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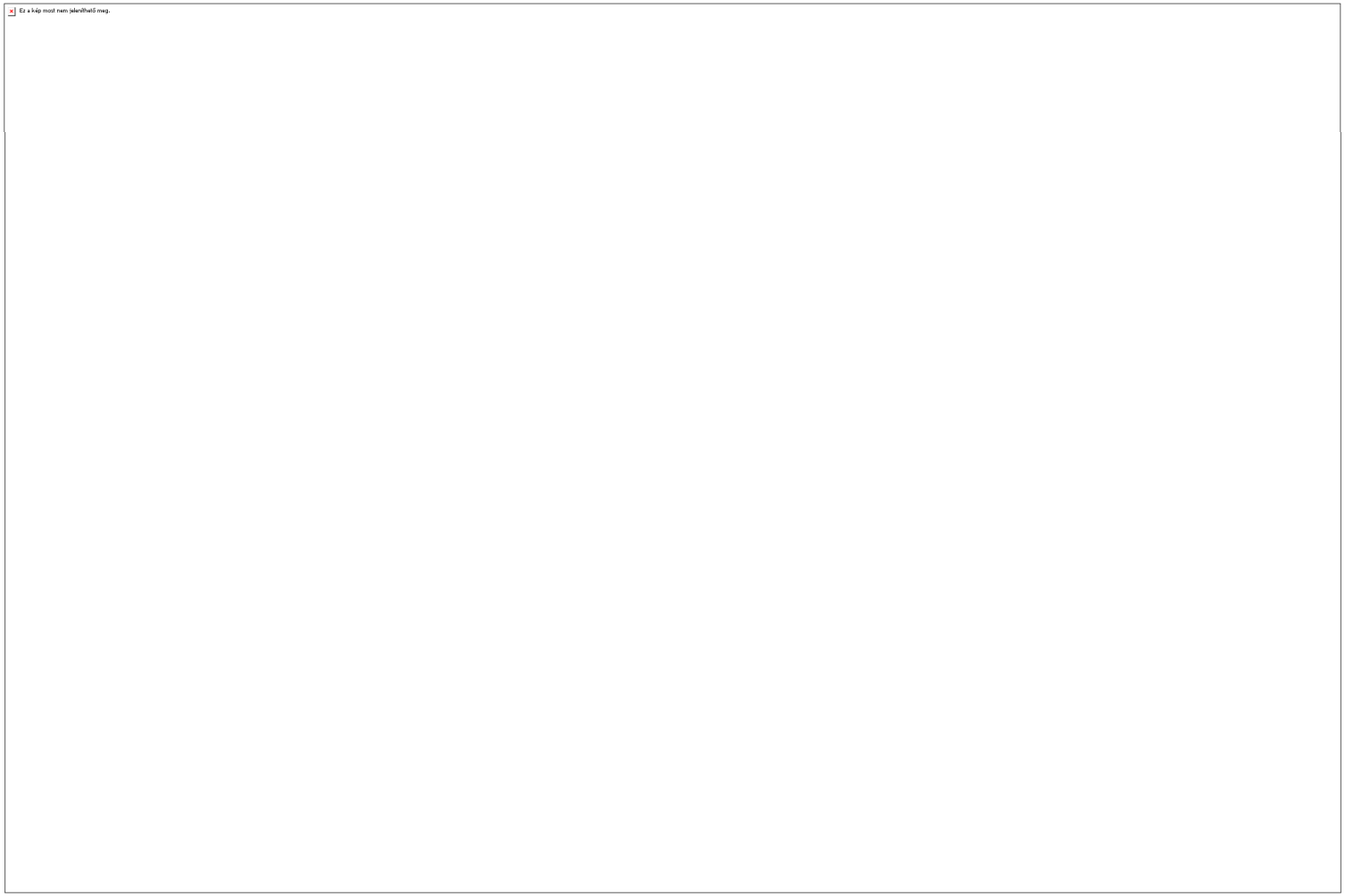
Objective assessment of children with birth injuries

