

Atypical facial behaviors in *C9orf72* hexanucleotide repeat expansion carriers have diffuse neural representations in primary motor cortex

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State of the art: When symptomatic, *C9orf72* hexanucleotide repeat expansion (*C9*) carriers often exhibit a spectrum of behavioral and motor changes. Facial behaviors are the products of emotions and motor networks, systems that are vulnerable in *C9*, but whether expansion carriers exhibit atypical facial movements is unknown.

Methodology: We measured 17 facial behaviors in 29 symptomatic *C9* expansion carriers (*C9*+symp), 19 asymptomatic expansion carriers (*C9*+asymp), and 34 expansion-negative healthy controls (*C9*-HC) during an emotional reactivity task in which participants viewed blocks of photographs that elicited sadness, disgust, or amusement. We used the Facial Action Coding System to quantify the second-by-second intensity of participants' facial behaviors during the task.

Results: Across trials, *C9*+symp had greater total facial behavior than *C9*+asymp ($t=18.86$, $p<.0001$) and *C9*-HC ($t=4.81$, $p<.0001$). In specific trials, *C9*+symp displayed greater prototypical expressions of sadness ($t=9.07$, $p<.0001$), disgust ($t=12.58$, $p<.0001$), and amusement ($t=7.82$, $p<.0001$) than *C9*+asymp and greater prototypical expressions of sadness ($t=7.61$, $p<.0001$) and disgust ($t=4.13$, $p<.0001$) than *C9*-HC. The *C9*+asymp group exhibited lower total facial behavior than *C9*-HC in all trials ($t=15.72$, $p<.0001$). Voxel-based morphometry analyses in *C9*+symp revealed that total facial behaviors had more diffuse gray matter correlates in the primary motor cortex than other groups. In *C9*+asymp and *C9*-HC, prototypical expressions displayed during specific trials related to gray matter volume in anterior and mid-cingulate cortex, associations not present in *C9*+symp.

Conclusion: These results suggest facial behaviors are atypical across the *C9* clinical spectrum and reflect the integrity of brain structures that support emotions and motor functioning.

Conflicts of interest

N/A