SPATIALLY DEFINED MOTOR DEFICITS IN PEOPLE WITH UNILATERAL COMPLEX REGIONAL PAIN SYNDROME

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KEY POINTS

1. We compared performance of motor tasks on each side of the body midline in people with unilateral CRPS.
2. There was a spatial bias towards the healthy side of the body midline, regardless of which hand was used.
3. The findings support the idea of 'somatospatial' neglect in people with CRPS.

BACKGROUND

A building body of evidence demonstrates spatially defined deficits in people with upper limb Complex Regional Pain Syndrome (CRPS). That is, thermoregulation and tactile processing are both disrupted according to where the hand is relative to the body midline. Here we wished to determine whether this midline effect also impacts on motor performance.

AIM: To determine whether motor accuracy and coordination is disrupted in people with unilateral upper limb CRPS, in a spatially defined manner.

OBJECTIVES: To investigate and compare the accuracy and coordination of simple motor tasks performed on the ipsilateral (or usual) and contralateral side of the body midline.

METHODS

Thirteen participants with CRPS Type 1 of one upper limb completed two motor experiments in random order.

EXPERIMENT 1: CIRCLE DRAWING TASK

Participants performed a circle drawing task that primarily tested motor accuracy. Participants were asked to draw 20 consecutive circles under eight different and randomly ordered conditions (each upper limb, on either side of the body midline, with eyes open or closed).

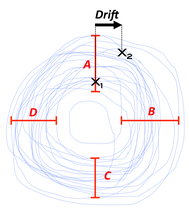

FIG 1: PRIMARY OUTCOMES FOR EXPERIMENT 1

'Error' was calculated by measuring the distance between the second innermost and second outermost circle at each point of the compass (*A + B + C + D*) (mm), and averaging them.

'Drift' was calculated by measuring the horizontal component of the distance (mm) from the starting point (x_1) to the finishing point (x_2).

EXPERIMENT 2: BUTTON PRESSING TASK

Participants performed a rapid button pressing task that tested motor coordination. They were asked to press the button as often as they could in 20 seconds under four different, randomly ordered and counterbalanced conditions (each upper limb, on either side of the body midline). The primary outcomes were the number of button presses (*'Count'*) and the SD of the interval (in seconds) between presses (*'Variability'*).

RESULTS

EXPERIMENT 1:

Motor accuracy for the circle drawing task was poorer when participants used their affected limb than when they used their healthy one (Error $p<0.001$; Drift $p<0.05$), and poorer when the task was performed on the affected side of the midline, regardless of limb (Error $p<0.001$; Drift $p<0.001$) **(Fig 2)**.

There was also a Limb x Side x Vision interaction for Drift ($p<0.05$): Drift with eyes closed for the affected limb in the affected side of space was 25.5mm (95%CI 18.3 – 32.6) towards the healthy side, compared to less than 8mm Drift for all other conditions **(Fig 2)**.

