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VARIABILITY OF VIDEO-BASED CLINICAL GAIT ANALYSIS IN HEMIPLEGIA AS PERFORMED BY PRACTITIONERS IN DIVERSE SPECIALTIES

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Objective: **Clinical gait analysis is widely used by different therapists working with hemiplegic patients. The purpose of this study was to assess the reliability of video-based clinical gait assessment, as performed by practitioners in diverse specialties.**

Design: **Five neurologists, 5 physiotherapists, and 5 doctors of physical medicine and rehabilitation (physiatrists) were asked to study a videotape of 6 patients with hemiplegia in the act of walking. This activity was chosen due to the wide use of gait information for therapeutic prescription and medical decision-making during medical consultations, at conventions, or in exchanges between therapists.**

Results: **Results highlighted a certain inconsistency in the use of the gait description indicators. The 15 therapists used 396 different locutions to describe the gaits of the 6 patients. These locutions yielded 60 general indicators, or gait disorders, which were grouped in 5 categories. Eleven of them were classified as "controversial" due to the significant inter-subject variability of the evaluations.**

Conclusion: **The study identified a large number of indicators that were used relatively inconsistently by the 3 specialties studied. The results of this study would appear to indicate that greater caution is needed when dealing with some of the "controversial" indicators, as well as with the "unusual" gait patterns observed in some patients.**

Key words: variability, functional gait assessment, gait analysis, hemiplegia, stroke.

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INTRODUCTION

The ability to walk with as "normal" a gait as possible is of fundamental psychological importance to patients, as well as being essential to their independent daily life (1). The restoration of a more functional and aesthetic gait is a basic priority for most stroke patients and their therapists (2, 3). During their numerous consultations in hospitals or in clinics, hemiplegic patients come into contact with a variety of medical or paramedical professionals from different specialties. However, as has been shown, the different professions involved in stroke care often use different gait analysis strategies and information (4), depending on their training and therapeutic aims.

A survey of the literature reveals the variability of the existing results. First, the validity of visually recorded parameters appears to be influenced by walking velocity, at least for temporal-distance measurements (5) and by the quality of the videography used (6). In addition, the reliability between and within observational gait analysis raters, both for real and video-based analysis, has been shown to be moderate to poor for several pathological conditions (7–15). On the other hand, some studies have demonstrated good, accurate and/or reliable evaluations for some gait parameters, such as push-off (16) or symmetry (17). Other studies – without gait parameter details, such as the functional ambulation profile-based – also report good to very good reliability and validity (18, 19). Studies of the concurrent validity of observational gait analysis through comparison of three-dimensional movement analyses have generally indicated fair to moderate agreement of the kinematics and spatiotemporal parameters (20). Recently, the accuracy and reliability of observational kinematic gait assessment performed via low or high speed bandwidth internet have been evaluated, confirming the feasibility of "tele-rehabilitation" (23).

Furthermore, studies have often evaluated the results in only 1 therapist specialty. For example, the variability in the visual gait assessment has been evaluated for physiotherapists (12, 24–26) or physiatrists (7, 8, 10). Very few authors have attempted to provide a "state of the art" review of observational gait analysis using validity and reliability analyses from the literature (16, 21, 22). To our knowledge, there have been no studies concerning the free gait parameter evaluation of hemiplegic patients by different professions, except for Watelain et al. (4).

To improve the co-ordination of stroke patient care and free video-based clinical gait analysis, we compared the data

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obtained from the video-based clinical gait assessments of different health professionals evaluating the same patients. This research comes from a global study of observational gait assessment. After studying the clinical gait analysis strategies of the different specialties (4), we specifically examined the consistency of the free observational data, particularly the indicators and/or types of patient that require special attention. Although gait analysis forms should normally be use to improve the analyses (14, 18, 26), free gait analysis is used in the very large majority of the cases, and thus was chosen as the focus of this study.

Our initial hypothesis was that the variability of free visual gait evaluation would highlight the differences between professions or between therapists, specifically for certain indicators. The overall aim of our study was to identify the fundamental indicators (those used freely by a majority of therapists in each of the professions involved), as well as those indicators that were omitted, causing seriously contradictory and/or highly divergent evaluations.

