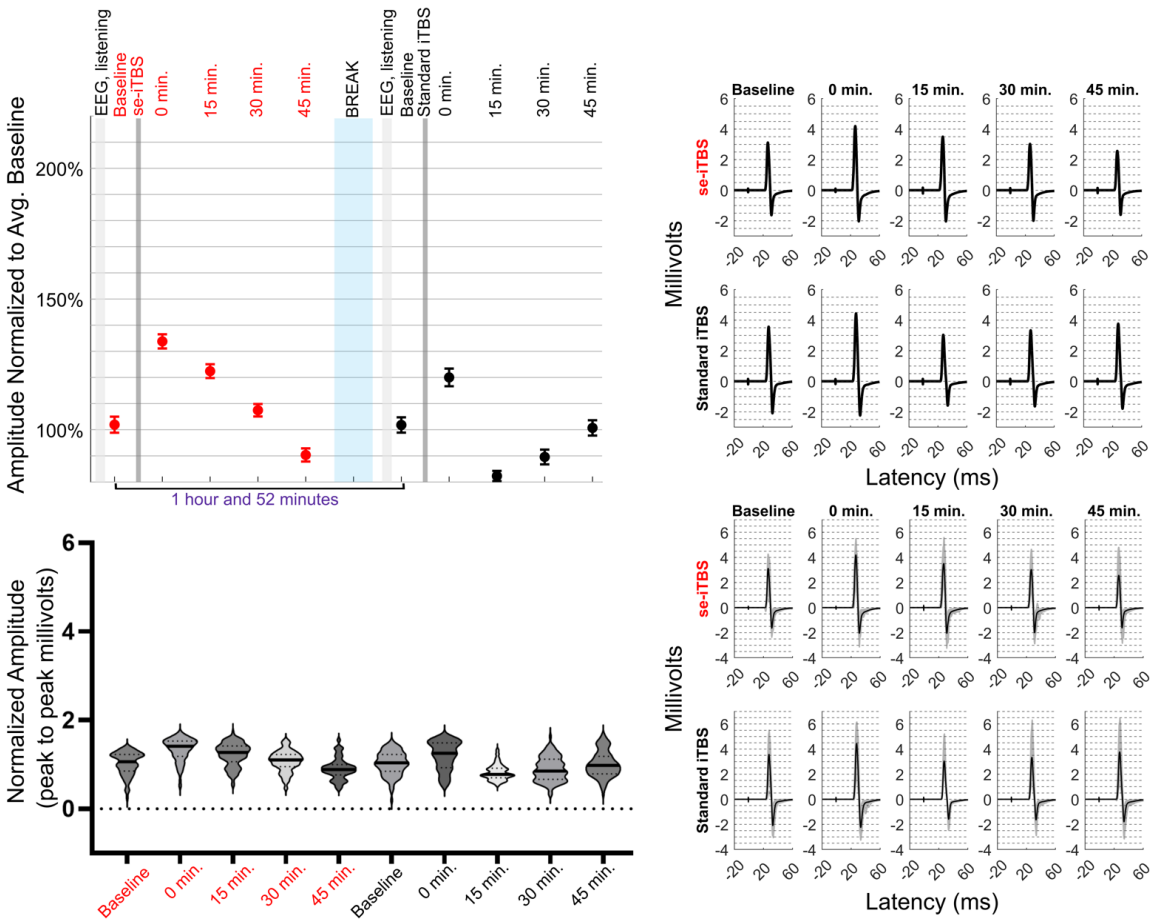

Figure S20. Participant 16 individual data

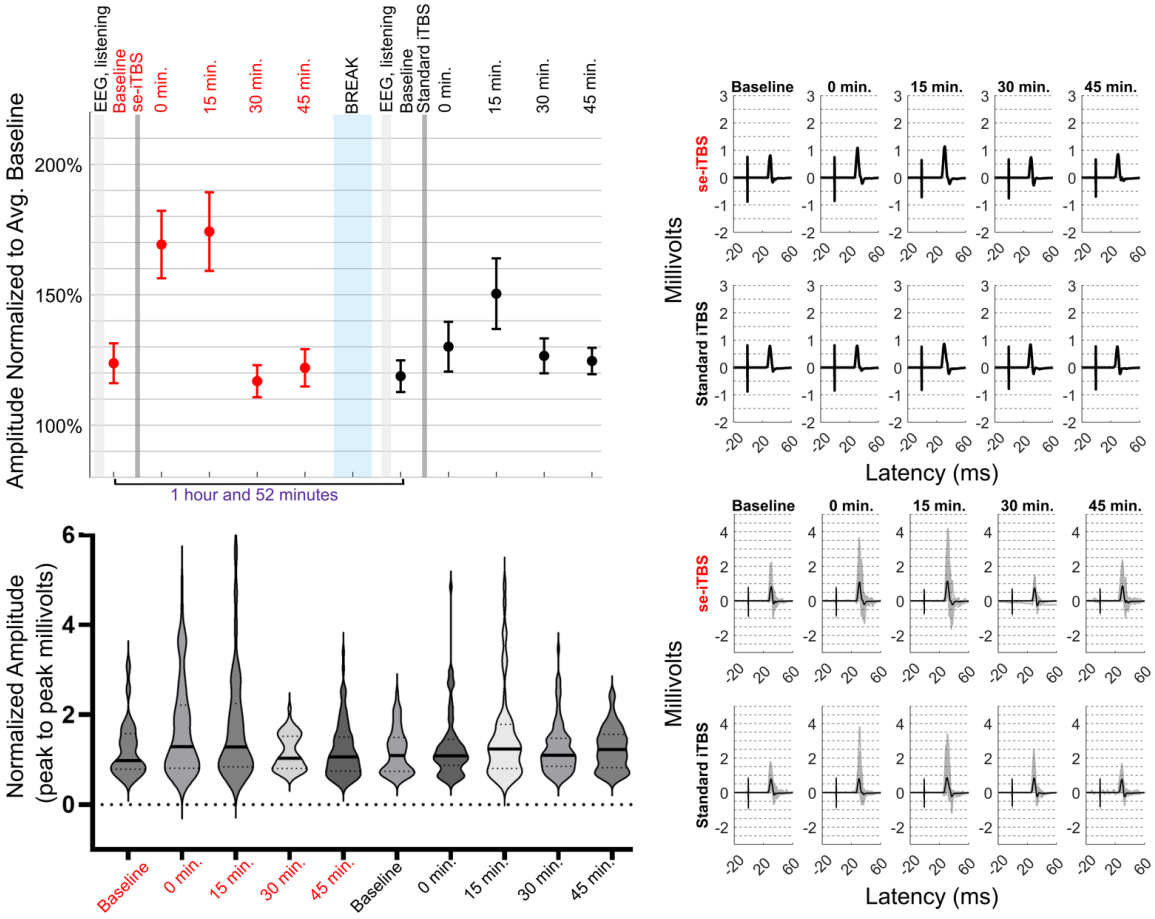

