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Using a goal attainment scale in the evaluation of outcomes in patients with diplegic cerebral palsy

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ABSTRACT

A goal attainment scale (GAS) was used to evaluate outcomes of surgical and non-surgical interventions to improve gait in 45 children with diplegic cerebral palsy. Personal goals were recorded during pre-intervention gait analysis in two groups. Twenty children underwent orthopaedic surgery (Group 1) and 25 children received a non-operative intervention (Group 2). Children and/or their carers were contacted post-intervention by telephone to complete a GAS questionnaire, rating the achievement of goals on a 5-point scale. The goals were similar in both groups. The composite GAS was transformed into a standardised measure (T-score) for each patient. Both groups on average achieved their goals (mean T-score for Group 2 was 56.3, versus 47.1 for Group 1). The difference between these two means was significant ($p = 0.010$). Additionally, 16 children had undergone a follow-up gait analysis during the study period, but the relationship between their Gait Profile Score and GAS was not statistically significant.

Both surgical and non-surgical interventions enabled children to achieve their goals, although Group 1 reported higher achievements. The GAS reflects patient's/parent's/carer's aspirations and may be as relevant as post-intervention kinematic or kinetic outcomes.

1. Introduction

Three-dimensional gait analysis is a standard evaluation of ambulant patients with cerebral palsy (CP). However, kinematic and kinetic outcomes may overlook a patient's goals and individual needs, such as pain relief. A Goal Attainment Scale (GAS) provides subjective information about a patient's needs. Goal Attainment Scales (GASs) were initially used in the 1960s in mental health [1], but have since been applied to other aspects of health care including stroke rehabilitation and geriatric care [2,3]. Steenbeek et al. [4] provided a critical review on the psychometric properties of GASs in paediatric rehabilitation and concluded that they had promising applications, particularly in light of its high sensitivity to change. With respect to CP, GASs have proven to be a robust, sensitive and effective measurement when combined with other methods of analysis [5].

Goal Attainment Scales vary markedly in the literature. Goals may be set and evaluated by a practitioner, an impartial supervisor or the patient/carer themselves. The latter is thought to be most beneficial as individuals are more likely to strive towards a goal set by themselves [6]. It may also be challenging for an impartial individual to evaluate a patient with whom they are unfamiliar, and it is likely that patient/family evaluation would be more comprehensive [5]. However, the underlying aim remains consistent: to identify goals that are specific to the patient and to evaluate goal achievement. Gordon et al. [5] employed a method that focuses on patient opinion, in which patients and/or their parents/carers establish three to four personal goals and rate their own success with these goals at follow up. The GAS calculation produces a standardised measure (T-score) as a marker of the degree of goal attainment [1].

The aims of this study were two-fold: firstly, to use a GAS to evaluate outcomes between children with CP who underwent orthopaedic surgery and those who underwent conservative therapies, and secondly to determine the correlation between the GAS T-score and the Gait Profile Score (GPS) as the relationship between GAS and kinematic analysis remains formally untested. We hypothesised that, firstly, patients undergoing gait improvement surgery would achieve their goals to a greater degree than children

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managed non-surgically and, secondly, that the GAS T-score would correlate negatively with the change in GPS.

2. Patients and methods

2.1. Patients

This is a retrospective analysis of 53 children with diplegic CP who attended for standard three dimensional gait analysis between 2012 and 2014. The evaluation comprised a standard clinical examination, visual assessment of gait using the Edinburgh Gait Score [7], kinematics, including the calculation of the Movement Analysis Profile and Gait Profile Score [8], and kinetics. Children who had undergone surgery within the previous 9 months were excluded. During the intervention period, 20 children had orthopaedic surgery to improve function and 33 had conservative management, which included intra-muscular botulinum toxin injections, physiotherapy and/or orthoses, to improve function. Four of these children/families were unable to be contacted post intervention, and a further four were excluded because they subsequently underwent selective dorsal rhizotomy. Thus 25 children were included in the non-surgical group of the study. It should be noted that many patients in the surgical group also received physiotherapy and some previously received botulinum toxin injections, but were classified as surgically managed for the purposes of this study. Sixteen of the 45 children in the study attended for follow-up gait analysis following intervention during the study period.

As mentioned, all patients had diplegic CP, but presented with a variety of gait abnormalities. These were not analysed extensively in this study, but included toe-walking, fixed flexion deformities and rotational abnormalities. The selection of these patients is based on clinical judgement when considering if a patient is suitable for gait-correcting surgery. The mean age of patients in the non-surgical group was 13.0 years, and 16.4 years in the surgical group.

