Visual search during interception in children with Spastic Unilateral Cerebral Palsy

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Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Observational non invasive

Summary

ID

NL-OMON32233

Source
ToetsingOnline

Brief title
Visual search in children with SUCP

Condition

- Other condition
- Musculoskeletal and connective tissue deformities (incl intervertebral disc disorders)

Synonym
hemiplegic, spastic hemiparetic cerebral palsy

Health condition

neurologische aandoeningen

Research involving
Human

Sponsors and support

Primary sponsor: Vrije Universiteit
Source(s) of monetary or material Support: beurs van Manchester Metropolitan University

Intervention

Keyword: Cerebral Palsy, interception, Visual search

Outcome measures

Primary outcome

Visual search of the participants

-Search rate; the mean number of useful visual fixations and the mean fixation duration per trial. A fixation is defined as the period of time when the point of gaze remains stationary within 1.5 degrees of movement tolerance for a period equal to, or greater than 120ms or 6 video frames (Williams et al., 1994). We expect the following useful visual fixation points; ball, interception area (see lab setup).

-Percentage viewing time; the amount of time participants spends on fixating to the various areas (ball, begin point, interception point)

Secondary outcome

Movement of the participants

Reaction time; The time between the first movement of the ball and the first movement of the participants (more than 5 cm towards the conveyor belt)

Average walking velocities; The average walking velocity is calculated from the displacement of the potentiometer wires from the moment the ball starts to move till the moment when the ball crosses the interception area. This parameter is used to calculate the deviation of the BA.

Deviation of the BA (dCBA); The BA is the angle between the ball, the head of the participant and the interception area, using the head of the participant as the angle centre. The velocity profile of the ball will be controlled by the conveyor belt and known by the experimenter. A constant BA strategy corresponds to the initial BA maintaining through the entire trajectory (Chardenon et al., 2002; Lenoir et al., 1999; Chohan et al. 2006). Therefore the dCBA will be calculated as the sum of the absolute differences in values between the initial BA and the BA calculated for each following sample. As duration of the trials varies with ball velocity, the dCBA will be normalized by dividing the absolute differences by the number of samples.

Ball movement

Successful grasp; When the ball is grasped within the defined interception area (measured by video image)

Location of the brain damage

MRI scans are part of a regular evaluation of children with CP (CBO richtlijn behandeling spastische cerebrale parese 2007). Therefore, MRI scans will be available for most of the participating children with CP. An experienced child neurologist (RJV) will score the pattern of brain damage on the MRI scan. This can serve as a control measure to assess that the lesion is indeed present in the left or right hemisphere.

Study description

Background summary

According to Glover (2004), an interceptive action can be guided by two strategies. Firstly, the action can be planned before the start or at the beginning of the action, or secondly the action can be controlled online in a continuous way. In the planning strategy an individual will select and initiate a certain motor program depending on the environment and the goals of the individual. For instance when grasping a moving ball, the person will estimate the velocity of the ball and plan their action according to this velocity. In order to let this strategy work properly it is important to take into account a wide variety of visual and cognitive information. An individual will process the size of the ball and the spatial relationship between the individual and the ball. Besides this, the weight of the ball is of importance. Is the ball light or heavy and therefore will it have to be grasped with one or two hands? All these aspect will be taking into consideration and will be dependent not only on vision but also on prior knowledge and reference to stored memories. Besides planning the movement in advance, the individual can use an online control strategy to help guide the movement towards the target. This online strategy allows to use the spatial relationships between the actor and the environment will be used to monitor and adjust the motor program if necessary. In the example of the moving ball, the person will have to look at the ball and adjust the path of the grasping hand when necessary. This strategy has the benefit of allowing for fast processing and similarly fast online adjustments. This does not only mean that the strategy is quickly updated but also that its memory is of short duration. If visual information regarding the target is removed, the control strategy will gradually decay over a period of more or less two seconds. Therefore, this strategy is dependent on the visual information for the online control of an interceptive task.
Performing an action task which requires walking towards and intercepting a moving object can be guided through both strategies. When the action task is guided by a planning strategy, the actor uses the information of the moving object at the start to plan the movement toward the interception area. This will not require a continuous observation of the object to-be-intercepted and can be considered as a more or less automatic strategy. On the other hand, the online control strategy will require a constant visual observation of the moving object. This is necessary when something unexpected is occurring, like a change in ball velocity.
Children with spastic unilateral cerebral palsy (SUCP) have a non-progressive brain damage on one side of the brain which causes besides obvious motor impairments also problems in the planning and control of an action (Chen & Yang, 2007; Steenbergen et al., 2000). In pilot measurements with children with SUCP differences were found in visual search behaviour when intercepting a constantly moving ball while walking. The results showed two different visual search strategies. Some of the children focussed their gaze