Figure S21. Participant 17 individual data

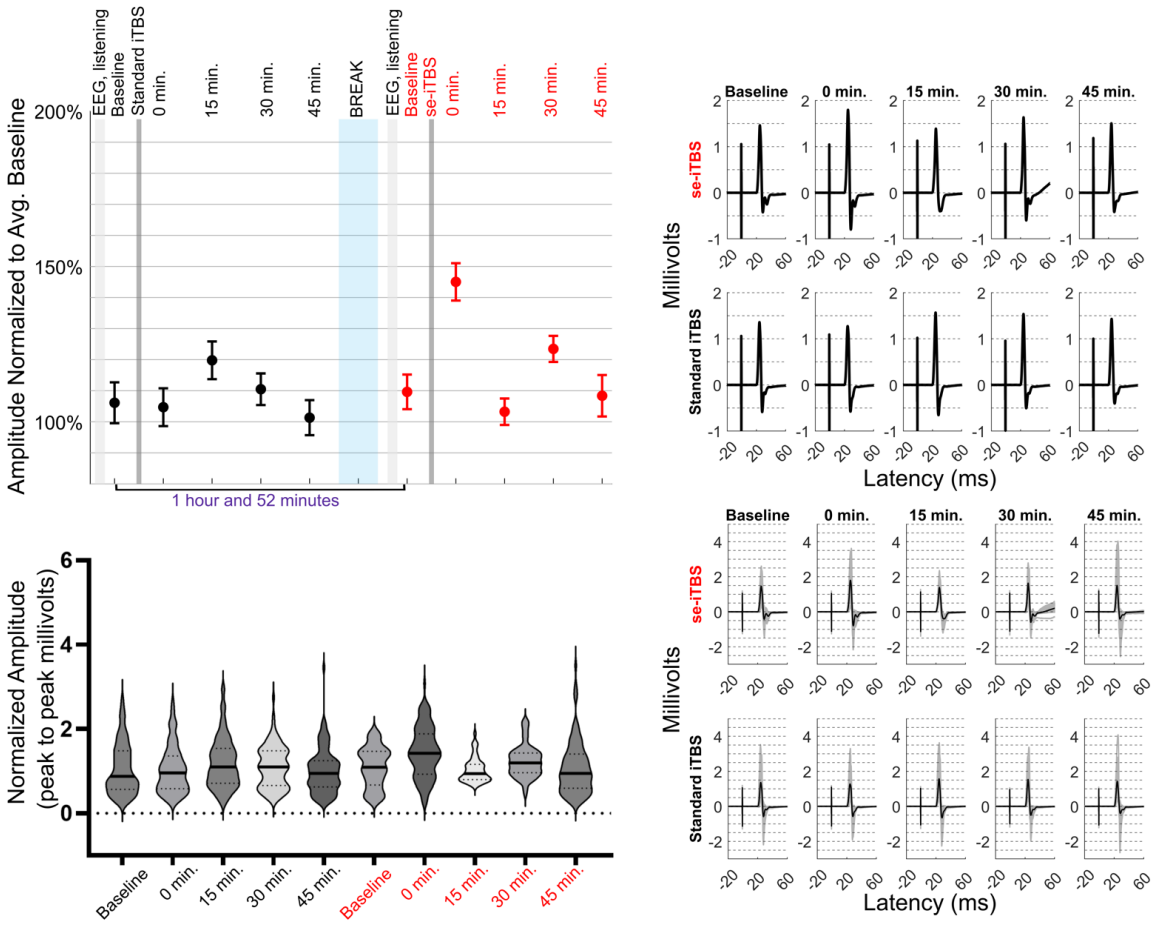