Á. Jobbágy[1], J. Schultheisz[2], M. Horváth[1], P. Bacsó[2], P. Csuhaj[1], H. Réfy Vraskó[2]

(1) Budapest University of Technology and Economics

(2) Gézengúz Foundation

Huple



Virtual reality in therapy

Object moving in 1D

Object moving in 2D

Approximation of human evaluation using sensors

- selecting a sensor and attaching it to Huple,
- definition of an appropriate movement,
- selection of the variable characterizing the movement,
- definition of parameters as well as algorithms that calculate the parameter values,

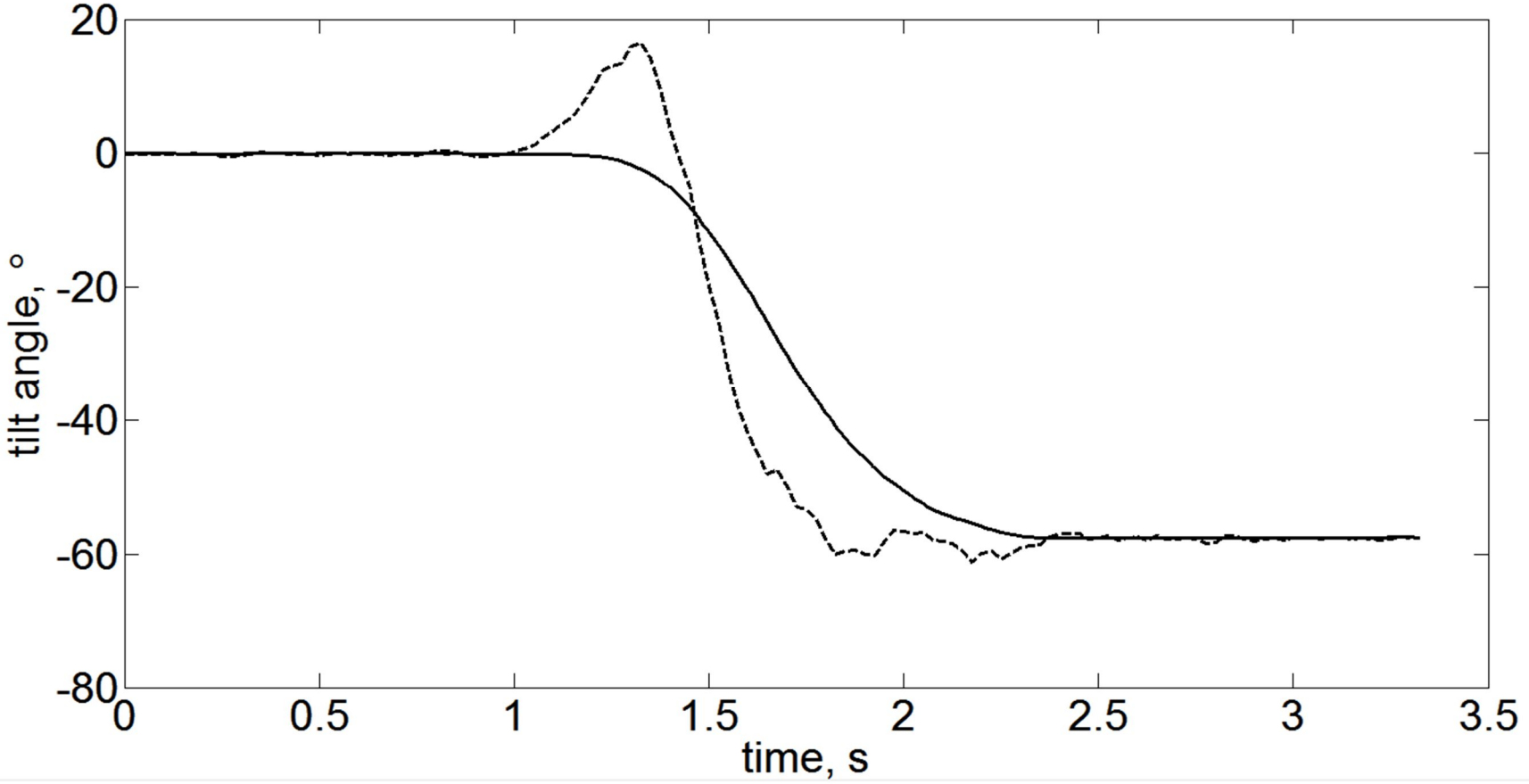
Approximation of human evaluation using sensors

