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Case Study

FUNCTIONAL GAIT PARAMETERS AS OBJECTIVE ASSESSMENT TOOLS IN PATIENTS WITH CHRONIC LOW BACK PAIN: A CASE STUDY

Ali A. Bani-Ahmed PT, CPT, CKTP,CDNP, Ph.D [1]

[1] University of Tabuk, Department of Physical Therapy, Faculty of Applied medical Sciences - Kingdom of Saudi Arabia (KSA).

ABSTRACT

We report a 38 yrs old patient with a previously diagnosed Chronic Low Back Pain who became severely functionally impaired as evidenced by the Oswestry Disability Questionnaire (56%). The aim of this study was to introduce changes in functional gait parameters as an assessment tool before and after a single session of Kinesiotape application in a patient with chronic LBP. We introduced, for the first time, gait parameters including the 10-meter walk test and the 6-minute walk test as the functional gait parameters of interest. There was (1) a 25% & 36% increase in normal walking speed and fast walking speed, respectively as evidenced by the 10MWT with 72% decrease in pain and (2) a 86% increase in walking tolerance as evidenced by the 6MWT with 88% decrease in pain. Our data demonstrated for the first time the possible effective use of gait assessment as objective motor performance measures to assess the therapy-induced improvement following therapeutic intervention in patient with chronic low back pain. We hope that these data will act as a starting point for further research to test the potential gait assessment measures to provide a more in-depth objective assessment in response to rehabilitation therapies in chronic low back pain patients.

KEY WORDS: Low Back pain, Gait, Kinesiotape, Chronic.

Address for correspondence: Ali A. Bani-Ahmad, PT, CPT, CKTP, PhD, Assistant Professor and consultant of Physical Therapy, Department of Physical Therapy, Faculty of Applied medical Sciences, University of Tabuk, 71491 Tabuk, KSA. Mobile: (00966)\ 533933971
Office (Extension): 014456 (1602) **E-Mail:** ali.baniahmed@gmail.com; a.baniahmad@ut.edu.sa

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INTRODUCTION

Low back pain (LBP) is considered the most common musculoskeletal conditions encountering medical practitioners [1]. Particularly, Studies examining the incident of LBP estimated that approximately 80% of adults will experience an episode of low back pain at least once in their lives, and approximately 20% of these cases progress to chronic low back pain [2].

Patients with low back pain (LBP) often report difficulties with walking. Gait abnormalities in patients with LBP has been investigated by many studies [3-9]. Such abnormalities include basic gait parameters spatio-temporal parameters, gait patterns, gait coordination and walking endurance. Most importantly, Studies have shown that patients with LBP walk slower than their healthy peers [5, 6] and further limitations in walking endurance [9].

Standardized assessment tools for therapy-induced physical improvement are limited to pain assessment and other basic test such as Range of motion. However, pain and disability assessments are highly subjective; for example,

the visual analog scale (VAS) [10] for pain and the Oswestry Disability Questionnaire (ODQ) [11] are patient-reported measures. The ODQ [12] is highly used by clinicians and researchers to quantify disability for low back pain. This self-completed questionnaire contains ten topics concerning intensity of pain, lifting, ability to care for oneself, ability to walk, ability to sit, sexual function, ability to stand, social life, sleep quality, and ability to travel. Each topic category is followed by 6 statements describing different potential scenarios in the patient's life relating to the topic. The patient then checks the statement which most closely resembles their situation. Each question is scored on a scale of 0–5 with the first statement being zero and indicating the least amount of disability and the last statement is scored 5 indicating most severe disability The scores for all questions answered are summed, then multiplied by two to obtain the index (range 0 to 100). Zero is equated with no disability and 100 is the maximum disability possible. The visual analog scale (VAS) [13] is a psychometric measurement instrument for subjective characteristics or attitudes toward pain. When responding to a VAS item, respondents specify their level of agreement to a statement by indicating a position along a continuous line between two end-points with zero indicating " no pain" and ten indicating "worst pain imaginable".