Figure S22. Participant 18 individual data

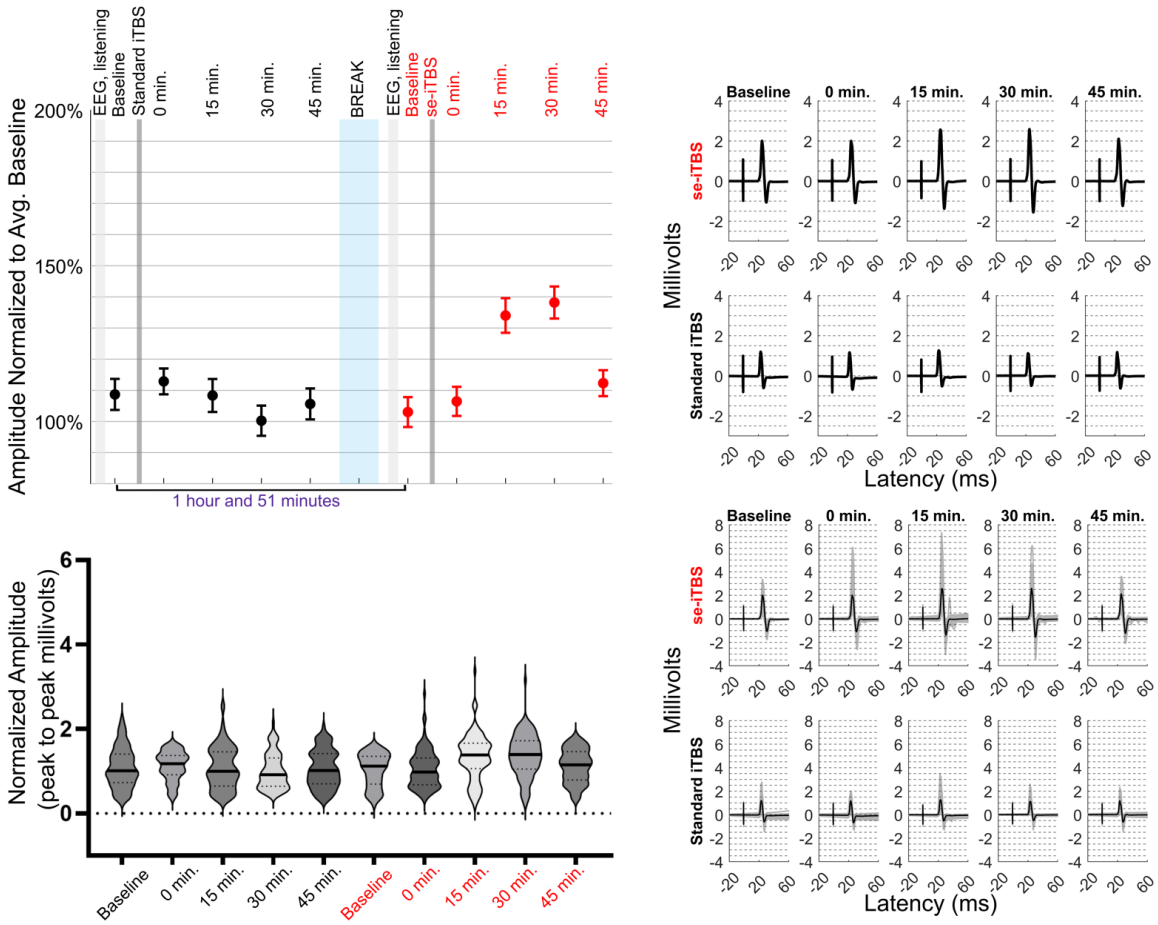

Figure S23. Participant 