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Barriers and Facilitators to Using Knee Gait Analysis Report Findings in Physiotherapy Practice

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Abstract

Background: Gait analysis can be used by physiotherapists to better understand the causes and consequences of knee pain. However, its use is not widespread among clinicians working with this clientele.

Objective: To identify the barriers and facilitators to using a gait analysis data report in the evaluation and treatment of patients with knee pain.

Design: A qualitative descriptive study design was used.

Methods: Eleven physiotherapists received training on the principles of knee gait analysis assessment and data interpretation. Each physiotherapist was instructed to send two knee patients for a gait analysis assessment and then incorporate these new data into their practice with these patients. A semi-structured interview was conducted to ascertain the physiotherapist's perception of the barriers and facilitators to using gait analysis. The verbatim transcripts were analyzed using content analysis software (NVivo 9).

Results: The main barriers were as follows: 1) difficulty interpreting the gait analysis data report; 2) gait analysis testing procedures appear lengthy and complex; and 3) cost involved. The facilitators were: 1) gait analysis is perceived as being useful, especially for complex cases; 2) assessment protocol and data are perceived as valid and reliable; and 3) favorable perception of kinematic analysis by work colleagues.

Conclusion: We were able to pinpoint the barriers and facilitators likely to promote the use of gait analysis in physiotherapy practice among knee injury patients. These barriers and facilitators are more related to the potential user (physiotherapist) and to the organizational and human environment than to gait analysis itself.

Keywords: Gait analysis; Knee kinematics; Physiotherapy practice; Barriers; Facilitators

Introduction

Advancements in healthcare technology have given rise to the development and refinement of tools that guide physiotherapists in choosing treatment interventions for their clients. Biomechanical gait analysis performed with a motion analysis system is included among these tools. Gait analysis allows for the measurement of the position and orientation in space of human body segments (kinematic analysis) during a movement task and for the estimation of the forces that cause these segmental displacements (kinetic analysis). Gait analysis can be used to gain a better understanding of the causes and consequences of certain movement disorders. It also provides clinicians an opportunity to measure the effect of interventions aimed at restoring joint function and improving the performance of walking such as surgery [1], physical therapy [2] or pharmacological treatment [3].

The vast majority of research on gait analysis has focused on how data is collected and interpreted [2,4-7]. Although this body of evidence includes publications whose conclusions on efficacy are sometimes diverse, it undoubtedly demonstrates the great technical precision and diagnostic potential of gait analysis. However, apart from technical considerations, as Wren et al. [8] point out, a smaller collection of research has also shown that gait analysis findings indeed influence treatment decision-making. More specifically, gait analysis alters initial treatment plans when clinical and gait analysis data are contradictory. Yet, gait analysis supports treatment decisions when these two types of data are congruent. Although Wren et al. [8] admit that further high-quality studies, such as randomized controlled trials, are needed to ascertain the efficacy of gait analysis in improving a patient's condition, there are a few studies of interest. One such example is the study conducted by Lofterod et al. [1]. This study demonstrated that an orthopedic surgical approach selected as a result of pre-operative gait analysis findings lead to better functional recovery compared to an approach chosen solely based on clinical assessment data. The cited studies mostly relate to the orthopedic surgical management of people with cerebral palsy. Unsurprisingly, these patients are often subjects involved in gait analysis studies (see also [9-13]).

Although a systematic review recently conducted by Wren et al. [8] on the efficacy of gait analysis confirms the relevance of incorporating this assessment into clinical practice, clinical use of gait analysis is not widespread among physiotherapists. Understanding the factors that facilitate or restrict physiotherapists from using gait analysis is a key element for promoting implementation in their practice. Benefits and limitations to gait analysis in clinical practice have been discussed in a few articles [14-16]. The substantial amount of time and cost associated with conducting gait analysis has been identified as limitations to its

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use in a clinical setting [15]. In addition, gait analysis reports are often lengthy and require specific knowledge and considerable effort to interpret the findings [15]. However, these limitations were identified from narrative reviews or expert opinions; they were not specific to physiotherapists and did not emerge from a research procedure. The purpose of this study was to identify the barriers and facilitators perceived by physiotherapists to using a gait kinematic analysis data report in their practice with patients presenting knee pain.