SUBJECTS AND METHODS

Specialists

We studied the clinical gait analysis strategies of 5 neurologists (N), 5 physiotherapists (P), and 5 physiatrists (R) at their respective institutions. These specialists all agreed to participate actively in the study. They were chosen because they were directly involved in the diagnosis and treatment of hemiplegic patients and work regularly with them. They work in the "Nord-Pas de Calais-Picardie" area in different departments. They all manage a clinical staff and practice in regional hospitals (France). Most of them (13 out of 15) practice only in hospitals, and none of them have uncorrected vision alterations. As senior teachers in their specialty at regional institutions, they can thus be considered representative of the specialty.

Patients with hemiplegia

The patient population consisted of 6 male patients with hemiplegia, aged 39 to 62, who had suffered a cerebrovascular accident from 6 months to 2 years prior to the study. The patients chosen were representative of the large range of autonomy and recovery levels that characterize stroke patient's gait. Each had recovered the ability to walk independently. One patient used a walking stick; none of the others used any form of assistance. The ambulation perimeter ranged from 20 to 400 m. One patient had excess weight as well as discrete valgus of both knees. The others presented no identified associated disorder that could affect locomotion.

Setting

The patients, all wearing swimsuits, were filmed face on, from behind and in profile (right and left), using a 50 Hz VHS videotape recorder. Each patient performed 10 trials, with rest between trials if necessary; each trial included an initiation phase and a walking phase completed on a 10-m walkway. The recordings were presented individually to each specialist, who was allowed to look at all or any part of the film as often as they wanted. They were asked to make a free detailed analysis of patient gait. All of these analyses and interviews were tape-recorded for detailed study.

Data analysis

Data analysis consisted of transcribing the visual functional gait analysis (FGA) on paper. First, each item of the FGA information was classified, specialist by specialist and patient by patient, and then grouped together to obtain a smaller number of indicators. Secondly, the overall list of the indicators conserved was associated to the specialist's evaluation (positively: used or negatively: not used). These indicators were grouped together in 5 categories (4). Afterwards, the use frequency of each indicator was analysed globally for each patient, each therapist and each specialty.

In the end, the indicators presenting a controversial or divergent evaluation were identified and grouped according to 3 criteria: (1) (C&D) the presence of contradictions (opposing opinions) or important divergences between specialists leading to extremely different qualitative appreciations; (2) (D) the presence of disavowals, in which a specialist indicates an error in judgement and changes his mind; and (3) (I) the presence of a gait disorder considered difficult to evaluate by at least one specialist.

The protocol, which is totally anonymous, was reviewed and approved by the local Institutional Ethics Review Board. After receiving the information, and prior to filming, each patient signed an informed consent form, accepting the entire protocol.

Statistical analysis

The Kolmogorov-Smirnov one-sample test was used to verify the normality of the data. A simple *t*-test was used to compare the mean values of specialist experience in order to determine whether more experienced specialists used more indicators than others, or fewer. Simple ANOVAs, followed by a *post hoc* Tukey (HSD) for pairwise comparison testing, were used to compare the means of indicators used in order to identify any differences between specialists within one specialty. The repartition of each indicator used was compared using χ^2-tests and α levels of 0.05, as in all other statistical analyses. This comparison highlighted the existence of relationships between the specialties and the indicators used. When such a relationship existed, the specialties were then compared using a one-tailed χ^2-test, following a corrected Bonferroni test and an α level reduction of 0.01 (3 tests are necessary to compare N with R, N with P, and R with P).

RESULTS

Context

The 3 specialties presented no differences in terms of experience, with a mean value of 23.6 years (SD 8.9, range 11–38). Patient characteristics are presented in Table I. Patients were able to walk a mean of 225 m (SD 148.6, range 20–400 m), with a mean walking speed of 0.41 m/s (SD 0.22, range 0.10–0.75 m/s). The average time spent to complete an FGA for each patient was 10 minutes (SD 3.1, range 4–15 minutes). The average number of times the specialist referred back to a particular sequence was 3.4 (SD 0.9, range 0–6).

Description and analysis of indicators

From a large semantic grouping, 60 general indicators were identified (Table II presents some examples of semantic grouping). The average number of citations per indicator was 23.5 (SD 19) with 30.3 (SD 17) for indicators cited more than 5 times (e.g. a mean superior or equal to once per patient). The average number of indicators used by a specialist was 23.8 (SD 8.4), with the rehabilitation specialists (R) using significantly more indicators than the neurologists (N) or the physiotherapists (P). However, there is an important variability in the mean number of indicators used by the different specialists (17.7–23.7 for N, 21.7–38.2 for R, and 15.8–23.3 for P). Within each specialty, differences can be observed between R1–R2, R2–R4, P1–P3, and P2–P3. There is also important variability in the indicators used for different patients (from 8 to 48).