- calibration of algorithms based on measurement results taken from children whose movement coordination has been qualified and quantified by therapists,
- verification of the assessment method by applying it to another group of children.

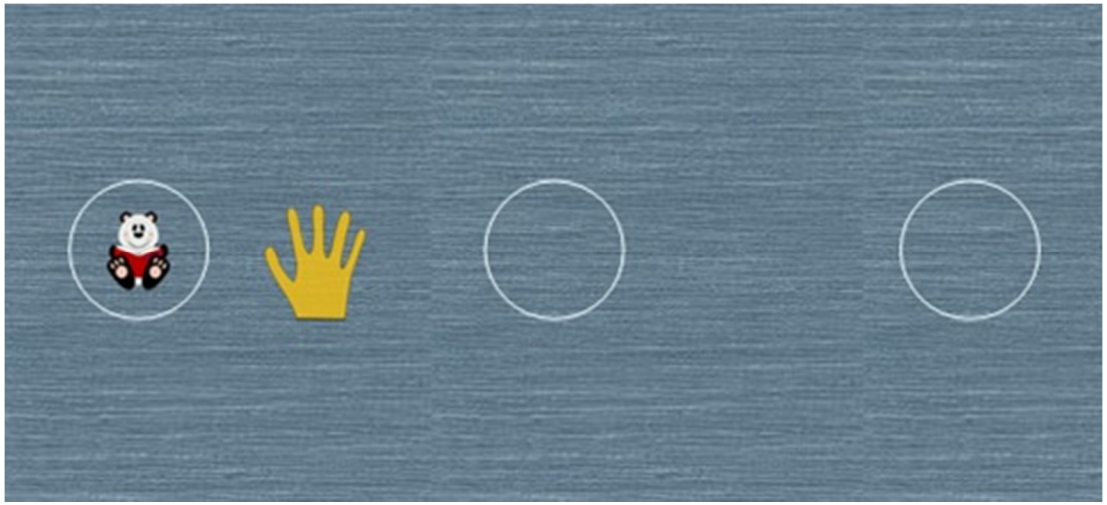
Orientation sensor: x-IMU

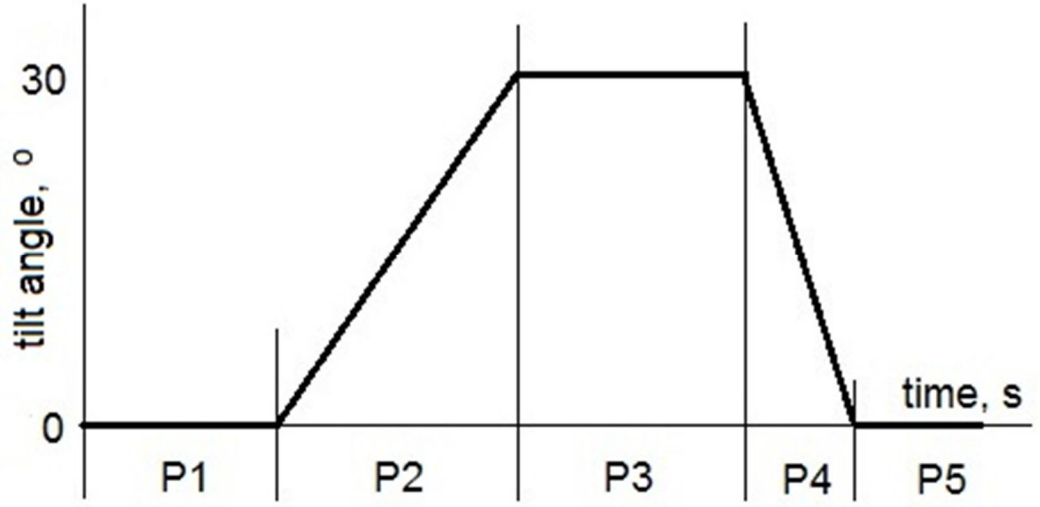
