

Gait value: a numerical measure for comparison of gait parameters between cerebral palsy patients and normal children

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INTRODUCTION

The evaluation of outcome in cerebral palsy (CP) following treatment needs further study as a reliable scoring system is yet to be developed.

AIMS AND OBJECTIVES

To formulate a scoring system by comparing the gait parameters between children with CP and normal subjects of similar age group.

METHODS AND MATERIALS

The gait parameters of 26 patients selected from the database were compared with 25 normal subjects and similarity between the curves assessed using a new statistical coefficient called the Similarity Distance Coefficient (SDC). The sagittal, coronal and transverse plane values obtained for the lower limb joints for the kinetic and kinematic parameters were considered for calculating a numerical value for the gait called the Gait Value (GV).

The difference in GV in the pre- and post-treatment period was expressed as a percentage called the Gait Value Difference (GVD). Summary of methodology is shown in the following flow chart (Figure 1).

RESULTS

The validation of the SDC was done using a coefficient matrix (Table 1). Curves C1 to C6 plotted using the SDC matrix. Curves 1, 2 and 3 are similar and Curves 4 and 5 are similar, whereas C6 is dissimilar from all (Figure 2).

Table 1: SDCs between different curves

	C1	C2	C3	C4	C5	C6
C1	1.000	0.750	0.750	0.542	0.487	0.487
C2	0.750	1.000	0.667	0.481	0.423	0.534
C3	0.750	0.667	1.000	0.498	0.543	0.418
C4	0.542	0.481	0.498	1.000	0.761	0.388
C5	0.487	0.423	0.543	0.761	1.000	0.352
C6	0.487	0.534	0.418	0.388	0.352	1.000

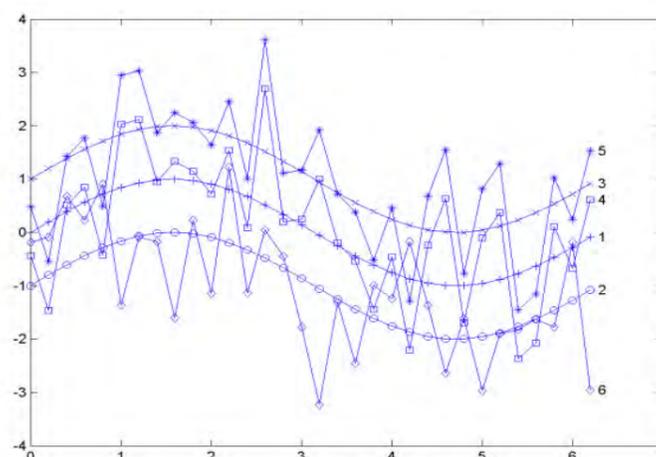


Figure 2: Different curves

The SDC difference between pre- and post-treatment for the left knee angle of a patient was 455.1 in the X-axis, 161.6 in the Y-axis and 204.2 in the Z-axis when the curves in Figure 3 were compared.

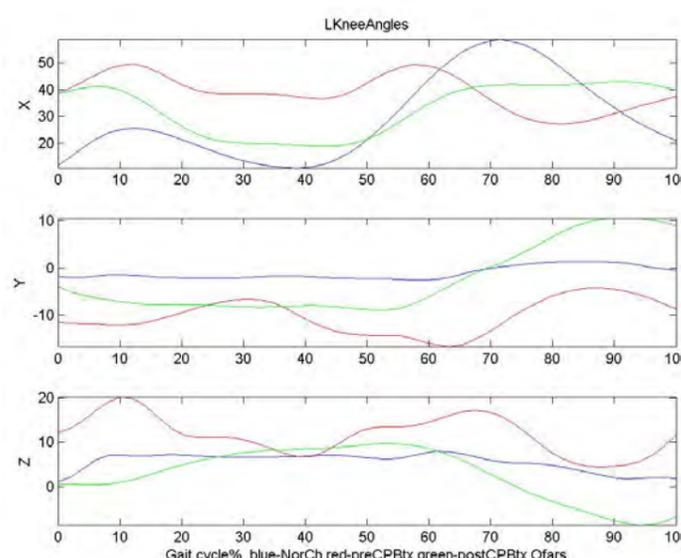


Figure 3: Three averaged curves from databases

The SDC difference between pre- and post-treatment for the left knee angle of another patient was -57.9 in the X-axis, -51.1 in the Y-axis and -60.1 in the Z-axis when the curves in Figure 4 were compared.