Table I. *Characteristics of subjects after stroke and gait characteristics*

Subject number	Age (years)	Weight (kg)	Height (cm)	Years since stroke	Gait perimeter (m)	Walking speed (m/s)	Affected side	Dominant side
1	54	69	170	1.6	300	0.55	L	R
2[1]	56	63	162	0.8	20	0.18	R	R
3	62	71	178	2	250	0.41	L	R
4	57	55	167	0.5	30	0.10	L	L
5	53	74	172	1.9	350	0.50	L	R
6[2]	39	78	157	1.8	400	0.75	L	L
Mean (SD)	53.5 (7.1)	68.3 (7.5)	167.7 (6.8)	1.4 (0.6)	225 (148.6)	0.41 (0.22)	–	–

[1] Used a single-point stick.
[2] Had discrete valgus of both knees as well as excessive weight.
L = left, R = right.

The breakdown of specialist citations for all the indicators used at least once per patient (6 or more) is presented in Table III. These indicators are grouped into 3 categories according to the number of citations by the 3 specialties. The first category (4 indicators) concerns indicators used less than 1 time in 4 (25%) by 2 specialties (indicators essentially used by 1 specialty). The second category (28 indicators) concerns indicators used less than 1 time in 4 by only 1 specialty (indicators little used by 1 specialty). The third category (13 indicators) concerns indicators used more than 1 time in 4 by all 3 specialties (indicators used equally by all 3 specialties). The 3 indicators groups are related to the 5 indicator categories (A–E) (4). The first of the 3 groups concerns indicators that are relatively little used (9–26 vs 7–63 and 7–82).

Of the 45 indicators, 42 were used by N and 43 by R, whereas P used all 45. The relationship between the specialty and the indicator use frequency is significant for 57% of the indicators (26–45 indicators). The highest number of significant relationships exists in the interpretative indicator category (E). The number of differences observed between N and R is similar to the number between N and P (15 vs 14), but the number of differences between R and P is much smaller, with 7.

Table IV presents the 10 most used indicators for each specialty. Only 4 of them were used by all 3 specialties. A total of 35 indicators were used for all 6 patients by the different specialists, but only 17 were used by at least 1 specific specialist for all patients.

Omission of indicator was defined as non-use of an indicator by any specialist when more than half of the others used it. The 22 indicators identified using this criterion is presented in Table V. The number of indicators omitted by 1–7 specialists varies between 7 and 13 for patients 1–6. No statistical difference can be noted, but patients 2 and 6 account for 13 and 11 omissions, respectively, while the others account for only 7 or 8.

Figure 1 presents the indicator use frequencies for all 6 patients for each specialty. For example, for all their functional gait analyses, each of the 3 specialties used 4.8–5.5% of the indicators for all 6 patients and 26.7–44.6 for only 1 patient.

Eleven gait disorders were identified as "controversial", meaning those for which there were more than 2 cases of disagreement between specialists or of evaluation difficulties during a FGA. For each indicator, the disagreements were classified as involving significant contradiction and/or divergence (C&D), disavowal (D), and/or evaluation difficulties (I). These controversial indicators are summarized in Table VI. The number of C&D, D or I per patient varied between 3 and 23 (1–16 for C&D and D only), with 3–10 for patients 1–5 and 23 for patient 6.

DISCUSSION

Methodology and its limitations

The important differences in methodology or populations used for the studies in the literature make comparison difficult. For example, some studies recommend rater training to increase reliability (21, 26). We chose to provide no special training, but rather to rely on extensive professional experience to represent

Table II. *Example of the semantic grouping of gait indicators that permitted the 396 locutions actually used to be regrouped into 60 general indicator categories*

Locutions	Indicators
Good heel strike Homogeneous initial contact Initial contact was not by the heel Initial contact by the external edge of the foot Initial contact by the forefoot Foot flat initial contact The initial contact was not controlled Heeling gait Homogeneous progression of the foot Winding displacement of the foot Unusual trajectory of the foot	Initial contact, foot progression
Recurvatum or small, slight recurvatum Significant recurvatum No recurvatum Knee flessum No knee flessum	Genu-Recurvatum/ Flessum

