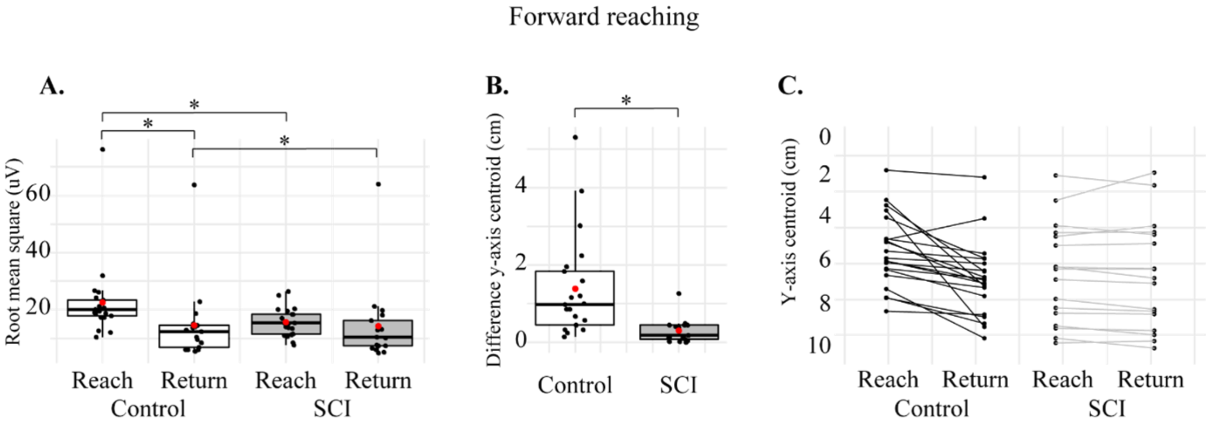
Supplementary materials 1

1. Regional distribution of the erector spinae (ES) activity when matching the reaching distance of control participants to individuals with spinal cord injury (SCI).

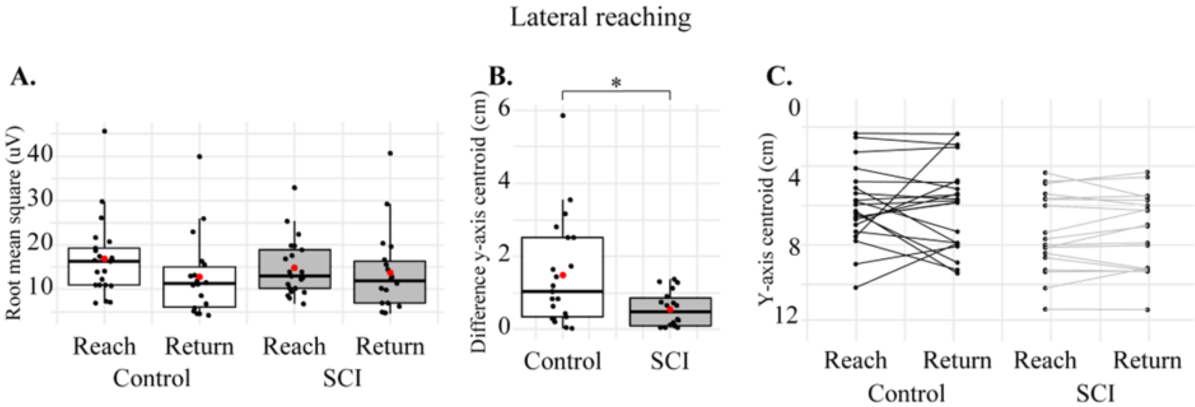
To investigate whether the observed differences between the controls and individuals with SCI in the reaching tasks were due to their different performance, i.e., the controls reached further, while the individuals with SCI reached with shorter distance, we calculated RMS amplitudes and y-axis of the centroid from a portion of the forward and lateral reaching in the controls so that the reaching distance was similar between the groups, and performed the same statistical analysis as described in the main text.

