



## Correlation between gait analysis and clinical questionnaires in patients with spontaneous osteonecrosis of the knee



Ronen Debi<sup>a</sup>, Amit Mor<sup>b,\*</sup>, Avi Elbaz<sup>b,1</sup>, Ganit Segal<sup>b</sup>, Omri Lubovsky<sup>a</sup>, Gadi Kahn<sup>a</sup>, Bezalel Peskin<sup>c</sup>, Yiftah Beer<sup>d</sup>, Ehud Atoun<sup>a</sup>

<sup>a</sup> Department of Orthopedic Surgery, Barzliay Medical Center, Ashkelon, Israel

<sup>b</sup> AposTherapy Research Group, Herzliya, Israel

<sup>c</sup> Department of Orthopedic Surgery, Rambam Health Care Campus, Haifa, Israel

<sup>d</sup> Department of Orthopedic Surgery, Assaf Harofeh Medical Center, Zerifin, Israel

### ARTICLE INFO

#### Article history:

Received 5 May 2016

Accepted 16 March 2017

#### Keywords:

SONK

Gait

Pain, function

### ABSTRACT

**Background:** Spontaneous osteonecrosis of the knee is usually verified by magnetic resonance imaging accompanied by clinical questionnaires to assess the level of pain and functional limitation. There is a lack however, in an objective functional test that will reflect the functional severity of spontaneous osteonecrosis of the knee. The purpose of the current study was to examine the correlation between spatiotemporal gait parameters and clinical questionnaires in patients with spontaneous osteonecrosis of the knee.

**Methods:** 28 patients (16 females and 12 males) were included in the analysis. Patients had unilateral spontaneous osteonecrosis of the knee of the medial femoral condyle confirmed by magnetic resonance imaging. All patients performed a computerized spatiotemporal gait analysis and completed the Western Ontario and McMaster University Osteoarthritis Index and the Short-Form 36. Relationships between selected spatiotemporal gait measures and self-assessment questionnaires were assessed by Spearman non-parametric correlations.

**Findings:** Significant correlations were found between selected spatiotemporal gait parameters and clinical questionnaires ( $r$  ranged between 0.28 and 0.79). Single limb support was the gait measure with the strongest correlation to pain ( $r = 0.58$ ), function ( $r = 0.56$ ) and quality of life.

**Interpretation:** Spatiotemporal gait assessment for patients with spontaneous osteonecrosis of the knee correlates with the patient's level of pain and functional limitation there by adding objective information regarding the functional condition of these patients.

© 2017 Elsevier Ltd. All rights reserved.

### 1. Introduction

Spontaneous osteonecrosis of the knee (SONK) is a pathology with a prevalence of almost 10% in persons older than 65 years of age who report meniscal complaints (Pape et al., 2002). However, the actual prevalence may be underestimated since many patients with end-stage osteoarthritis (OA) may have had undiagnosed occult SONK (Mont et al., 2011).

At initial evaluation, plain radiographs should be obtained, although in the early course of the disease they are often negative and in some cases remain negative for the duration of clinical symptoms (Haupt et al., 1983). Bone scintigraphy may show increased uptake in the affected condyle. However, this method has poor sensitivity and specificity (Mont et al., 2008; Pivec et al., 2013). Magnetic resonance imaging

(MRI) is recommended for detection of early stages of the disease due to its high sensitivity in detecting bone edema (Fotiadou and Karantanis, 2009). Furthermore, MRI is often used as an outcome measure to assess the effect of treatment alongside self-reported questionnaires to assess pain and function (Breer et al., 2013; Heyse et al., 2011). Nevertheless, MRI is an expensive test and usually requires a relatively long appointment time.

To understand and assess the symptoms and functional severity of patients suffering from various knee pathologies, clinicians and researchers use validated self-evaluation questionnaires such as the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36 Health Survey) (Bellamy et al., 1988; Ware and Sherbourne, 1992). There is, however, a lack of accurate, objective, non-invasive and straightforward clinical tools for assessing SONK in terms of functional independence and performance.

Gait analysis has been used to assess the effect of various pathological conditions on the biomechanical properties of the lower limbs (Allet et al., 2008; Andriacchi and Hurwitz, 1997; Simon, 2004), evaluates the

\* Corresponding author at: AposTherapy Research Group, 1 Abba Even Blvd., Herzliya 46733, Israel.

E-mail address: [researchdept10@gmail.com](mailto:researchdept10@gmail.com) (A. Mor).

<sup>1</sup> First and second authors had the same contribution.

severity of disease (Bulgheroni et al., 2007; Elbaz et al., 2014) and determines the effect of different treatment modalities (Andriacchi and Hurwitz, 1997; Bar-Ziv et al., 2010; Becker et al., 1995; Foley et al., 2010). Furthermore, spatiotemporal gait analysis has been shown to be an objective measurement tool that correlates with pain, function and quality of life (Debi et al., 2011; Harding et al., 1994; Khodadadeh and Eisenstein, 1993). Single limb support (SLS) is a phase of the gait cycle that corresponds to the time spent on one limb, while the contralateral limb swings forward. In healthy populations, this phase accounts for 38.5–40.5% of the gait cycle (Perry, 1992). Studies have shown that patients with knee OA attempt to avoid pain by decreasing loads from the affected joint (Stauffer et al., 1977), and that SLS can express the level of pain and functional limitation in patients with knee OA and may also reflect a patient's functional condition during different daily tasks (Elbaz et al., 2012).