continuously on the moving ball, which seemed to plead for the use of an online control mechanism. Other children seemed to focus their gaze in the beginning of the trial towards the ball and afterwards switched their gaze towards the interception area. This suggested that they use a planning strategy. Why they appeared to use different strategies is unclear. A planning strategy would appear to be sufficient since the ball was not changing velocity. A possible explanation can be found in the planning deficits of children with SUCP. Several authors have claimed that children with SUCP with damage to the left side of the brain suffer from planning deficits (Steenbergen et al., 2000, 2007; Te Velde et al., 2005). This because the brain areas involved in planning are mostly located on the left side of the brain (Johnson-Frey et al., 2005). If indeed planning deficits exist, it is expected that the children with damage on the left side of the brain rely only on the online control strategy. In order to perform properly, they would have the object-to-be intercepted under continuous visual control.

Study objective

Therefore the goal of this study is to investigate the use of the two strategies in children with SUCP by means of eye movements. In order to investigate these strategies, manipulations will be performed to provoke the use of a certain strategy. If the planning strategy is being used then an occlusion in the middle of the trajectory of the ball would not affect the performance, while the control strategy would be affected by this. If planning deficits are present then we expect the control strategy to take over. If this is not possible, like in the condition where a part of the trajectory is occluded, then performance will decrease. In addition, it is expected that differences will appear when performing the task with the impaired instead of the less-impaired hand. We expect that performing the grasping task with the less-impaired hand will be more automatic than performing the task with the impaired hand and therefore the individual will depend on the planning strategy. It is expected that when performing the task with the impaired hand the individual will rely more on the control strategy.

Study design

The study is conducted in two separate experiments. In experiment 1 we will test planning versus online control based on eye-movements. In the second experiment we will investigate the effect of the grasping hand on the eye-movements. We chose to separate the two, in order to reduce the load on the participants.
The control group will be measured first. The familiarity of the investigators with the experimental protocol and equipment will increase after several sessions. This way we hope to build some routine and to reduce the total experimental time by the time the children with SUCP will participate. By experience, we know that maintaining their attention to the task is a bigger

problem in children with SUCP than in controls.

Study burden and risks

Benefits: This research will give further inside into the perception-movement coupling. And in the (near) future, this information can improve treatment of the perception motor difficulties in children with SUCP.

The study will not have a direct beneficial effect for the children.

Risks/Burdens: We do not expect any special risks for the participants. The non-invasive methods used in the planned experiment (goggles and potentiometer) do not represent a risk in performing the task.

Group relatedness: There is an opportunity to look at developmental differences. Besides this, there is also a possibility for practical implications. Recent literature showed than visual search is a possible intervention method (Crowdy et al., 2002). By training visual search one*s movement can be improved. Early intervention will be more meaningful and effective.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adolescents (12-15 years)
Adolescents (16-17 years)
Children (2-11 years)

Inclusion criteria

-Clinical diagnosis of spastic unilateral cerebral palsy (GMFCS level 1-2 (Palisano, 2007)) according to the medical records with damage on either the right or the hemisphere, respectively
-age between 8 and 18 years.
-the ability to walk independent without walking aid other than insoles and/or orthoses.

Exclusion criteria

-visual neglect or any other kind of vision problems which can not be corrected by glasses (as reported by parents)
-Additional disorders (other than CP) concerning the musculoskeletal system
-Parents/guardians and/or child who do not understand Dutch or English well enough to take part in this project

Study design

Design

Study type:	Observational non invasive
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Basic science

Recruitment

NL
Recruitment status: Recruitment stopped

Start date (anticipated):	02-01-2009
Enrollment:	40
Type:	Actual

Ethics review

Approved WMO Date:	03-12-2008
Application type:	First submission
Review commission:	METC Amsterdam UMC

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL23161.029.08