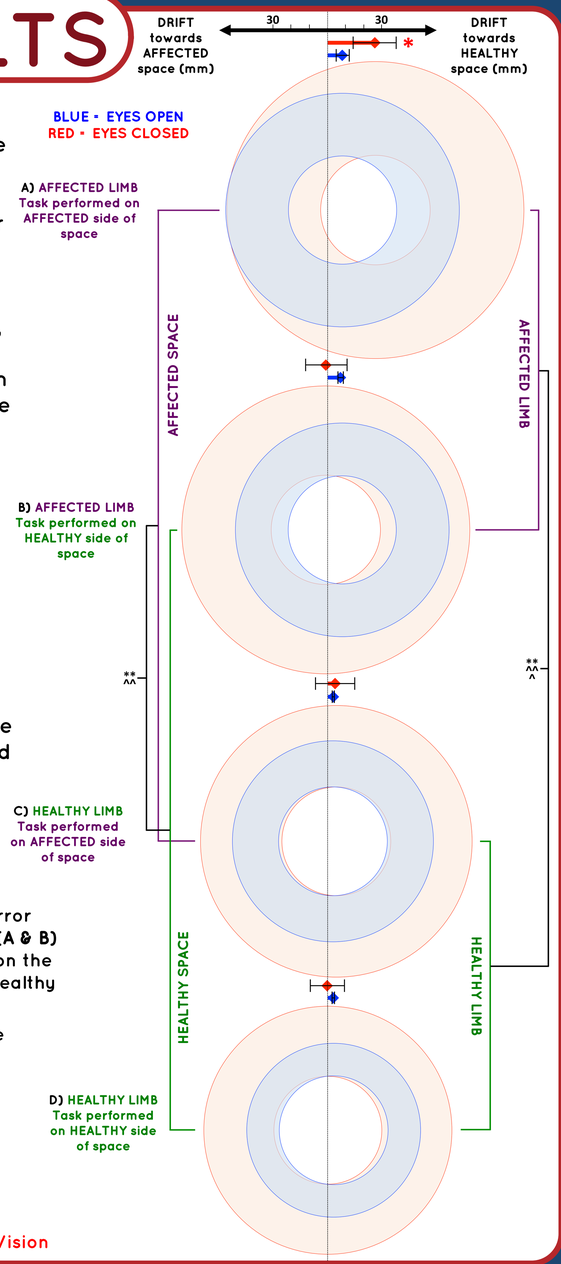

FIG 2: CIRCLE DRAWING

Visual representation of Error and Drift for the affected **(A & B)** and healthy limb **(C & D)**, on the affected **(A & C)** and the healthy side of space **(B & D)**.

Error is represented as the mean difference between the inner and outer radii with the inner radius constant. For Drift, SD (error bars) is shown.

**p<0.001 for Error
^^p<0.001 for Drift
^p<0.05 for Drift
*p<0.05 for Drift x Side x Vision

EXPERIMENT 2:

Motor coordination for the button pressing task was poorer when participants used their affected limb than when they used their healthy one (Count $p<0.001$; Variability $p=0.05$), and poorer when the task was performed on the affected side of the midline, regardless of limb (Count $p<0.001$; Variability $p=0.02$) **(Fig 3 & 4)**.

BASELINE CHARACTERISTICS	PARTICIPANTS (n=13)
Age (yrs) [mean (SD)]	40.5 (12.7)
Gender (F:M)	8:5
Dominant limb (R:L)	11:2
Affected limb (R:L)	7:6
Duration of CRPS	
50-150 wks	8
151-200+ wks	5
Pain over past 2 days (NRS) [mean (SD)]	4.9 (1.4)

TABLE 1: BASELINE CHARACTERISTICS

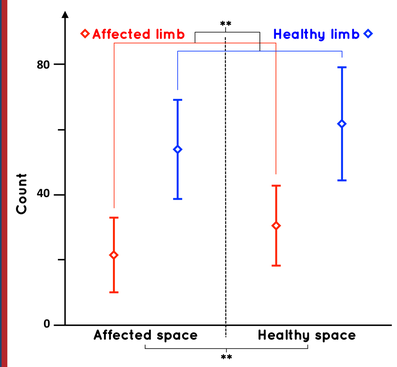

FIG 3: BUTTON PRESS – COUNT
Mean number of button presses in 20 seconds [error bars = SD; **p<0.001]

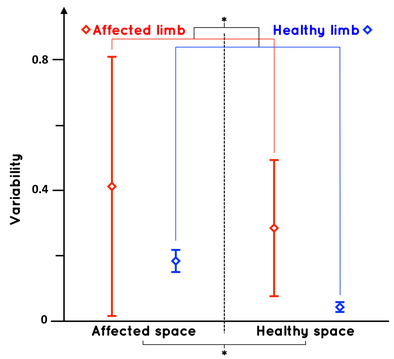

FIG 4: BUTTON PRESS – VARIABILITY
SD of the interval (sec) between button presses [error bars = SD; *p<0.05]

CONCLUSIONS

A spatial bias towards the healthy side of the body midline was evident for upper limb motor tasks performed by participants with CRPS. The results suggest that the midline-centred dysfunction in the processing of tactile input and the regulation of temperature that is present in this population also extends to movement performance. This finding provides further support for the concept of 'somatospatial' neglect in people with CRPS. Further investigation of therapies that target the interdependent relationship between spatial and bodily representations in CRPS is warranted.

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