Methods

Conceptual framework

An electronic search in various databases (Medline, Embase, EBM Reviews) quickly reveals that the identification of barriers and facilitators to using gait analysis results in physiotherapy has not been the focus of any scientific study. Thus, the conceptual framework of our study is drawn from a body of literature on the introduction of practice guidelines. The classification model developed in 2003 by Saillour-Glenisson and Michel [17] was used to identify these barriers and facilitators. Although this classification model was specifically designed for practice guidelines, we adapted it to the context of our study. This classification includes three main categories of barriers and facilitators, with several themes specific to each category. The categories are as follows: 1) barriers and facilitators related to biomechanical gait assessment and analysis; 2) barriers and facilitators related to the potential users; and 3) barriers and facilitators related to the human and organizational environment in which gait analysis will be used. The interview guide was developed using this classification. Our study design is descriptive and exploratory in nature and uses qualitative methods (semi-structured interviews) to meet our objective.

Procedures and data collection

The physiotherapists were recruited from a list of physiotherapists working in the Eastern township region (Quebec, Canada) and who practiced in the field of orthopaedics (n=64). A letter describing the study was sent and those who were willing to participate were invited to contact the project coordinator. The physiotherapists who agreed to participate (n=14) were provided with training on gait analysis. The training session discussed the principles of knee gait kinematics recorded during normal and pathological gait as well as how to interpret the results. We choose to focus on knee kinematics because pain and injuries of the knee are now considered to be a major health problem. A document resulting from the work done by the Bone and Joint Decade [18] on the musculoskeletal health status suggests that the prevalence of pain in peripheral joints is similar to that of back pain (26.4% vs. 27.0%). Among the reported cases of peripheral joint pain, nearly 62% involve the knee joint. The training discussed the knee kinematics of the following knee disorders: osteoarthritis, patella-femoral joint syndrome, anterior cruciate ligament and meniscal injuries. An expert clinician scientist facilitated the training session and gave a demonstration of a typical gait analysis assessment. Participants were given a written document which presented the scientific evidence on the subject, examples of case studies and a summary of the course.

The second step involved encouraging the participating physiotherapists to use gait kinematic analysis data in their practice. Each physiotherapist was asked to identify two patients consulting for knee pain among new patients who had come to their practice. The physiotherapists were instructed to evaluate both patients using their current assessment practices (i.e., without taking gait analysis results into account) and then develop a treatment plan for each patient. Before initiating this plan, the identified patients were asked to undergo a gait analysis that same week. The test took place at the School of Rehabilitation of the Université de Sherbrooke and was conducted by a qualified professional.

The gait analysis protocol was structured according to gait analysis protocols used in studies examining the knee and readers are invited to read the method section of these studies for more details [2,19]. The results of the knee gait kinematic assessment were presented as curves, illustrating the angular displacement (position of the joint) in relation to the gait cycle. These curves, which made up the graphic portion of the report, were accompanied by descriptive text. Each patient's report was sent to their respective physiotherapist. This information allowed the physiotherapists to integrate these new data into the clinical assessments that they had conducted beforehand. Both knees were analyzed, even if only one knee was affected. Institutional ethics approvals were obtained (#10-031) and all participants (physiotherapists and patients) signed the informed content.

Once they received the report on the two patients they had referred for kinematic evaluation, the physiotherapist were instructed to contact the project coordinator to make an appointment for an interview. The interview consisted of a 45 minute semi-structured interview to ascertain the physiotherapist's perception of the many barriers and facilitators to using biomechanical assessment in their practice among these patients. This type of interview was considered the most appropriate as it allowed for direct insight into the physiotherapist's experience. The content of the interview guide was validated by experts and pretested during pilot interviews. Finally, respondents also had to evaluate some themes (i.e., usefulness, level of comfort) using visual numerical scales ranging from l to 10. In total, 11 physiotherapists took part in the interview and 21 patients benefited from a biomechanical assessment. The recruitment for the interviews stopped once redundancy in the themes was observed during the codification procedure [20].

Analysis

The interviews were transcribed and the content of the verbatim transcripts were initially verified using content analysis software (NVivo 9). This thematic analysis was performed using a list of themes chosen in advance on the basis of the Saillour-Glenisson and Michel [17] classification model. An analysis guide including specific coding rules was designed from the themes to help the two people assigned to coding have a clear understanding of the themes in the verbatim transcripts. This analysis guide was developed from the Landry [21] method, consisting of five distinct steps: 1) determination of the objectives of the content analysis, 2) pre-analysis; 3) analysis of the material being studied; 4) assessment of the reliability and validity of the data; and 5) analysis and interpretation of the results. The first analysis guide was pretested to ensure that the criteria were clear, relevant, exclusive and reliable. Given the fact that there was optimal agreement between the two people assigned to coding from the beginning (greater than 95 percent reliability), this allowed for a quick start to the research.