A repeated-measures ANOVA demonstrated a large effect of movement phase ($F_{1,36} = 6.64$, $p = 0.014$; $\eta^2 p = 0.16$), and an interaction of movement phase x group ($F_{1,36} = 6.21$, $p = 0.017$; $\eta^2 p = 0.15$) on global EMG amplitude during forward reaching (SCI = 17, control = 21). Post-hoc analyses revealed greater global EMG amplitude during the reaching phase than the returning phase in the controls ($Z = -3.50$, $p < .001$), whereas the EMG amplitude was not different between the two phases of the reaching movement in the participants with SCI (Z = -.40, $p = .69$; Supplementary figure 1A). In addition, global EMG amplitude was lower in individuals with SCI than in the controls during the reaching phase ($Z = -3.48$, $p < .001$) and during the returning phase ($Z = -2.13$, $p = .033$) of the task. For the y-axis of the centroid, there was a small-to-medium effect of movement phase ($F_{1,36} = 14.73$, $p < 0.001$; $\eta^2 p = 0.29$) and an interaction of movement phase x group ($F_{1,36} = 11.66$, $p = 0.002$; $\eta^2 p = 0.25$) during forward reaching. When comparing the changes in the y-axis of the centroid from reaching to returning phases between participants with SCI and the controls, the difference was greater in the controls (1.39cm, SD 1.32) than in the participants with SCI (0.31cm, SD 0.31; $Z = -3.66$; $p < 0.001$; Supplementary figure 1B & C).



Supplementary figure 1. HDEMG during forward reaching. (A) Group data of global EMG amplitude (controls n = 21, males n = 7; SCI n = 17, males n = 14). The horizontal line within the box represents the median, and outer edges of the box the 25th and 75th percentiles. The upper and lower whiskers extend to 1.5 times the interquartile range. The red dot indicates the mean value. (B) Group data of the y-axis of the centroid (controls n = 21, males n = 7; SCI n = 17, males n = 14) for the reaching and returning phases. (C) Individual differences in the y-axis of the centroid between reaching and returning phases. $*p < 0.05$.

In lateral reaching, there was no effect of movement phase ($F_{1,37} = .82$, $p = 0.372$; $\eta^2p = 0.02$), but there was an interaction of movement phase x group ($F_{1,37} = 5.00$, $p < 0.031$; $\eta^2p = 0.12$) with a small effect size on global EMG amplitude during lateral reaching (SCI = 18, control = 21; Supplementary figure 2A). When comparing the changes in the y-axis of the centroid from reaching to returning phases between participants with SCI and the controls there was a between-group difference, with the controls (1.49cm, SD 1.47) demonstrating a greater y-axis centroid difference compared to the SCI group (0.55cm, SD 0.49; $Z = -2.28$; $p = 0.022$; Supplementary figure 2B & C).



Supplementary figure 2. HDEMG of lateral reaching. (A) Group results of global EMG amplitude (controls n = 21, males n = 7; SCI n = 18 males n = 15). The horizontal line within the box represents the median, and outer edges of the box the 25th and 75th percentiles. The upper and lower whiskers extend to 1.5 times the interquartile range. The red dot indicates the mean. (B) Group data of the y-axis of the centroid (controls n = 21, males n = 7; SCI n = 18, males n = 15) for the reaching and returning phases. (C) Individual differences of the y-axis of the centroid between reaching and returning phases. *$p < 0.05$.

2. The influence of increased thoraco-lumbar flexion on regional distribution of the erector spinae (ES) activity during postural tasks in control participants

To determine whether a more caudally distributed activation of the ES seen in individuals with SCI during the rapid shoulder flexion task and during the external predicted perturbation task was related to an adapted posterior pelvic tilt posture when seated. Three control participants were instructed to sit with an upright posture and consequently with an increased thoraco-lumbar flexion, i.e., a slouching seated posture, to simulate the posture of individuals with spinal cord injury and performed the tasks as described in the methods. The heatmaps and the y-axis of the centroid of these three participants were calculated and are presented below. Overall, the location of the y-axis centroid remains to be in the cranial part of the ES, suggesting that the change in the regional distribution of activation seen in the participants with SCI was unlikely caused by their seated posture.

Supplementary figure legends

Supplementary figure 3. HDEMG of the rapid shoulder flexion task. Differential EMG amplitude maps of the ES based on the APA (left two columns) and shoulder flexion (right two columns) analysis windows in rapid shoulder flexion, obtained from three able-bodied participants who sat in an upright posture (left), and a slouched posture (right) to simulate the posture of individuals with SCI. The deep-blue squares are removed channels after the visual inspection for noisy channels. The large white circle represents the y-axis centroid, while the smaller white circles represent the active channels, meaning those with an RMS amplitude higher than 70% of the maximum RMS amplitude across the grid.

Supplementary figure 4. HDEMG of the external perturbation task. Differential EMG amplitude maps of the ES based on the APA (left) and CPA (right) analysis windows in the external perturbation task, obtained from three able-bodied participants who sat in an upright posture (left two columns), and a slouched posture (right two columns) to simulate the posture of individuals with SCI. The deep-blue squares are removed channels after the visual inspection for noisy channels. The large white circle represents the y-axis centroid, while the smaller white circles represent the active channels, meaning those with an RMS amplitude higher than 70% of the maximum RMS amplitude across the grid.