19 individual data

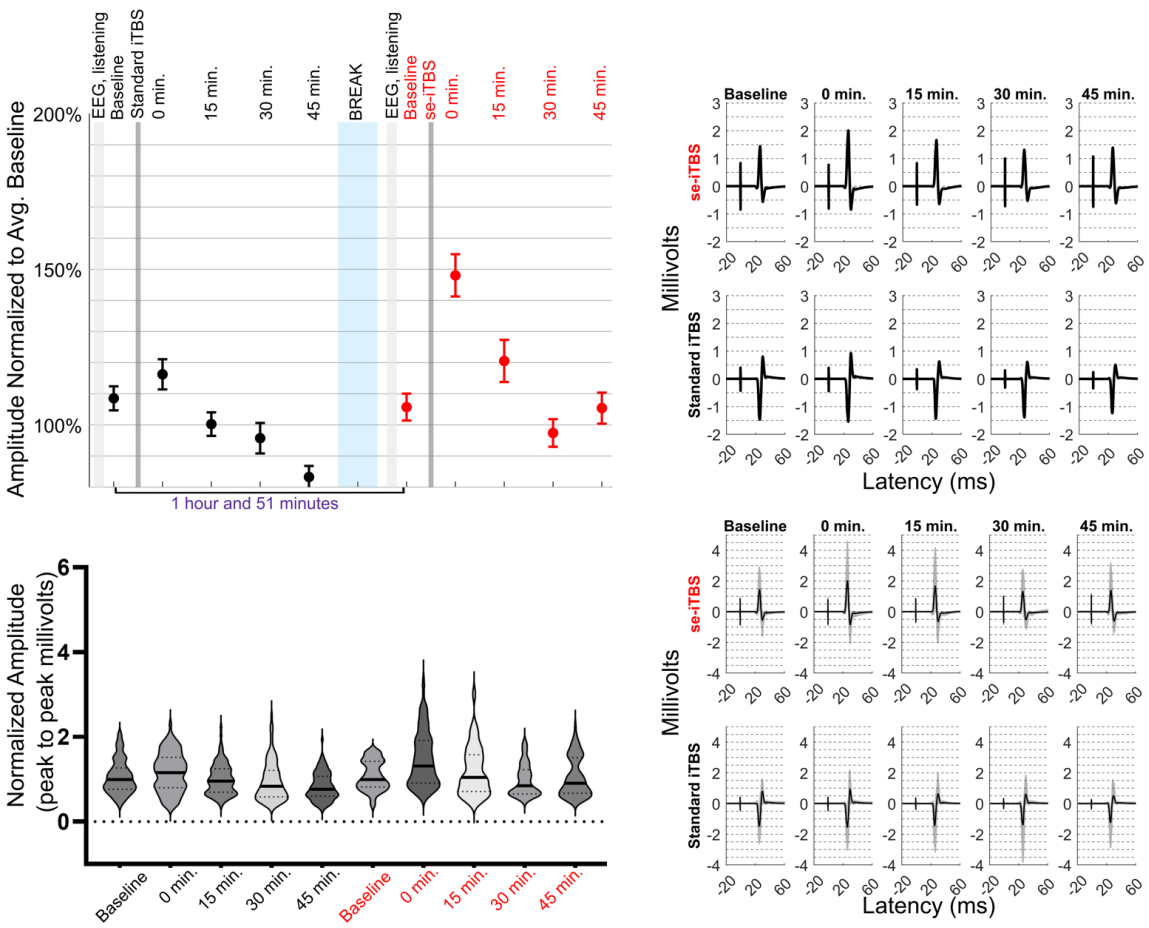

Figure S24. Participant 20 individual data