Results

Participants' characteristics

Table 1 summarizes the characteristics of the physiotherapists and Table 2 provides details on the clinical profile of the patient sample.

The results are presented as follows: participants' perceptions,

Characteristics	N	%
Number of years of experience		
Less than 5 years	6	54.5
5-10 years	2	18.2
11 or more years	3	27.3
Employment sector		
Private	8	72.7
Public	1	9.1
Private and public	2	18.2
Occupational status		
Full-time employee	7	63.6
Part-time employee	1	9.1
Management	2	18.2
Self-employed worker	1	9.1
Primary clientele		
Orthopedic outpatients (A)	3	27.3
Post-surgical/hospitalized clients (B)	0	0.0
Neurologically impaired clients (C)	0	0.0
Seniors (D)	1	9.1
Athletes (E)	1	9.1
Injured workers (F)	1	9.1
Two types of clientele: A and F	1	9.1
Two types of clientele: A and E	1	9.1
Three types of clientele: A, E and F	1	9.1
Four types of clientele: A, C, E and F	1	9.1
All types of clientele: A, B, C, D, E and F	1	9.1
Level of comfort with technology in personal life (scale from 1 to 10)		
Self-assessment rating of 6-10: comfortable	9	81.8
Self-assessment rating of 1-5: somewhat comfortable or not comfortable	1	9.1
Did not answer	1	9.1
Level of comfort with technology at work (scale from 1 to 10)		
Self-assessment rating of 6-10: comfortable	10	90.9
Self-assessment rating of 1-5: somewhat comfortable or not at all comfortable	0	0.0
Did not answer	1	9.1

Table 1: Characteristics of surveyed physiotherapists (N=11).

Clinical data	N	%
Diagnosis		
Ligament injury	5	23.8
Meniscal injury	4	19.0
Symptomatic and/or radiological osteoarthritis	4	19.0
Pain (as part of a specific diagnosis)	4	19.0
Dislocation of the patella	1	4.8
Patellofemoral pain syndrome	3	14.3
Reason for consultation*		
Pain	17	81.0
Decrease in articular amplitude	6	28.6
Decrease in function (activities of daily living, leisure, sports)	5	23.8
Types of cases encountered		
Acute	3	14.3
Subacute	10	47.6
Chronic	8	38.1
Types of conditions		
Traumatic	12	57.1
Degenerative	9	42.9

*Total exceeds 100% due to multiple responses.

Table 2: Clinical information related to the patients referred by the physiotherapists.

remarks and comments are reported and the incidence of each item is then calculated (e.g., n=3). This helped to identify possible trends despite the small sample size. Quotations are sometimes included to highlight a person's viewpoint that is consistent with that of others in the study or that differs from the mainstream. Scores obtained from the numerical scales are included whenever possible.

Factors related to the biomechanical gait assessment and analysis

Demonstration of the kinematic assessment: The physiotherapists were asked to rank the complexity of the kinematic assessment performed during the training session on a scale from 1 to 10, where 1 meant "Not complex" and 10 "Very complex". If the manner in which the kinematic assessment was conducted was not generally perceived as overly complex, no fewer than 3 out of 11 participants ranked it 7 or higher. One physiotherapist in the group provided the following comment, which reflects the viewpoints of two other participants:

The setup of the equipment seemed a little arduous and in the end, it took a lot more time than what we had been told. In my opinion, it did not seem easy. It's hard to imagine one of my patients having the examination.

As for the protocol in terms of the physical well-being of the clients, all respondents agreed that it seemed safe. Therefore, the complaints that 3 of the physiotherapists received from their clients relating to discomfort while walking with the equipment did not seem to have a significant impact on the "physical well-being" or "safety" associated with gait analysis.

Results report handed out following the demonstration: All of the physiotherapists surveyed felt that the presentation of the report they received was carefully prepared. However, as for the graphic section (illustrating the kinematic curves) and the descriptive text section of the report, some respondents raised some negative points and proposed recommendations, which were both esthetic and practical in nature.

