Anticipatory motor planning in children and adults

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Background

- Motor planning is the ability to take into account the demands of an upcoming task when planning a movement1, e.g. picking up an upturned cup on a draining board for a drink.
- Previous studies2 have indicated deficits in motor planning in adolescents with Hemiplegic Cerebral Palsy (HCP).
- Our long-term aim is to compare motor planning in children with HCP with age-matched controls.
- We have previously devised a motor planning test suitable for adults and children and obtained normative data in healthy adults.

Aim

- To compare motor planning in healthy 9-11 year old children with previously collected data from healthy adults.

Hypothesis

- Motor planning will be immature in 9-11 year olds compared with adults.

Methods

Participants: 36 children aged 9-11 years, 20 adults aged 20-41 years.

Handle Rotation Task:
1) Participants were seated at a standardized distance from the device. An appropriate handle size was used, on the basis of their hand span.
2) Handle turning instructions were presented pictorially on a computer screen, with moving arrows indicating turn direction and one of six pictures for the target destination. At least 6 practice trials were undertaken before testing.
3) The task involved 48 trials consisting of 60° (n=6), 120° (n=6) and 180° (n=12) turns in each direction, presented in a random order. Participants performed the tasks using their dominant hand, followed by their non-dominant hand; they were encouraged to complete each turn without readjusting the initial grip.

How it reflects action planning

- With a neutral grip (left), it is biomechanically almost impossible to perform 180° turn without readjusting grip or letting go – failed turn (right).
- A planned grip (left) allows smooth completion of a 180° clockwise turn without grip readjustment - successful turn (right).

Data collection

- The tasks were video-recorded to determine the starting grip positions for each turn
- Time at which the handle reached each position was electronically recorded to calculate the reaction time (time from video presentation to initiation of turn) and total turn time

Turns were discounted if they were in the wrong direction (except for 180° turns), to the wrong destination or if the handle was not grasped at start with the thumb opposite the fingers.

Results

Grip adopted (thumb positioning)

- The graphs demonstrate handle turning patterns of children (top) were similar to adults (bottom) but with higher preference for neutral start grip, showing less evidence of planning of 180° turns than adults.

Conclusion

- Action planning is well developed in adults, but less mature in 9-11 year old children.
- Further data collection from both younger and older children is needed to clarify the development and maturity of action planning across different age groups.

Reference