- accelerometer (±8 g, 12-bit), magnetometer (±8.1 G, 12-bit) and gyroscope (±2000 °/s, 16-bit),
- programmable full scale range,
- sampling frequency was set to 64 Hz (maximum 512 Hz),
- size: 57 × 38 × 21 mm and it weighs 49 grams,
- bluetooth communication.

x-IMU vs. simple 3D accelerometer



Tested movement: active tilting





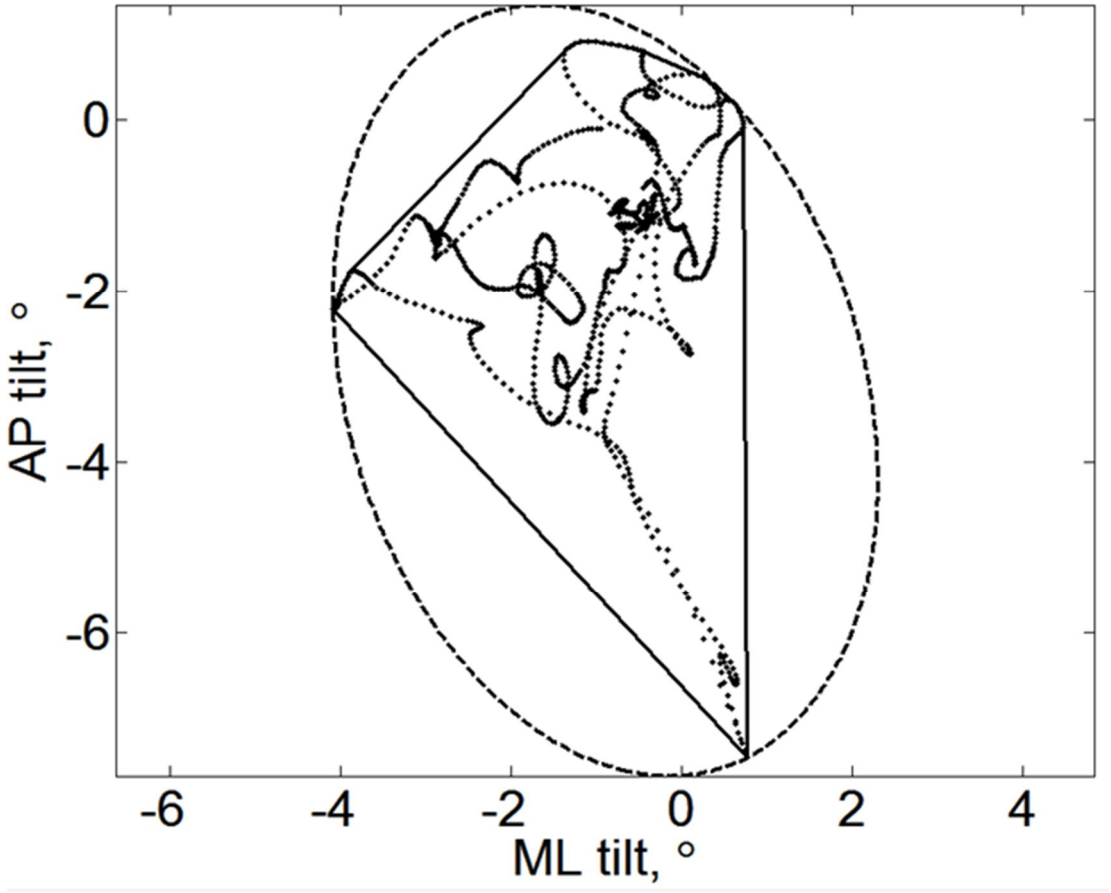
Tested children: group (a)