Four points were raised concerning the graphs: 1) since there is no reference curve for the frontal and transverse planes of motion, one should be added. This curve could be called the "normal curve pattern" or "ideal curve pattern" (n=4); 2) it would be a good idea to identify areas of the curves that require the physiotherapist's specific attention (n=3); and 3) the size or scale of the graphs should be increased to improve their legibility (n=3).

In terms of the text, respondents identified three points of concern: 1) the text was described as heavy and dense; bulleted items would lighten the text (n=3); 2) guidelines or recommendations should be made available to help guide physiotherapists in making decisions about the corrections and treatments they are considering for their clients (n=3); and 3) the text should be put into laymen terms, as one of the respondents points out:

Many physiotherapists have been working for a long time and have not just come out of university. So, if you want to grab their attention, they should not be forced to get too far into the research [to be able to understand the report] (n=1).

Nevertheless, these negative points and recommendations do not however affect the viewpoint of the surveyed physiotherapists on the usefulness of the graphic and descriptive text sections of the report. In fact, on a scale from 1 to 10, where 1 was "Not useful" and 10 was "Very useful", 2 physiotherapists gave a score of less than 7 for the

graphic section and 1 physiotherapist gave a score of less than 7 for the text section.

Factors related to the potential user, the physiotherapist

Training received: Overall, the physiotherapists felt that the training was useful for interpreting the report, i.e., making a connection between the results of the kinematic analysis and each client's condition. In fact, on a scale ranging from 1 to 10, where 1 was "Not useful" and 10 was "Very useful", only two participants gave a mark less than 7 out of 10. The perceived relevance of the training did not however prevent the respondents from making suggestions or corrections, and for good reason. Many would have preferred better time management (n=6) by allocating more time to reviewing the case studies. This would have therefore helped them to understand the curves profiles in relation to the cases examined. This is clearly illustrated in the following comment made by one participant:

I feel that we went too quickly through the part at the end of the training that covered the two case studies. In actual fact, this really could have been the main part, rather than explaining the conditions with respect to the curves. I think this was discussed too quickly even though [it is] very important.

Gait analysis findings interpretation: With regard to understanding the gait analysis report, there is no denying that there was a moderate degree of difficulty associated with interpretation of the report. On a scale from 1 to 10, where 1 meant "Not difficult" and 10 meant "Very difficult", 8 out of 11 respondents assessed their level of difficulty in establishing a connection between the report and the patient's condition with a mark of 4 or more (out of 10), the mark determined by the researchers as indicating significant difficulty. Three participants (n=3) had to read the report several times in order to fully grasp the information in the report. Respondents did agree that the case studies presented in the documents given out during the training session greatly facilitated their comprehension. These cases studies incorporated clinical information and well-defined recommendations based on the kinematic data to better understand the patient's condition.

Perception of the usefulness of gait analysis: The physiotherapists in our sample were asked to judge the usefulness of kinematic analysis in the context of their practices. On a scale from 1 to 10, where 1 meant "Not useful" and 10 meant "Very useful", only one person gave a mark less than 7; this was the physiotherapist with the most physiotherapy experience, i.e. 24 years.

The physiotherapists were then asked to identify, on a client care continuum, at which place(s)/time(s) this tool would be most useful. The choices of response were as follows: screening, helping with diagnostic impression and measuring effectiveness of treatment. Respondents were also able to provide another response. Table 3 shows the number of mentions for each response. The results showed that gait analysis would be especially useful for helping with diagnostic impression (n=7). Next came measuring the effectiveness of treatment (n=4), and then screening (n=3).

Situation of gait analysis in the continuum of care	Number of mentions	% of total mentions
Screening	3	16.7
Helping with diagnostic impression	7	38.9
Measuring the effectiveness of treatment	4	22.2
Other: To better isolate all deficits, injuries or other problems	2	11.1
Other: To help with therapeutic decision-making	2	11.1
Total mentions	18	100.0

Table 3: Situation of gait analysis in the continuum of care of patients consulting for a knee pain according to surveyed physiotherapists.