Table III. *Gait indicators cited more than 5 times. For each indicator, the percentage of use by the 3 specialties is given. For example, in the last line of group 2, no neurologists (N) used the indicator "Quality of pelvic step", while it was used 43% in physiatrist (R) functional gait analysis and 57% in the physiotherapist's (P). The category of indicators (Cat) and the number of citations (Nb Cit) is also presented. The indicators are grouped according to their use by the 3 specialties: Group 1 = Cited less than 25% for 2 specialties, group 2 = cited less than 25% by only one specialty, and group 3 = cited more than 25% by the 3 specialties*

Groups	Indicators	Neurologists	Physiatrists	Physiotherapists	Cat	Nb Cit
1	Hand mobility[+#]	81[1, 2]	12[1]	8[2]	A	26
1	Leg drooped, stamping of foot	0[1]	78[1, 3]	22[3]	C	17
1	Steppage[+]	77[1]	0[1, 3]	23[3]	B	16
1	Possible other afflictions	91[1, 2]	0[1]	9[2]	E	9
2	Hyper or hypotonia/spasticity[+#]	44[2]	32	24[2]	E	63
2	Step length, symmetry/asymmetry*[+#]	17[1, 2]	47[1]	36[2]	C	58
2	Quality of support[#]	24[2]	29[3]	47[2, 3]	C	51
2	Genu-Recurvatum/Flessum*#	15[2]	33	52[2]	A	48
2	Flexion/extension quality of lower limb*	46[2]	42	12[2]	B	42
2	Stability, ankle/knee/hip[#]	16[1]	55[1, 3]	29[3]	A	34
2	Particularly localized defect (proximal, distal, brachio-facial etc.)*[+]	38	41	21	D	34
2	Equinus	36	42	21	A	30
2	Rotation hip/pelvis[+#]	10[1, 2]	50[1]	40[2]	A	30
2	Limb Trajectory[+#]	47	20	33	C	29
2	Balance	45	38	17	D	29
2	Control of ankle/knee/hip, including locking of knee[#]	21[1]	43[1]	36	A	27
2	Lateral bending, rotation, retroposition of trunk etc.	56[1]	16[1]	28	B	27
2	Efficiency of a particular muscle[+#]	11[2]	37	52[2]	E	27
2	Motor deficiency[#]	59[2]	33	8[2]	E	26
2	Symmetry of shoulders	12[1]	60[1, 3]	28[3]	A	25
2	General posture, symmetry[+#]	35	49[3]	16[3]	D	25
2	Half-turn, standing up from chair	57[2]	33	10[2]	D	21
2	Swaggering or saluting	9[2]	36	55[2]	B	20
2	Pelvic hike to allow clearance[+]	11[1]	47[1]	42	A	19
2	Step duration, rhythm	11[2]	32	57[2]	C	19
2	Quality of double support, loading response	10[1]	52[1]	38	C	19
2	General synchronism, dissociation of planes[+]	15[1]	55[1]	30	D	19
2	Lack of fluidity, jolting etc	24	47	29	D	17
2	Synkinesis[+]	43	38	19	D	16
2	Quality of push-off	0[1]	67[1]	33	C	15
2	Looks his feet, care taken when walking ...	33	56[3]	11[3]	D	8
2	Quality of pelvic step*	0[1, 2]	43[1]	57[2]	A	7
3	Posture of superior member[+#]	37	33	30	B	82
3	Flexion/extension, ankle/knee/hip*[+#]	28	36	36	A	69
3	Hip circumduction*[+#]	36	37	27	B	59
3	Initial contact, foot progression*[+#]	25	35	40	A	48
3	Swing, mobility, good functioning of arms[#]	27	44	29	B	45
3	Varus/Valgus, ankle/knee/hip[#]	40	30	30	A	44
3	Step width, angle	30	40	30	C	30
3	Leg thrown forwards or dragged	29	36	35	C	30
3	Quality of swing phase*[+]	36	29	35	C	28
3	Sensibility disorder*[#]	42	33	25	E	28
3	Walking speed	26	44	30	D	23
3	Parameters modified by repetition (circumduction, spasticity, etc.)	33	34	33	D	17
3	Mobility of shoulder blade	29	29	42	A	7

[+] Indicators used at least once per specialist.
[#] The 10 most used indicators (Table IV).
* Controversial indicator (Table VI).
[1] $p < 0.01$ between N and R, [2] $p < 0.01$ between N and P, [3] $p < 0.01$ between R and P (in grey).

current good clinical practice, as is the case in the majority of studies concerning the variability or reliability of FGA.