Patient	Gender	Age	Diagnosis	Rating by therapists
C1	female	5	central hypotonia	7/10
C2	female	3	benign congenital hypotonia	6/10
C3	female	3	benign congenital hypotonia	5/10
C4	male	4	minimal cerebral dysfunction	4/10
C5	female	3	myotonia congenital	3/10

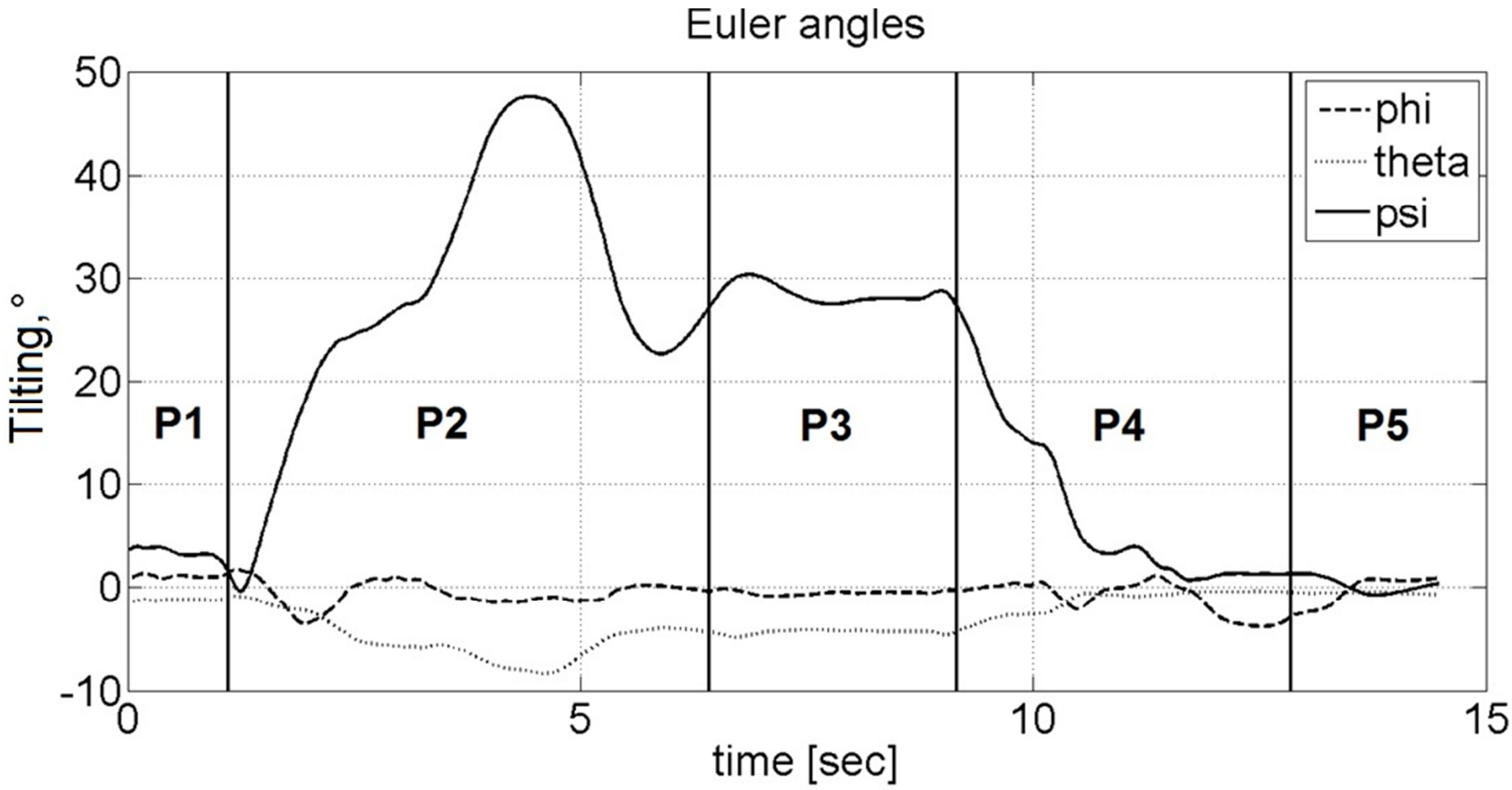
Tested children: group (b)