The latter tests are highly subjective. Therefore, objective motor performance measures, especially gait assessment, could add further insights to the effectiveness of various treatment modalities. In fact, a 2015 review [9] investigated gait behaviors as an objective outcome in low back disorders has concluded that objective motor performance measures, especially gait assessment, could improve evaluation of low back disorder interventions.

A major limitation is assessing rehabilitation outcomes in patients with low back pain is to determine which clinical and functional assessment tools are reliable and strongly relate to the functional limitation and disability. Consequently, clinicians should consider their use with patients with low back pain syndromes. For example, as many patients with LBD undergo numerous treatment therapies, Kinesiotape (KT), developed by Dr. Kenso Kase in the 1970's, has been introduced as an effective adjunctive therapy to improve the symptoms in patients with LBP [14]. In fact, many studies have shown immediate effects KT on pain, postural stability and range of motion [15, 16].

A 2016 systematic review [14] examined and summarized the evidence of recent Randomized Controlled Trials regarding the effectiveness of KT on chronic LBP patients. the review showed that KT use in LBP seems promising by improving ROM, muscular endurance and motor control. The review finally concluded that objective assessment tools are needed to strengthen the evidence of the effectiveness of KT on LBP.

The overall objective of this study is to address the limitation in assessing rehabilitation outcomes in patients with chronic low back pain. Specifically, The aim of this case study was to introduce gait parameters as an objective assessment tool on a patient with chronic LBP. We introduced the 10-meter walk test and the 6-minute walk test as the functional gait parameters of interest. Pain assessment will be closely monitored during the two functional gait parameters before and after the kinesiotape application.

CASE REPORT

Patient's description:

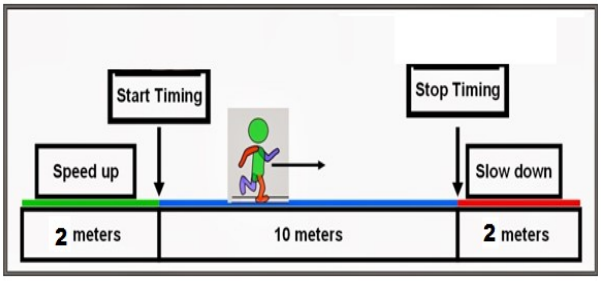
The patient was a 38 years old retired military male patient who suffered a work-related injury while in-service after jumping from an high spot eleven years ago. Secondary to his chronic injury, the patient was forced to retire 3 years ago. The patient had no surgical intervention but conventional physical therapy to address his injury with poor-fair outcomes as reported by the patient. The personal medical history didn't include any chronic conditions with no other neurological, psychiatric, or cardiovascular diseases.

Table 1. Medical History Timeline

Nov-06	Work-related back injury with serving in military
Jan-07	Began physical therapy (PT)
2007 - 2012	PT continued (Modalities and electrical stimulation along with exercises
2013	Retired from service secondary to back injury
2013-2017	PT stopped

clinical assessments

Fig. 1: The 10-meter walk test.



The participant consented to the study procedures before data collection. Disability was measured using two questionnaires (1) The Oswestry Disability Index contains ten items related to limitations in daily life activities, rating each on a 0–5 point scale; the points are added together and converted into a percentage [12]. Oswestry scores may be categorized as: minimally disabled (0–10%), moderately disabled (20–40%), severely disabled (40–60%), crippled (60–80%), or bedbound (80–100%) [11] (2) Pain was recorded by the participant using a 10-cm visual analogue scale [13], where 0 represented no pain and 10 represented unbearable pain. Detailed assessment of pain intensity was conducted by asking the patient about the average pain intensity within the last week, best pain, worst pain and the current pain intensity.

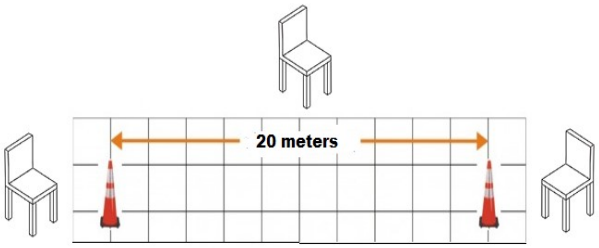
The objective motor performance measures, a gait assessment, included the timed 10-meter walk test [17] (normal and fast walking conditions) for walking speed and the six-minute walk test [18] for walking tolerance for long distances.