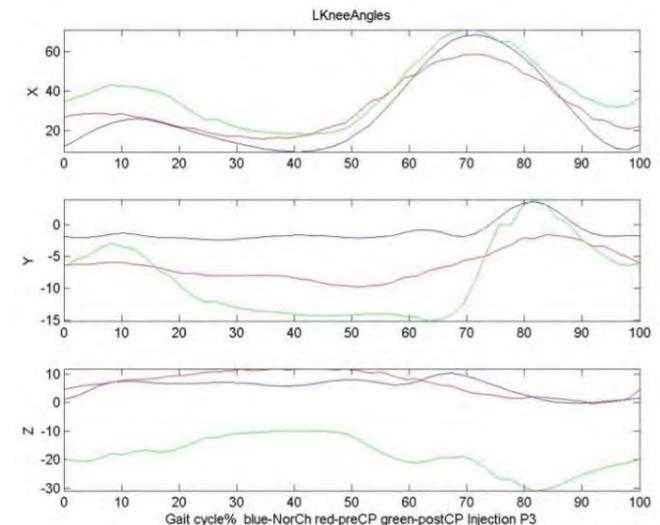


Figure 4: Different curves from three databases

The results show that 50% of patients treated by botulinum injection and 50% of the patients treated by surgical method showed an increase in the GV in the post-treatment period. On validation of the results with the temporal parameters, the correlation was evident above the value 26.9% and below the value -14.91%.

DISCUSSION

GV and GVD measurements should be considered as an essential tool for the determination outcome of treatment in patients with CP. The results show that the GV corresponded to clinical and temporal parameters of the gait and the GVD was efficient in detecting the outcome after treatment. However, the coordinates to be considered for estimating the GV requires further validation before it can be used in clinical practice. It is also recommended to have a model curve for each gait parameter so that the value obtained by comparison remains consistent. The GVD correlated with the temporal parameters above the value 26.9% and below -14.91% which indicates that values above 26.9% the temporal parameters improved and values below -14.91% the temporal parameters showed deterioration in the post-treatment period. Fifty percent of patients showed a positive GVD and the remaining 50% showed a negative value in the post-treatment period.

CONCLUSIONS

The SDC, GV and GVD are effective tools in explaining the gait as a numerical value. It may help to quantify the outcome of treatment in CP and can be used by various treating centres.

REFERENCES: [1] Baker R et al., Gait and Posture 2009, 30: 265-269. [2] Cook R and Schneider I., Journal of Paediatric Orthopaedics 2003, 23: 292-295. [3] Wang W et al., Chinese Journal of Scientific Instrument 2008, 29: 1-7.

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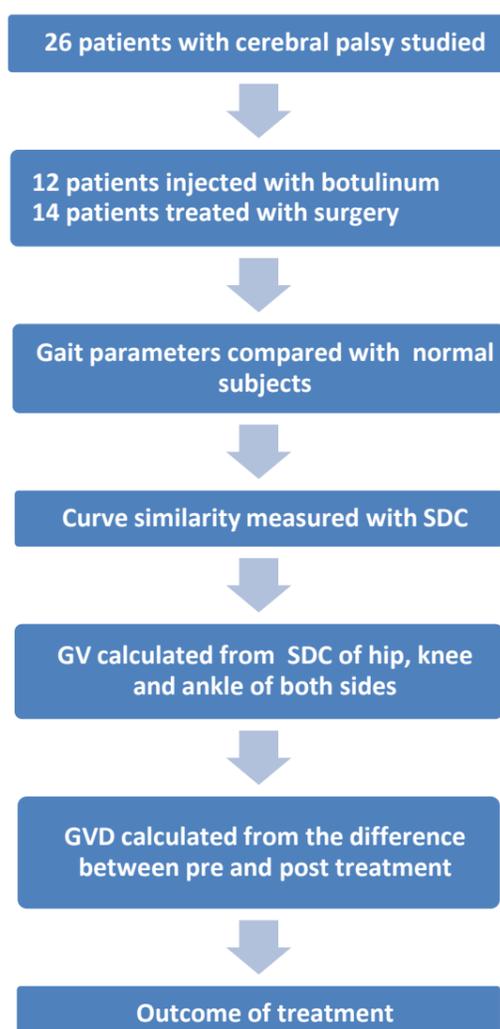


Figure 1: Summary of methodology