Patient	Gender	Age	Diagnosis	Rating by therapists
C8	male	8	motor and mental retardation, coordination problems	best
C9	male	5	pes planus, calcaneovalgus	middle
C10	male	6	congenital hypotonia, coordination problems	middle
C11	female	5	congenital hypotonia	worst
C12	male	6	minimal cerebral dysfunction	middle

Sitting still



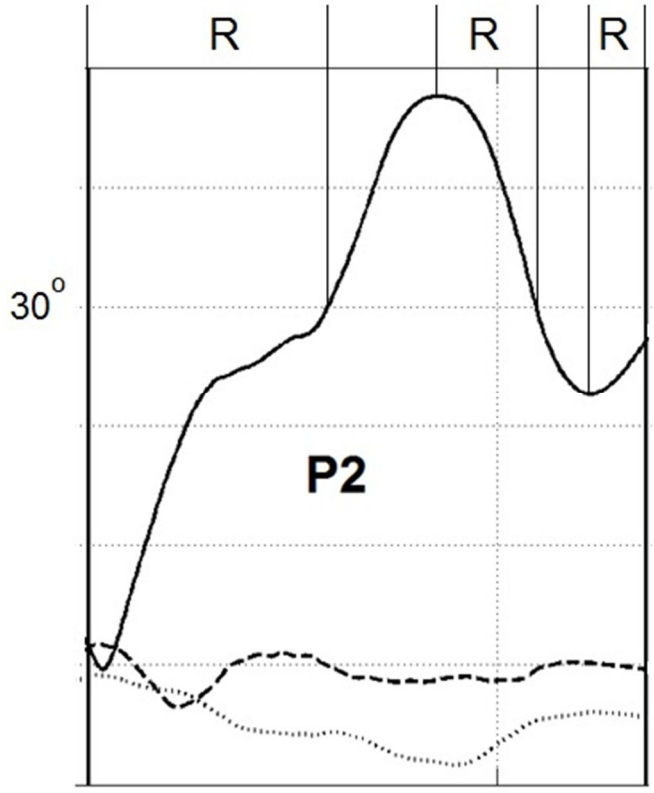