For the timed 10-meter walk test (Figure 1), Subjects were asked to walk at their usual speed and then at their maximum speed on a 10-meter walkway in a clinical setting. For the usual speed condition, subjects were instructed to walk at a speed that was comfortable for them. For the maximum speed condition, subjects were instructed to walk as fast as they could without discomfort and safely. The test was repeated 3 times for both normal and fast walking conditions and an average time was calculated and documented.

For the timed 6-minute walk test (Figure 2), Subject was asked to walk on a 20-meter walkway in a clinical setting. The subject was asked to walk while attempting to cover as much distance as possible in 6 minutes, not to speak, that rests were allowed, but that they should resume walking as soon as they were able. During the 6MWT, patients were given feedback at the end of every minute with encouragement such as “you are doing well”. The test was perfumed one time and the total number of laps were documented and used to calculate the total distance covered.

Pain intensity was monitored during the 10-meter and 6-minute walk tests using the VAS.

Fig. 2: The 6 minute walk test.



The Kinesiotape application

As shown on Figure 3, the following steps were followed in KT application:

Step 1: Two vertical stripes on each side with anchors either side of the top of the buttock cleft and apply upwards either side of the spine to a mid-point with less than 25% stretch

Step 2: One horizontal strip across the most painful area with a 50% stretch

Fig. 3: The KT application.

RESULTS

The patient was severely functionally disabled as indicated by the The Oswestry Disability Questionnaire with moderate-to-severe pain intensity as evidenced by the VAS.

At baseline (Table 1), the patient was within the

severe functional disability as indicated by the Oswestry Disability Questionnaire (56%).

The pain intensity scale revealed an average pain score of (7/10) Within one week period, a best pain score of (4/10), a worst pain score of (8/10) and a current pain score of (6/10) on the day of examination.

Table 2: Demographic and clinical data.

Age/Sex	Time post-onset	Pain (within past 1 week)				ODS
		Average	Best	Worst	Current	
38 yrs/M	11 years	7	4	8	6	56%

The patient gait parameters were severely impaired and exhibited lower walking speed and walking tolerance values as compared to their healthy peers prior KT application (PRE).

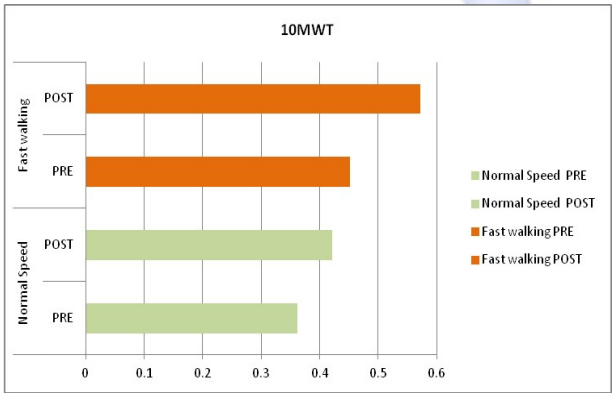
The 10-meter walk test: the average self selected normal walking speed was 0.36 m/sec which is below the healthy normative values for healthy adults in their 30s (1.46 m/s) [17, 19]. The fast walking speed was 0.42 m/sec, which was also below the healthy normative values for healthy adults in their 30s (2.45 m/s) [17, 19]. The patient reported pain intensity score of (7/10) during both test conditions.

The 6-minute walk test: The total distance covered by the patient was 230 meters which is below the healthy normative values for healthy adults in their 30s (630.6 meters) [20, 21].

Furthermore, the patient reported severe pain intensity (8/10) during the test. Consequently, the patient rested 11 times during the test.