To confirm whether spatiotemporal parameters are valid and feasible for functional assessment of patients with SONK, first they must be compared to the common questionnaires currently being used for evaluating knee pathologies. The purpose of this study was to examine the correlation between spatiotemporal parameters and the WOMAC questionnaire and SF-36 Health Survey in patients with SONK. Furthermore, we aim to identify the strongest gait parameter that correlates with the patient's symptoms.

## 2. Material and methods

This was a retrospective analysis of patients diagnosed with SONK. The research methodology was similar to other research studies that examined patients with different musculoskeletal conditions as will be described below (Assa et al., 2013; Gigi et al., 2015; Khashan et al., 2014). Ethics committee approval was obtained from a leading medical center. The study is registered in [clinicaltrials.gov](http://clinicaltrials.gov) (NIH protocol no. NCT00767780).

A search for patients diagnosed with SONK by referring physicians was performed on the research database of the AposTherapy Center in Herzliya, Israel. Between April 2009 and July 2015, 87 patients were referred to the center and were enrolled in the database. The inclusion criterion was SONK of the medial femoral condyle confirmed by MRI. Exclusion criteria included a history of major trauma, predisposing factors of osteonecrosis, osteoarthritis, previous surgery to the knee excluding arthroscopy and knee arthroscopy <3 months.

### 2.1. Spatiotemporal gait analysis

Following an extensive medical history anamnesis and clinical examination, all patients underwent a computerized spatiotemporal gait evaluation (GaitMat system, E.Q., Inc. Chalfont, PA). Patients were asked to walk barefoot at a self-selected speed. Patients walked 3 m before and after the walkway mat to allow sufficient acceleration and deceleration time outside the measurement area. Four trials were conducted and acquired data was stored for further analysis. The mean value of the four trials was calculated for each of the following parameters: velocity (cm/s), involved and uninvolved step length (cm), cadence (steps/min), involved and uninvolved stride length (cm), base of support (cm), involved and uninvolved swing (% gait cycle (GC)), involved and uninvolved stance (%GC), involved and uninvolved single limb support (%GC) (SLS) and involved and uninvolved double limb support (% GC) (DLS).

### 2.2. Self-assessment questionnaires

Patients completed two self-assessment questionnaires. Western Ontario and McMaster University (WOMAC) Osteoarthritis Index was used to assess pain and function. It contains 24 VAS scale questions divided into three categories: pain, stiffness and function. These scales are scored from 0 mm to 100 mm, where 0 indicates no pain/stiffness/

functional limitation and 100 indicates worst pain/stiffness/functional limitation. The SF-36 assesses different aspects of quality of life (QoL). It is comprised of 36 Likert scale questions with a total score and eight sub-scales including physical function, pain, role limitation due to physical health, energy/fatigue, emotional well-being, role limitation due to emotional health, social functioning, and general health. In addition, two summarizing scores can be further calculated: physical score (including the average score of the following subscales: physical function, pain, role limitation due to physical health and general health) and mental score (including the average score of the following subscales: energy/fatigue, emotional well-being, role limitation due to emotional health and social functioning).

These scales are scored from 0 to 100, with higher scores indicating a better state of health and quality of life.

### 2.3. Statistical analysis

Data were analyzed with SPSS software version 21.0. (SPSS Inc. Headquarters, 233 S. Wacker Drive, 11th Floor Chicago, Illinois 60606, USA). The significance levels were set at 0.05. The distributions of continuous variables were examined using the Kolmogorov-Smirnov non-parametric test. Data were presented as the mean and standard deviation for self-assessment questionnaires and spatiotemporal variables. Relationships between selected spatiotemporal gait measures and self-assessment questionnaires were assessed by Spearman non-parametric correlations.

## 3. Results

A total of 28 patients (16 females and 12 males) met the criteria and were included in the analysis. Mean (SD) duration of symptoms was 6.3 (4.8) months. Table 1 summarizes patients' characteristics. Table 2 present the gait data of the study population.

Significant correlations were found between selected spatiotemporal gait measures and self-assessment questionnaires. SLS was the gait parameter with the strongest correlation to WOMAC pain, WOMAC function, and SF-36 sub-scales (Fig. 1). Results are summarized in Table 3.

## 4. Discussion

Although SONK is a common pathology with a prevalence of almost 10% in persons older than 65 years of age who report meniscal complaints, it is difficult to diagnose in its early stages by plain radiography. MRI is more appropriate and accurate and is recommended in the early stages of the disease due to its high sensitivity in detecting bone edema (Fotiadou and Karantanas, 2009). However, MRI is an expensive test and usually requires a relatively long waiting period. Furthermore, MRI is a static evaluation of the knee and a complementary assessment of the patient's functional condition is also warranted. Self-assessment questionnaires are also used to determine the level of pain and functional limitation of the patient. However, although these are widely-used validated questionnaires, they are still subjective. The use of

**Table 1**

Patients' characteristics and self-assessment questionnaires. Results are presented as mean (SD).

	Patients with SONK	Range
N (F/M)	28 (16/12)	
Age (years)	67.3 (8.3)	41–85
BMI (kg/m <sup>2</sup> )	33.1 (9.5)	26.7–38.9
WOMAC-pain	48.2 (24.5)	2.2–94.4
WOMAC-function	49.3 (24.7)	4.8–94.1
SF-36 total score	37.8 (14.5)	13.3–68.8
SF-36 physical score	30.6 (14.9)	9.2–68.3
SF-36 mental score	42.9 (16.2)	11.8–85.8

Download English Version:

<https://daneshyari.com/en/article/5706994>

Download Persian Version:

<https://daneshyari.com/article/5706994>

[Daneshyari.com](https://daneshyari.com)