One simplistic approach to gait analysis maintains that, like many other actions, gait analysis can be divided into 3 parts: (i) information encoding, (ii) information processing and (iii) responses (27–29). In this case, using video-recordings offers several advantages. It provides the same patient information, in the same way, to all the specialists. It can help negate the effect of variations in specialist attitudes, patient performance due to gait variability or fatigue, or attention lapses at crucial moments (7, 8). For example, in patients whose strokes occurred at least 2 years earlier, gait speed can vary up to 25% (15). However, despite these variations, specialists must consciously or unconsciously transform images of movement into quantitative values to be compared against known norms, and then comment on those comparisons.

Table IV. *The 10 most used indicators for each specialty. The indicators shared by the 3 specialties are presented in grey and those common to physiatrists and physiotherapists in light grey*

Neurologists		Physiatrists		Physiotherapists	
Indicators	Nb	Indicators	Nb	Indicators	Nb
Posture of superior member	30	Posture of superior member	27	Posture of superior member	25
Hyper or hypotonia/spasticity	28	Step length, symmetry/asymmetry	27	Flexion/extension, ankle/knee/hip	25
Hand mobility	21	Flexion/extension, ankle/knee/hip	25	Genu-Recurvatum/Flessum	25
Hip circumduction	21	Hip circumduction	22	Quality of support	24
Flexion/extension, ankle/knee/hip	19	Stability, ankle/knee/hip	21	Step length, symmetry/asymmetry	21
Motor deficiency	16	Hyper or hypotonia/spasticity	20	Initial contact, foot progression	19
Varus/valgus, ankle/knee/hip	15	Swing, mobility, good functioning of arms	20	Control of ankle/knee/hip, including locking of knee	17
Rotation hip/pelvis	14	Control of ankle/knee/hip, including locking of knee	20	Hip circumduction	16
Limb trajectory	14	General posture, symmetry	18	Hyper or hypotonia/spasticity	15
Sensibility disorder	14	Initial contact, foot progression	17	Efficiency of a particular muscle	14

Nb = number of indicator citations by the given specialty.

Table V. *Number of gait indicator omissions (i.e. number of "non-uses" per specialist when more than half of them used that indicator). For example, "Hyper or hypotonia/spasticity" was used by more than 7 specialists out of 15 for each subject, and according to our criteria, 1–7 specialists did not use it*

Nb	Cat.	Indicators	S1	S2	S3	S4	S5	S6
1	A	Flexion/extension, ankle/knee/hip	2	2	2	–	2	5
2		Varus/Valgus, ankle/knee/hip	–	4	–	–	5	6
3		Stability, ankle/knee/hip	–	–	–	6	–	–
4		Equinus	–	5	–	–	7	7
5		Initial contact, foot progression	7	–	7	–	5	7
6		Genu-Recurvatum/Flessum	–	2	–	7	7	7
7		Control of ankle/knee/hip, including locking of knee	6	–	–	5	–	5
8		Rotation hip/pelvis	–	3	–	–	–	–
9	B	Hip circumduction	–	6	–	–	–	6
10		Flexion/extension quality of lower limb	–	5	–	–	–	–
11		Swing, mobility, good functioning of arms	2	6	5	–	–	–
12		Swaggering or saluting	–	7	–	–	–	–
13		Lateral bending, rotation, retroposition of trunk etc.	7	–	–	–	–	–
14	C	Step length, symmetry/asymmetry	5	4	4	2	–	–
15		Quality of support	4	6	7	4	–	–
16		Quality of double support, loading response	–	–	–	–	6	–
17	D	General posture, symmetry	–	6	–	6	–	–
18		Balance	–	–	7	3	–	–
19		Walking speed	–	–	–	–	–	7
20		Lack of fluidity, jolting etc	–	–	–	–	–	7
21	E	Hyper or hypotonia/spasticity	5	1	4	7	5	6
22		Sensibility disorder	–	–	–	–	–	7
		Number of omission	8	13	7	8	7	11

Nb = number of the indicator, Cat. = categories, – no omissions according to our criteria.