The patient improved functionally and exhibited higher gait parameters scores and lower pain intensity levels after the KT application (POST)

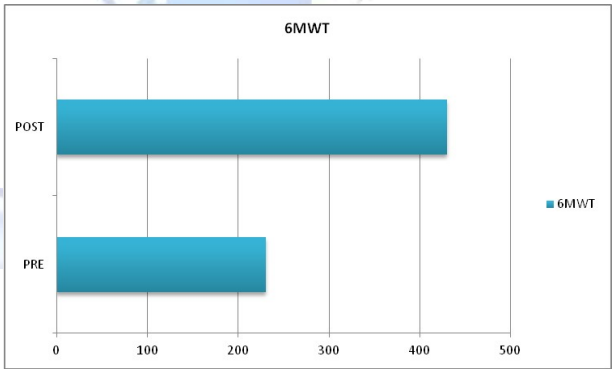
Fig. 4: Changes in the 10 MWT in the normal and fast walking speed conditions before (PRE) and after (POST) the KT application.



The 10-meter walk test (Chart 1): The average self selected normal walking speed improved and was 0.45 m/sec which is still below the healthy normative values for healthy adults in their 30s (1.46 m/s). However, it might be reasonable to conclude such improvement a substantial meaningful change considering that the patients reported a 5-point decrease in pain intensity (2/10) which is considered a clinically important difference [22].

The 6-minute walk test: The total distance covered by the patient was 430 meters which is still below the healthy normative values for healthy adults in their 30s (630.6 meters) [20, 21]. However, it might be reasonable to conclude such improvement a substantial meaningful change considering that the patients reported a 7-point decrease in pain intensity (1/10) which is considered substantially a clinically important difference [22]. In addition to the latter, the patient didn't stop or rest at all during the test after the KT application.

Fig. 5: Changes in the 6 MWT in the normal and fast walking speed conditions before (PRE) and after (POST) the KT application.



DISCUSSION

The main goal of this case study was to shed some light gait parameters as an objective assessment tool to assess treatment outcomes in patients with chronic low back pain

Specifically, this is the first study to introduce gait parameters as an assessment tool on a patient with chronic low back pain.

Specifically, we found:

i. 25% & 36% increase in normal walking speed and fast walking speed, respectively as evidenced by the 10MWT with 72% decrease in pain.

ii. 86% increase in walking tolerance as evidenced by the 6MWT with 88% decrease in

pain. As stated above, this patient exhibited baseline lower gait parameters that was consistent with his functional disability status as evidenced by the ODQ. Patients with LBP has been shown to adapt pathological walking patterns such as decreased pelvic rotation, decreased trunk coordination, decreased arm swing [5, 7] and decreased walking parameters [8, 9] which act as a protective mechanism to decrease their pain and discomfort [23, 24].

Further, as no definite conclusions could be made from a single case study, it was not our goal to show that our data may or may not strengthen the evidence of the potential to use KT in clinical practice in LBP management [14] even though that sufficient evidence have shown an immediate and substantial improvement in patients with low back pain [15, 16]. In fact, our subject showed improvement in their walking parameter which was consistent with clinically meaningful decrease in pain. Persons with chronic LBP with high levels of disability are also likely to have low levels of physical activity and impaired walking abilities [25]. Improving the return to a normal physical activity level is an important goal for the rehabilitation of patients with chronic low pain [26]. Therefore, with reducing pain as the major restrictor to physical activity, adding objective assessment tools such as gait parameters including walking speed and endurance will further enhance our understanding of the concept of recvoery in patients withchronic low back pain. We strongly believe that this will not only result in improving pain and disability outcomes but will also fulfill gaps in the literature by introducing more functional and objected assessment tools such as walking as evidenced by the 10-meter walk test and the 6-minute walk test.

These preliminary findings indicated that it might be useful to use of gait assessment as objective motor performance measures to assess the therapy-induced improvement following therapeutic interventions in patients with chronic low back pain. Yet, we hope that these data will act as a starting point for further research to test the potential use of gait assessment measures to provide a more in-depth objective assessment in response to rehabilitation therapies in chronic low back pain patients.

CONCLUSION

In conclusion, the use of gait parameters seems to be an important aspect of assessing rehabilitation outcomes following therapeutic interventions in chronic LBP patients. We hope that this case study should be guiding future researchers bridging the gap between rehabilitation interventions and outcomes in patients with chronic low back pain.

Declaration of interest statement: The author certifies that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Conflicts of interest: **None**

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