Surgical interventions were varied. Most consisted of a specific set of procedures: gastrocnemius lengthening, semitendinosus tenotomy, and tibialis anterior shortening. However patients receiving other procedures were also included, for example midfoot arthrodesis and femoral derotation osteotomy. Three patients in the surgical group had also received previous orthopaedic surgery, but evaluation of outcome was based on the most recent surgical intervention.

At the pre-intervention visit for gait analysis parents/carers of children completed a questionnaire to establish their top three or four goals. These were discussed with gait laboratory staff to establish SMART goals [9]. Parents/carers were asked to rate each goal on a 3-point scale in terms of importance and perceived difficulty, allowing goals to be weighted (weight = importance × difficulty).

The mean follow-up of the non-surgical group was 23.3 months and 17.2 months for surgical patients. Parents/carers were contacted by telephone at follow-up to complete the second part of the GAS questionnaire. Some patients were young at the time of the study, so goals for all patients were established and rated by parents/carers for all patients. The achievement of goals was rated using a scale of five points (−2 to +2), with 0 equivalent to goal achievement. Baseline was taken as −1; −2 denoted deterioration; and +1 or 2 indicated improvement exceeding the expectations of the goal. An example of a questionnaire is shown in Fig. 1.

2.2. GAS calculation and statistical analyses

Goal achievement ratings were converted to a GAS T-score using the GAS calculation [10].

Patient stated goal	Importance	Difficulty	Baseline	Achieved
1. Improve pain control	3	3	-1	+2
2. Fall less frequently	3	3	-1	+1
3. Walk for longer	2	2	-1	0

Fig. 1. Example of a GAS questionnaire. Each goal is rated in terms of importance and perceived difficulty on a scale of 1–3, in which 3 indicates highly important and highly difficult. Goals were rated on a 5-point scale of −2 to +2.

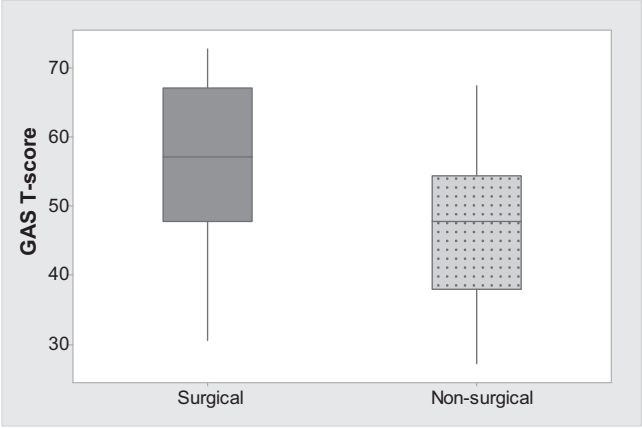

Fig. 2. Boxplot showing mean T-scores for surgical and non-surgical patients with 95% confidence intervals.

The T-score is a standardised measure with a mean of 50 and a standard deviation of 10 [1]. Thus if goals were met the T-score was 50; exceeding goal expectations resulted in a T-score greater than 50 and failing to achieve goals resulted in a T-score of less than 50. A T-score of 50 could be achieved by each individual goal being rated as 0 or by a combination of goals rated as below and above 0. A two-sample t-test was used to analyse the difference in mean T-scores between the groups.

The 16 patients who had a follow-up gait analysis were used to analyse the correlation between GPS and GAS. The change in GPS was calculated by subtracting the baseline GPS from the follow-up GPS. Pearson's correlation coefficient was used to calculate the relationship of the GPS with the T-score.

Statistical analysis was performed using Minitab statistical software package. The T-score was tested for normality using the Shapiro-Wilk test. A p-value >0.1 was considered to refute the null hypothesis, indicating a normal distribution. For the t-test and Pearson's correlation coefficient, a p-value <0.05 was considered statistically significant.

The nature of goals was analysed by grouping individual goals into broader categories and calculating percentages. Goals were also considered with respect to the International Classification of Function, Disability and Health (ICF) Core Sets for children with CP, which systematically categorises the functional abilities and challenges of children with CP. Four ICF categories are recognised: structure, function, activities and participation, and environment [11].

3. Results

There was no evidence to reject normality (Shapiro-Wilk $p > 0.1$) for the T-score of non-surgical and surgical patients. The mean T-score for the non-surgical group was 47.1 and was not significantly different from 50 ($p = 0.173$). In this group, 72 goals were described; 27% exceeded, 33% achieved and 40% were not