Greenberg et al. (20) compared estimations of gait movement amplitude and spatiotemporal values, quantified via Vicon three-dimensional movement analyses and found it difficult to estimate any of the parameters that contribute to FGA variability. More recently, in a similar study, Read et al. (30) concluded that the numeric values obtained using Edinburgh visual score elements correlate well with the measurement values obtained from instrumented gait. Noonan et al. (31) evaluated inter-observer variability in 4 different centres and detected variability both in the gait analyses and the treatment recommendations for the majority of patients. These kinds of studies often emphasize the difficulty of human gait analysis and suggest that variability could stem from the 3-step information-processing approach to the human mind.

Our study differs from the majority of the studies previously cited. First, the experimental conditions were unlike those in clinical practice. This is not terribly important however, because the aim of the study was not to evaluate the accuracy of patient FGAs, as others have done (9, 14, 16, 20, 25, 32), but rather to assess FGA variability within and between different specialties in free gait analyses. We, on the other hand, modelled our approach on the Patla & Clouse (33) analytical methodology in an effort to focus on indicator use frequency in free FGA and describe the differences observed.

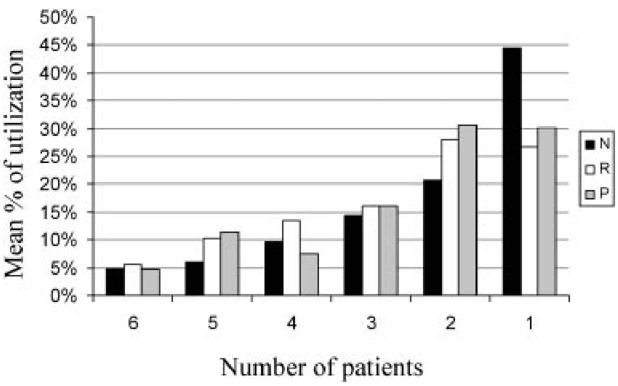

Fig. 1. Indicator use frequencies for all functional gait analysis (FGA), for each specialty. For example, for all the neurologist FGA, the indicators used for the 6 patients represented only 4.95% of the indicators, and those used for only 1 patient represented 44.65%.

Variability of clinical gait analysis

A global survey of the results reveals significant differences between and within specialties. Physiatrists (R) used more indicators than neurologists (N) and physiotherapists (P), while N tended to more homogeneous indicator use without intra-specialty differences. The total number of indicators used in a specialty is similar for the 3 categories, with 8–9/10 of all the identified indicators being used. These results would seem to indicate that there is an important inter-professional indicator database, although this database was used differently by the 3 specialties, with a few indicators being used regularly for all patients (Fig. 1).

The more important differences within R and P could be due a stronger clinical practice orientation in these 2 professions, as compared with the less multidisciplinary initial training of neurologists. The number of indicators used per specialist indicates a tendency to more description only for the patient who walked using an assistance device, who also had the greatest alteration (S2). On the other hand, the patient with an atypical gait for patients with hemiplegia (S6) accounted for the least number of indicators. The global approach supposes the "patient-dependent" variability of free gait analysis and would point to taking special care with the FGA of atypical patients.

The variability of FGA is demonstrated by the indicator categories (4) and, to a greater degree, by the indicators used by several specialties, with significant differences for 57%. The lack of difference between R and P is certainly due to the serious implication of R in P's initial training and their close collaboration in clinical practice. However, the important differences between the 3 professions point to the presence of very different gait analysis strategies (4) and could explain the omissions of several indicators that are, nevertheless, important in other professions and thus in patient care.

Tables IV and V as well as Fig. 1 confirm the voluntary or involuntary omissions of indicators. Indeed, the indicators used in more than 50% of FGA represent only 15% of all the indicators. Only 1 indicator was used by all 5 members of a given specialty for all FGA. This indicates that some specialists try to maintain FGA consistency or that they at least have an unconscious framework or outline of the pathology and systematically use the same few indicators.