In the event that they would see clients with knee problems which were more complex to assess, the physiotherapists surveyed all agreed that gait analysis might help them. Various reasons, including some which supported the results above, were given: it helps for developing better treatment plans, based on objective data and, in addition, data which is more precise than the naked eye (n=5); using it makes it possible to have more specific coverage of the various gait deficits which may be experienced by any one individual, or to detect them (n=3); gait analysis can confirm or reverse clinical hypotheses made at the time of clinical assessment (n=3); it increases client satisfaction; clients can consult the report graphics and thus feel more involved in the management process (n=2). The words of one participant support the reasons listed above:

I *think that having an additional test in hand can help me find certain elements which I wasn't able to assess properly. As a result, I can develop better treatment plans or change my treatment plan and get better results. And I think that when the client sees either that there is a plateau or he is not satisfied, he hasn't achieved his objectives. Offering him an additional test, I think will help him at least hope that there is something more to be done. I think that people are very demanding: they want increasingly comprehensive tests, so they can be sure that they've had all appropriate care before they accept loss of function.*

Changes to the treatment plan: Kinematic analysis enhanced the clinical assessment performed before receipt of the report, but did not challenge the usefulness of the clinical assessment. Therefore, no significant changes were made to the initial treatment plans developed. The words of one participant were typical of what all the physiotherapists thought:

I think that I had already observed ¾ of what was found [through kinematic analysis], and it was already being treated. However, there are certain elements I had overlooked or didn't think were so important but then, I really paid special attention to them. So, it complemented what I had already recommended.

Perceptions about the validity of assessment measurements: Overall, the physiotherapists questioned believed that gait analysis measurements are valid, i.e., that the assessment does measure tibiofemoral movement. On a scale from 1 to 10, where 1 meant "No validity" and 10 meant "High validity", only one person gave a mark less than 6, the mark established as representing a perception of low validity. One participant justified his perception of high validity as follows:

There really are anatomical markers and everything. Sure, there can be a little movement because of the skin, but I think the procedure and protocol are well defined. We are also sure of getting maximum extension. So, in my opinion, it's [gait analysis] very valid.

Nonetheless, one participant specified that evaluating gait in a controlled environment does not give the same results as in a real context (n=1).

Kinematic analysis as value added to current practice? According to respondents, the value added of gait analysis resides mainly in its complementarities with more traditional assessment tools and methods, considered valid and in use for a long time in the profession. Therefore, knee gait analysis will not replace them overnight. It would be used primarily to complement what is already

being done because of the qualities listed above: its high accuracy, the objectivity of data, the help it provides for diagnosing, and the fact that it promotes treatment which is more adapted to the person.

Factors related to the assessment context

Clients' specific reactions: Generally, the clients recruited by the physiotherapists expressed their satisfaction with the assessment received. The few cases of dissatisfaction (n=3) were attributable to discomfort experienced when wearing the equipment. On a more positive note, one participant (n=1) reported that his clients understood their condition better when the graphs of kinematic data were shown to them, and that the consultation then became more interactive.

Perception of target clientele: In the participants' opinions, the first target group for kinematic knee analysis is athletes, who need greater precision in their treatment plans. Next come cases or pathologies for which assessments using traditional tools and methods are insufficient for giving a clinical impression. However, one physiotherapist emphasized the versatility of gait analysis, thereby returning to the idea of its complementarity:

With the improvements that are probable with the equipment, I would use it with almost all my patients. Even if it just confirms what type of injury and which muscles to work on. I think it's more comprehensive than what we can do with our own manual assessment, even though that's still good.

Nonetheless, gait analysis was perceived as less appropriate for certain groups, represented by: 1) acute cases already experiencing knee pain; 2) seniors with degenerative disease and/or reduced mobility; and 3) mild or simple cases already responding well to physiotherapy. One participant said, referring to the third group:

I'd say you really just have to start with the basics, show the patient everything that has to be done. Then, if that doesn't work, then, we go further with the analysis. But for patients at the first stage of physiotherapy, I think it doesn't necessarily apply right away. We were getting on fine before this technique was created, what we were doing to resolve problems was working.

Perception about possible reception by colleagues: All the physiotherapists questioned agreed that their work colleagues would give gait analysis a very favorable reception. On this point, the fact that the data produced is objective – it is based on a technological tool, not on a human assessment which is likely to be subjective – and is complementary to what is already being done clinically was a significant factor. It is also significant to note that one participant (n=1) justified his favorable reception by the time-saving which could be achieved; this precision test is faster than magnetic resonance imaging, which takes some time to obtain.