Best performing child



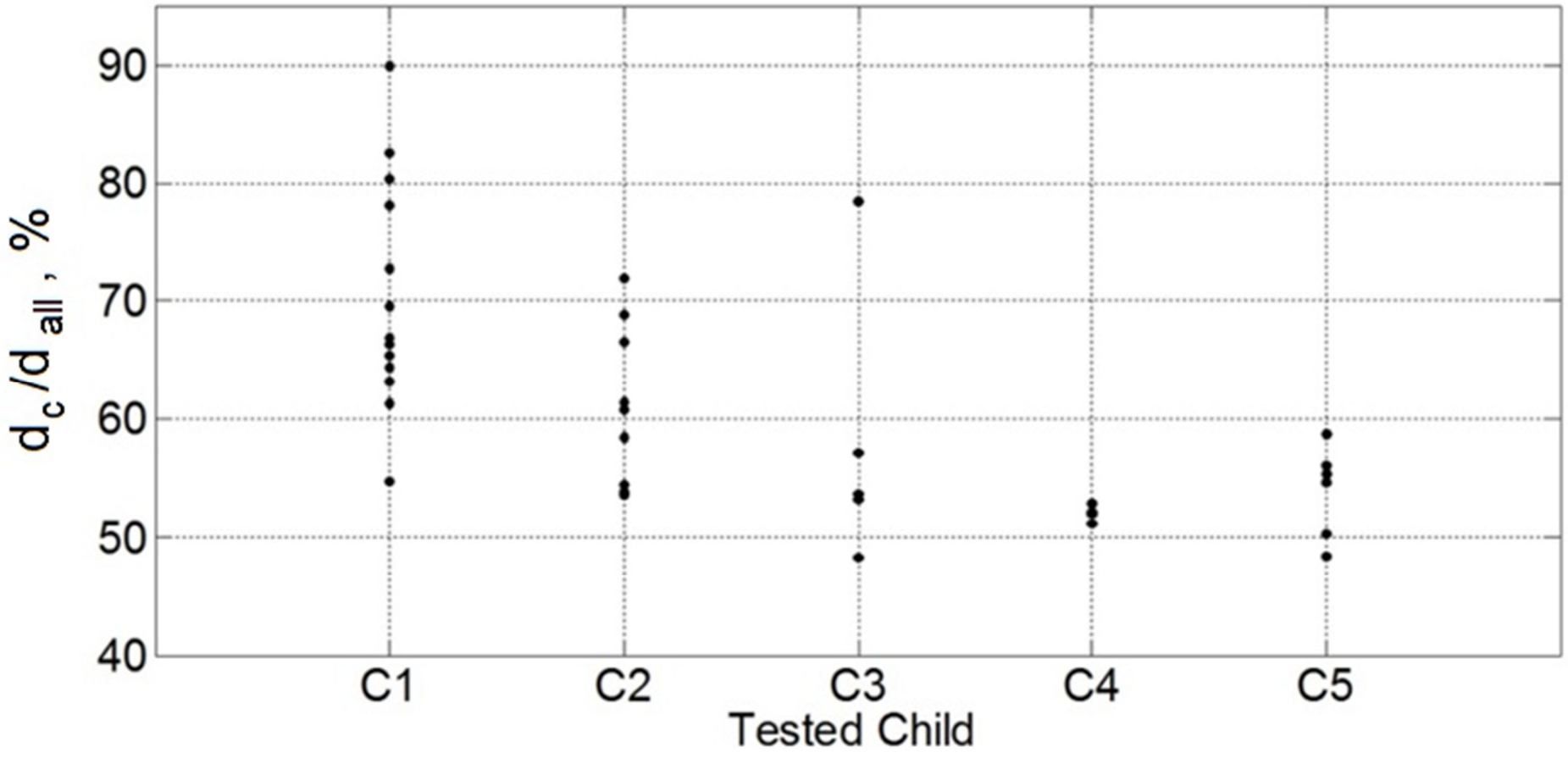
Quantification of movement control

- time to complete the test, also broken down to phases P2, P3 and P4,
- maximum speed in phases P2 and P4,
- average speed in phases P2 and P4,
- area A_{cover},
- dominant frequency in phases P1 and P3,
- ratio t_c/t_{all} in phases P2 and P4.