This framework does not preclude considerable omissions, however. The numbers of these indicators is higher in localized and regional categories and thus requires more attention. Figure 1 shows that more than half of the indicators used are only used for 1 or 2 patients and that the indicators used during the 6 FGA varied greatly. Omission is also more frequent for patients S2 and S6 and confirms the necessity of paying special attention when performing FGAs for atypical patients or for those with severe gait alterations.

While specialists tend to use some indicators systematically, they also have a large range of qualitative, interpretative or subjective indicators, such as "patient could do better" or "intentionally walking slowly", which are used sparingly. Some indicators were used by only 1 or 2 specialists. This wide range of possibilities is part of the power of FGA.

Table VI. *"Controversial" indicators (i.e. those for which we observed more than 2 cases of disagreement between specialists or of stated evaluation difficulties). For each indicator: C&D – significant contradiction(s) and/or divergence(s); D – disavowal(s); I – considered to be difficult to evaluate*

Nb	Cat.	"Controversial" indicators	Nb of d.	I	C&D	D	S1	S2	S3	S4	S5	S6
1	C	Step length, symmetry/asymmetry	8	2	4	2	2	–	3	–	1	2
2	A	Initial contact and foot progression	8	2	6	–	1	1	1	–	–	5
3	A	Flexion/extension, ankle/knee/hip	6	2	3	1	1	–	1	1	1	2
4	E	Sensibility disorder	6	2	3	1	1	–	–	1	2	2
5	C	Quality of the swing phase	5	1	2	2	1	2	–	–	–	2
6	B	Flexion/extension quality of lower limb	5	2	3	–	1	–	–	1	–	3
7	A	Genu-Recurvatum/Flessum	4	–	4	–	2	–	1	–	–	1
8	D	Particularly localized defect (proximal, distal, brachio-facial etc.)	4	–	4	–	1	1	1	–	–	1
9	*	Use of assistance devices	3	–	3	–	–	–	2	–	–	1
10	B	Hip circumduction	3	1	1	1	–	–	1	–	–	2
11	A	Quality pelvic step	3	1	2	–	–	1	–	–	–	2
			55	13	35	7	10	5	10	3	4	23

Nb = number, Nb of d. = number of contradictory/divergent indicators, S1–S6 = hemiplegia patients 1–6.
* Indicator used less than 6 times and than not presented in Table III.

Some of ours indicators like “flexion/extension, ankle, knee, hip”, group several indicators found on gait analysis forms (12, 26, 34, 35). Although these gait analysis forms do help avoid omissions, they contain high numbers of indicators, they force practitioners to use the list of indicators and they often must be filled out completely—all of which increases the time necessary for data acquisition.

As shown in Table VI, there are 11 controversial indicators with more than 2 contradictory or divergent opinions (C&D). All indicator categories were affected, including those that seem easy to evaluate. The variability of patient gait capacity throughout the evaluation could contribute to these C&D (15). Some of these C&D were among the most used indicators; others, such as “Use of assistance device”, had high numbers of C&D considering the number of citations.

The literature has also reported important differences in the reliability of certain FGA indicators (8, 9, 13, 26). For example, Saleh & Murdoch (9) reported that the gait parameters, “step length” and “step time”, are difficult to assess visually, which could explain the higher numbers of C&D for the “step length symmetry/asymmetry” indicators in our study. It is also interesting to note the atypical gait patient (S6) accounted for the highest number of C&D, whereas the lowest number of C&D were observed for patients S4 and S5, who were typical hemiplegia cases, thus confirming the “patient-dependent” variability of FGA. Such gait analysis discrepancies have already been reported (7, 8, 10, 11, 26, 32); however, as far as we know, no study has examined free gait evaluation. Some researchers (10, 32) have reached the conclusion that visual gait assessment is only moderately reliable and have made the assumption that the lack of reliability is caused by the process of gait assessment itself (information processing), rather than by the constraints of gait assessment (information encoding).

In conclusion, our study identified a large number of indicators that were used relatively inconsistently by the 3 specialties studied. The results of our research would indicate that greater caution is needed when dealing with some of the “controversial” indicators, as well as with the “unusual” gait patterns observed in some patients. These factors argue for a more systematic procedure, using a specific reduced-information form. This procedure could be performed by all categories of specialists and would incorporate a standardized approach for decision-making like the one proposed by Steiner et al. (37). In future research, it would be interesting to evaluate whether the differences observed in free gait evaluation could significantly modify treatment decisions.

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