Economic and accessibility factors which might be barriers: According to participants, economic factors which might be barriers to adopting and using gait analysis are as follows: assessment and travel costs must be paid by the patient (n=4), expense coverage by clients' insurance companies (n=3), and cost/benefit ratio (n=3). Furthermore, although respondents considered that the proposed cost for an assessment was reasonable (it would be Cdn $125, based on estimates), they were less of this opinion if repeated measurements were required, for example, to check improvements in a client's condition. It should be noted that, on a scale from 1 to 10, where 1 meant "No barrier" and 10 meant "Insurmountable barrier", 2 responses were equal to or greater than 7, irrespective of the factor considered. As a result, these factors can be seen as moderate barriers.

For factors of accessibility and availability, most participants said that potential barriers to kinematic data use were the proximity of the assessment site to the client's place of residence (n=5) and the time slots available for administering the assessment (n=3) – evening time slots should be offered for working people. On the same scale described above, 2 responses were again equal to or greater than 7). Thus, these factors may also be considered as moderate barriers.

Anticipated barriers

Barriers most likely to adversely affect the use of kinematic analysis in a clinical setting: Barriers and facilitators are summarized in Table 4. Of all the barriers mentioned during interviews, all respondents were encouraged to say which one or ones, in their opinion, were mostly likely to adversely affect the use of gait analysis in a clinical setting. One stood out, i.e., the cost having to be paid by clients (n=5). Even though a cost of $125 for an assessment was considered acceptable – and even more so if a portion was covered by insurance – repeated measurements were seen as too expensive. Other factors were added to the list: difficulty associated with interpreting kinematic data (n=4), the validity is challenged because the equipment setup may alter gait pattern (n=1), and the fact that the sizable cost-benefit ratio compared with clinical assessments and tests currently being used has yet to be demonstrated (n=1). One participant (n=1), who did not commit to one specific barrier, wanted to make the following clarification:

Sure, costs and proximity are factors. But, can we call them barriers? I think that, when someone is facing the possibility of loss of function or the possibility of loss of benefits, meaning that if the insurer says, 'well, you are not making progress, we are cutting your treatment,'

Barriers and facilitators	Category
Barriers	
a) Equipment installation which appears lengthy and complex.	GA
b) Training which does not focus enough on concrete applications of kinematic data.	PU
c) Data interpretation is challenging; establishing a connection between the data and the patient's condition was difficult.	PU
d) The data report is not very directive, it does not include guidelines or recommendations to guide decision-making about treatment action.	PU
e) Assessment and travel costs which must be paid by clients (especially if insurance does not offer any reimbursement), the significant cost of repeated measurements which may be necessary.	OE
f) A long distance between the location of the gait analysis clinic and the client's place of residence.	OE
Facilitators	
a) The report format is esthetic and appealing to read	GA
b) Gait analysis is perceived as being useful, especially for complex cases.	PU
c) Assessment protocol and data are perceived as valid and reliable.	PU
d) Comfort using technology (in daily life and at work).	PU
e) Definitely favorable perception of kinematic analysis by work colleagues.	
f) Potential introduction in the workplace perceived as being fairly easy.	OE

GA: barriers and facilitators related to biomechanical gait assessment and analysis; PU: barriers and facilitators related to the potential users; OE: barriers and facilitators related to the human and organizational environment in which gait analysis will be used.

Table 4: Barriers and facilitators identified from this study and their categories.

I think there are many people who will be motivated to go. When a professional recommends a test, often, people are okay with having it. I don't think there are really any things which are going to prejudice the use of kinematic analysis or prevent it.

With respect to introducing gait analysis in the workplace, it was perceived as fairly easy. Still on a scale from 1 to 10, where 1 meant "Not easy" and 10 meant "Very easy", two participants gave a mark of 2 out of 10, and a third participant, a mark of 3 out of 10.

Discussion

The goal of this qualitative exploratory study was to identify the barriers and facilitators to using the results of knee gait kinematics in physiotherapy practice. The barriers and facilitators were classified according to three main categories: 1) barriers and facilitators related to biomechanical gait assessment and analysis; 2) barriers and facilitators related to the potential users; and 3) barriers and facilitators related to the human and organizational environment in which gait analysis will be used.

