

Posture Tracksection

GAIT INITIATION DIFFERS BETWEEN CHILDREN WITH HEMIPLEGIC CEREBRAL PALSY AND AGE-MATCHED CONTROLS

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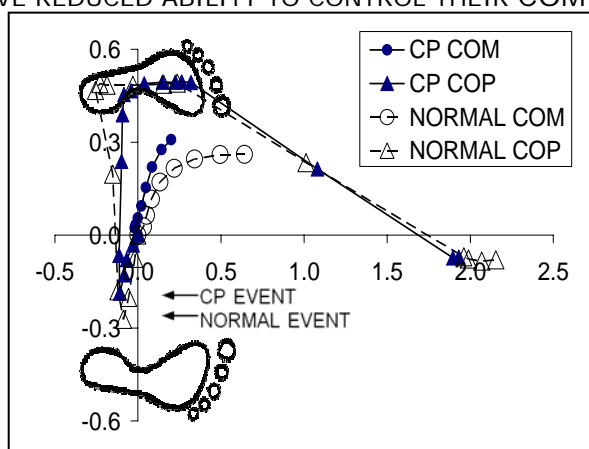
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AIMS: THE DISTANCE FROM THE FLOOR PROJECTION OF THE CENTER OF MASS (COM) TO THE CENTER OF PRESSURE (COP) DURING GAIT INITIATION HAS BEEN FOUND TO DIFFER BETWEEN HEALTHY ADULTS AND THOSE WITH BALANCE IMPAIRMENT^{1,2}, PROVIDING INSIGHT INTO DYNAMIC BALANCE STRATEGIES IN OLDER ADULTS. THE PURPOSE OF THIS PROSPECTIVE STUDY WAS TO DETERMINE IF A SIMILAR DIFFERENCE EXISTS BETWEEN CHILDREN WITH CEREBRAL PALSY AND TYPICALLY DEVELOPING CONTROLS, AND IF A METRIC DERIVED FROM THE COM AND COP DISPLACEMENT COULD BE USED TO DESCRIBE BALANCE ABILITY IN THESE POPULATIONS.

METHODS: AN ARRAY OF FOUR KISTLER FORCE PLATFORMS AND A SIX-CAMERA VICON 512 MOTION CAPTURE SYSTEM WERE USED FOR DATA CAPTURE. THIRTY SUBJECTS (15 AGE-MATCHED PAIRS) GAVE INFORMED CONSENT, DONNED A 36 TARGET FULL-BODY REFLECTIVE MARKER SET, AND WERE INSTRUCTED TO STAND WITH EACH FOOT ON A SEPARATE PLATFORM A COMFORTABLE DISTANCE APART. THE COM OF EACH SUBJECT WAS CALCULATED USING A FULL-BODY KINEMATIC MODEL MODIFIED FOR CHILDREN. THE COM-COP DISTANCE WAS MEASURED AT THE GREATEST POSTERIOR AND LATERAL COP DISPLACEMENT IN THE DIRECTION OF THE FIRST SWING LIMB (FIGURE). COM-COP DISTANCES WERE NORMALIZED USING THE SUBJECT'S BASE OF SUPPORT (ANKLE-ANKLE DISTANCE). NORMALIZED DISTANCES WERE GROUPED BY INITIATING LIMB (DOMINANT AND UNAFFECTED, OR NON-DOMINANT AND AFFECTED LIMB) AND DIAGNOSIS. DIFFERENCES BETWEEN AND WITHIN SUBJECTS WERE COMPARED USING PAIRED T-TESTS AND WERE BONFERRONI-ADJUSTED FOR FOUR PAIR-WISE COMPARISONS.

RESULTS: NORMALIZED COM-COP DISTANCES IN CHILDREN WITH CP WERE FOUND TO BE SHORTER THAN THEIR PATHOLOGY-FREE COUNTERPARTS IN BOTH NON-DOMINANT ($N = 30$, $M_{N-DCP} = 0.21$, $M_{N-DNORM} = 0.33$, $P = 0.018$) AND DOMINANT-SIDE INITIATIONS ($N = 30$, $M_{DCP} = 0.18$, $M_{DNORM} = 0.30$, $P = 0.023$). COM-COP DISTANCES WITHIN SUBJECTS AND BETWEEN DOMINANT AND NON-DOMINANT INITIATIONS WERE NOT SIGNIFICANTLY DIFFERENT IN EITHER CHILDREN WITH CP ($P > 0.05$) OR CONTROLS ($P > 0.05$).

CONCLUSIONS: THE SMALLER COM-COP DISTANCE FOUND IN THE CP POPULATION SUGGESTS THAT THE DYNAMIC BALANCE STRATEGY USED BY THESE CHILDREN IS ALTERED IN RESPONSE TO INHERENT PHYSICAL LIMITATIONS IMPOSED BY THE DISEASE. A LARGE COM-COP DISTANCE PROVIDES A GREATER MOMENT-GENERATING CAPABILITY ABOUT THE COM, PROVIDING MORE EFFICIENT CONTROL. HOWEVER, AS THE DISTANCE BETWEEN COM AND COP INCREASES, THERE ARE HIGHER DEMANDS PLACED ON THE SUBJECT'S STRENGTH AND BALANCE ABILITY IN ORDER TO CONTAIN THEIR COM DISPLACEMENT WITHIN THEIR BASE OF SUPPORT. THESE DATA IMPLY THAT CHILDREN WITH SMALLER COM-COP DISTANCES HAVE REDUCED ABILITY TO CONTROL THEIR COM AND THAT CHILDREN WITH CEREBRAL PALSY ARE RETICENT TO PRODUCE COM TRAJECTORIES BEYOND THEIR ABILITY TO CONTROL. BOTH POPULATIONS SHOWED NO DIFFERENCES BETWEEN SIDES IN THEIR COM-COP DISTANCES. THIS MAY BE ASSOCIATED WITH THE INHERENT BIPEDAL NATURE OF THE GAIT INITIATION TASK, WHERE IMPAIRMENT ON ONE SIDE INFLUENCED THE COM-COP DISTANCE REGARDLESS OF THE INITIATING LEG. THIS METRIC MAY PROVE TO BE A USEFUL PHYSICAL MEASURE FOR DETERMINING BALANCE ABILITY IN THE PEDIATRIC CP POPULATION.



REPRESENTATIVE COM AND COP TRAJECTORIES NORMALIZED BY BASE OF SUPPORT DURING GAIT INITIATION IN A CHILD WITH CEREBRAL PALSY COMPARED TO CONTROL

¹C.J.HAAS, ET AL, ARCH PHYS MED REHABIL 2005; 86: 2172-2176. ²M.MARTIN, ET AL, PHYS THER 2002; 82: 566-577

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