CORRELATION BETWEEN VISUAL GAIT ANALYSIS AND FUNCTIONAL ASPECTS IN CEREBRAL PALSY

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ABSTRACT
Objective: To verify the correlation between visual gait analysis (VGA) and functional aspects using the Timed Up and Go Test (TUG) and Gross Motor Function Classification System (GMFCS) in individuals with cerebral palsy (CP). Methods: Retrospective cross sectional study of 35 patients with CP. The mean age 12.61 years old, 94.3% were spastic; 34.4% hemiplegic, 54.3% diplegic, 11.4% triplegic; 45.7% were level II GMFCS, 42.9% level I, 5.7% level III and 5.7% level IV. VGA was analyzed by the Edinburgh visual gait score (EVGS), functional mobility was assessed by TUG and functionality through GMFCS. The Spearman correlation was used for statistical analysis. Results: The mean EVGS score was 18.97. The mean TUG was 13.71sec. EVGS showed moderate correlation with TUG (r=0.46, p=0.03) and GMFCS (r=0.45, p=0.00). Conclusion: Worse VGA scores correlate to worse functionality and mobility performance. Due to the observed correlation, it is possible to assert that VGA is a useful tool on evaluation of CP patients. Level of Evidence III, Retrospective Comparative Study.

Keywords: Gait. Cerebral palsy. Evaluation.
The intra and inter-observer reliability of the scale depends on the observers’ experience and training - the higher the experience, the greater the intraobserver reliability. A study concluded that the observation of gait events by inexperienced observers using EVGS was moderately reliable, however, there was little precision when compared to experienced observers and to CGA. Another study comparing PRS and EVGS, showed excellent intraobserver reliability, but the inter-observer reliability for both scales was considered low. The study recommended that VGA was made by the same observer. The reliability and validity of EVGS and five other tools was compared with the CGA. EVGS was considered the best tool to assess the gait pattern in CP, because it considers motion data in the three planes, with good reliability and concurrent validity.  

There are studies that correlate data from VGA with functional mobility measurements and levels of functionality. There are a correlation between data from CGA and EVGS and the Gross Motor Function Classification System levels (GMFCS), demonstrated that high scores on both gait assessment methods matched with high levels of GMFCS. In another study, the Timed Up & Go method (TUG) was analyzed, along with other functional mobility elements and showed strong correlation with functional gait ability of individuals with CP. Kerr et al. have shown that low levels of GMFCS were associated to low values of the Pediatric Evaluation of Disability Inventory. GMFCS was developed to classify the functional abilities of children with CP. This scale is currently considered the most reliable and best known in pediatric CP rehabilitation.  

TUG is a quick and easy test that assesses the functional mobility and consists in measuring the time spent to go from the sitting position to orthostatic posture, start walking at the command, stop, return, come back, and sit down again. This test was validated and adapted for children and adolescents with CP and has also has normal values for children and adolescents. With this perspective, the objective of this study was to verify the correlation between gait pattern measured by EVGS, functional mobility (TUG) and the level of functionality (GMFCS) of individuals with CP.

**RESULTS**

The review included data from 35 patients who underwent VGA and 28 subjects that were also evaluated through the TUG test. Table 1 shows the characteristics of the participants of the study. Both correlations of EVGS with TUG and GMFCS showed a moderate magnitude, according to Table 2.

| Criteria | Edinburgh | TUG | GMFCS |
|----------|-----------|-----|------|
| Edinburgh | Correlation of Edinburgh’s Visual Gait Analysis with GMFCS and TUG. | | |
| | GMFCS | Magnitude | TUG | Magnitude |
| Edinburgh | 0.45 (0.00) | Moderate | 0.46 (0.03) | Moderate |

Statistical analysis

For statistical purposes, the normality of continuous variables was assessed by the Shapiro-Wilk test. Data with normal distribution were presented as mean and standard deviation and asymmetric data with median and interquartile range. Categorical variables were expressed as absolute and relative frequency. The association between the total Edinburgh score (sum of both lower limbs) with GMFCS and TUG was performed using Spearman’s correlation test. All analysis and data processing were performed using SPSS version 18.0 (SPSS Inc., USA). In all cases, differences were considered significant when p<0.05.
DISCUSSÃO

Correlations of EVGS with TUG and GMFCS, found in our study, were considered as moderate, showing the relationship between gait pattern, functional mobility and level of functionality. It has been shown that individuals with high scores on EVGS, i.e., major changes in gait pattern took more time to carry out the functional mobility test (TUG) and had worst level of functionality (GMFCS). Similar results were obtained by Robinson et al., who demonstrated a strong relationship between the results of CGA and EVGS, reinforcing the latter as an appropriate tool for examiners who do not have access to CGA. In this study, authors found a strong relationship between both CGA and EVGS with level of GMFCS I-III, and it has been observed that high gait scores were associated to high levels of GMFCS. A study that analyzed the gait performance through speed and the Gross Motor Function Measure (GMFM) demonstrated its relationship with the dimensions D (standing) and E (walking, running and jumping). The authors emphasized that the video recording enables better analysis of movements and assists the selection and evaluation of gait training strategies. The correlation between functional tests as TUG and the levels of GMFCS was demonstrated in a study that investigated the gait behavior in adult patients with CP. The authors reported decline in gait function, as compared with adolescents, and in 39% of cases there was change in the level of GMFCS. A correlation between TUG, GMFCS and Functional Mobility Scale with the six-minute walk test, evaluated in the study, showing that TUG had a direct influence on the functional gait ability. The literature reports GMFCS findings correlate with other mobility scales, such as the Pediatric Evaluation of Disability Inventory, for example, demonstrating that the lower the GMFCS level, the lower the mobility score at the Pediatric Evaluation of Disability Inventory. However, this study did not directly analyzed gait abnormalities, as in our study.

CONCLUSION

It was possible to demonstrate that VGA, analyzed by the Edinburgh protocol, is able to correlate gait abnormalities with functional capacity, measured by the TUG test and GMFCS. Worse scores correlate with worse performance in terms of functionality and mobility in CP. EVGS seems to be an appropriate tool to evaluate the progress of patients with CP.

AUTHORS’ CONTRIBUTIONS: Each author contributed individually and significantly to the development of the study. All authors contributed to the writing of the manuscript. MRF (0000-0002-3990-2090)* reviewed the records for data collection. APT (0000-0001-5406-661X)* reviewed the literature and wrote the draft of the paper. RDNP (0000-0001-9728-3649)* evaluated the data of the statistical analysis. All authors contributed to the intellectual concept of the study. *ORCID (Open Researcher and Contributor ID).

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