The gait analysis assessment protocol was not perceived as very complex, but several physiotherapists in the sample reported that installation took a long time. This is in accordance with Simon [15] who also identified gait analysis testing protocol inefficiency as a limitation to clinical use. Although the physiotherapists surveyed considered that the text and graphic sections of the report given to them were helpful, and that the overall presentation was carefully prepared, it must be noted that it was moderately difficult to interpret the report. To rectify this, participants suggested adding a reference curve for the frontal and transverse planes of motion. In actual fact, that is not possible because of the tremendous variability in knee kinematic curve profiles for these movement planes [22,23]. Participants also suggested identifying the critical times or areas on the curves, requiring very specific attention. Some would appreciate guidelines or recommendations being available to guide decision-making about corrections and treatments to consider for patients. Again, the report issue was also reported by Simon [15]. No matter how advanced the technology regarding this issue is, human clinical judgment will always be part of the process. Interpreting gait analysis reports is a clinical skill that is developed with practice and/or mentorship. Using a team format for applying those results to management of a patient might be a way to facilitate data interpretation. It would probably be necessary to devote more time to presenting case studies during the training. Case studies bridge the gap more easily between theory and practice, finding concrete applications for kinematic data.

Gait analysis enhanced the clinical assessment performed before receipt of the report, but did not challenge the usefulness of the clinical assessment. Thus, no significant changes were made to initial treatment plans. Instead, what came across in participants' words was the idea that knee kinematic analysis was complementary to what is already being done; it can highlight certain aspects of the patient's condition, which are difficult to observe with the naked eye. In other words, it is more comprehensive, more precise. Undoubtedly that is why, according to participants, the first target group for knee kinematic analysis is athletes, followed by cases or pathologies for which clinical assessment was not sufficient to confirm a diagnostic impression. However, it is agreed that knee gait kinematic applies less to patients with an acute knee condition who are experiencing knee pain; their gait is already affected. Physiotherapists perceived gait analysis as being useful in their practice, especially for helping with diagnosing and measuring the effectiveness of a treatment. Therefore, they would not hesitate to use it for complex cases, to which could be added the ability to confirm or reverse hypotheses made during clinical assessment. The physiotherapists thought that the validity of kinetic assessment measurements was high. On the other hand, the discomfort when walking with the equipment would need to be overcome. In the opinion of several participants, this may interfere with the results because the patient's usual gait pattern was perceived as being modified.

The physiotherapists agreed that reception of gait analysis by their work colleagues would be very favorable, and that introducing it in the workplace would be fairly easy. On this point, the fact that the data produced is objective – based on a technological tool, not on a human assessment likely to be subjective – and complementary to what is already being done clinically, was a major factor. Although they did not appear to pose a problem, the same cannot be said of the economic and accessibility factors identified by participants, all perceived as being moderate barriers to adopting and using gait analysis. Of those factors, the major ones to consider are: assessment and travel costs having to be paid by knee patients (especially if insurance companies are not offering any reimbursement), the significant cost of repeated measurements which may be required, and the proximity of the clinic to the client's place of residence.

In light of these results, it is now possible to answer the main objective of our research, which was to identify the barriers and facilitators inherent in introducing and using knee gait kinematic analysis data report for physiotherapy management of patients with knee pain. In summary, and to return to the classification proposed by Saillour-Glenisson and Michel [17], we must observe that barriers and facilitators are more related to the potential user (physiotherapist) and organizational and human environment, than to the gait analysis itself. The main barriers were as follows: 1) difficulty interpreting the gait analysis data report; 2) gait analysis testing procedures appear lengthy and complex; and 3) cost involved. The facilitators were: 1) gait analysis is perceived as being useful, especially for complex cases; 2) assessment protocol and data are perceived as valid and reliable; and 3) favorable perception of kinematic analysis by work colleagues.

We must point out a few limitations of this study. It might be relevant to include data about the hip and ankle joints. One participant did comment on the limiting nature of biomechanical assessment which concentrates only on one defined region, in this case the knee. Although biomechanical gait analysis is now a topic that is within the scope of many physiotherapy curricula, the clinicians in our sample could hardly have developed the skills for using gait analysis data since they did not have access to this assessment. In that context, we restricted ourselves to kinematic knee data, since the objective of the training was to introduce physiotherapists to gait analysis. For the same reason, the study results are limited to the context in which the physiotherapists and patients were recruited. However, this is representative of most physiotherapists practicing in the province of Quebec and we assume that this context is not unique. But we are aware that undergraduate and continuing education as well as the healthcare system might be different in other Canadian provinces or countries. This study should be replicated to other contexts for transferability of the results.

To conclude, with our exploratory study, we were able to pinpoint barriers and facilitators likely to promote successful implementation of gait analysis in physiotherapy practice, for clients with knee pain.

Knee gait kinematics, is perceived as being complementary to clinical examination and it helped to better understand the pathomechanics of complex knee disorders that can cause pain.

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