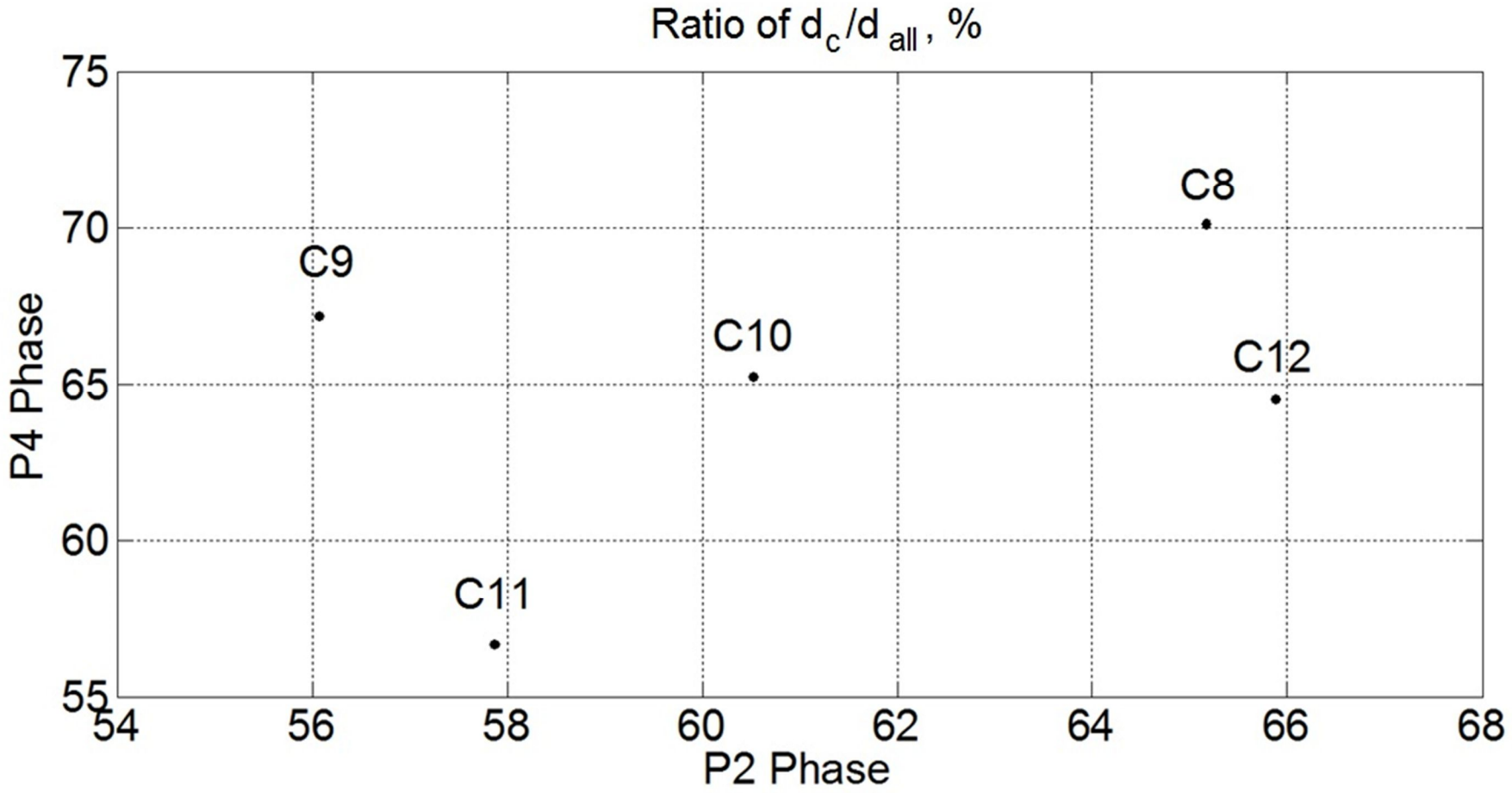
Ratio t_c/t_{all}



Quantification of group (a)



Quantification of group (b)



Conclusion

The medical device Huple is applicable to assess the actual movement coordination of children with sensorimotoric problems.

The evaluation method based on x-IMU as an orientation sensor can easily be used by the therapists.

Thank you for your attention!