The Journal of Physical Therapy Science

S P T S

Original Article

Functional state of knee arthritis patients and related factors

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Abstract. [Purpose] The objective of this study is to provide a direction for efficient management of arthritis through the analysis of multiple factors related to the functional state of patients. [Subjects and Methods] The Visual Analog Scale, Knee Society Knee Score & Function Score, Hospital for Special Surgery, Short Form-36 Health Survey and Western Ontario McMaster Universities Osteoarthritis Index for a total of 135 patients with knee arthritis were determined with a survey. [Results] There is a significant correlation between age, pain, Knee Society Knee Score, Hospital for Special Surgery, Knee Society Function Score, and Western Ontario McMaster Universities Osteoarthritis Index score. [Conclusion] It is necessary to improve the factors that affect knee function and quality of life, and a study on knee joint muscle strength is suggested as a follow-up study.
Key words: Total knee replacement, SF-36, WOMAC

INTRODUCTION

Knee osteoarthritis is a disease that causes pain, functional limitation and disability, and its incidence rate is gradually rising with an increase in the elderly population[1, 2]. Since knee osteoarthritis causes pain and restricts the mobility of joints, it interferes with walking and activities of daily living[3]. An elderly person with knee osteoarthritis is at greater risk of falling down, and it has been reported that about 30% of the elderly population aged 65 and older experience a fall at least once a year[4]. The present study aims to analyze factors that affect the quality of life of patients with knee osteoarthritis through an assessment of the patients' quality of life.

SUBJECTS AND METHODS

Participants for this study were selected from among 135 patients with knee osteoarthritis who were hospitalized at the H Hospital in South Korea. The inclusion criteria were as follows: patients who have undergone no operations except knee surgery, no functional limitation with nervous system disorders or other diseases, and the ability to understand the purpose of the study and fully participate in it. The exclusion criteria were as follows: patients with other diseases except for knee arthritis, patients that underwent reoperation within one year. The present study was approved by the Sahmyook University Institutional Review Board (SYUIRB2013-021) and the objective of the study and its requirements were explained to the subjects, and all participants provided written consent, in accordance with the ethical principles of the Declaration of Helsinki.

In this study, the general characteristics of the participants were recorded and consisted of age, gender, weight, and

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height. Medical characteristics, specifically body mass index, pain in the knee, range of motion in the knee, range of knee contracture, angle of the varus, and quality of life, were evaluated. To measure the pain in the knee, we used the visual analog scale (VAS). The goniometer was used for evaluation of the range of motion in the knee. To measure the angle of the genu varus, we used radiological inspection methods. To measure the quality of life and functional state of the knee before and after knee surgery, we used the knee society function score (KSFS), hospital severity score (HSS), short form-36 (SF-36), and The Western Ontario and McMaster Universities Arthritis Index (WOMAC).

The VAS was used for the evaluation of knee pain. During the study, the patients rated their pain on a 100 mm horizontal linear scale of 0 to 10, with a higher score indicating more severe pain[5]. During knee flexion and extension, the knee's range of motion was measured using a goniometer when pain was felt. The tibiofemoral angle was measured on anterior-posterior x-ray images in a standing position. The function of the knee joint was evaluated based on functional activities using the Knee Society Knee Score (KSFS), which encompasses pain, range of motion, stability, flexion contracture and distance of walking, and the Knee Society Function Score (KSFS), which includes stair climbing[6]. In addition, the Hospital Severity Score (HSS) was used to evaluate the clinical state of patients with total knee replacement.

Moreover, the Short Form 36 (SF-36) health survey was employed to assess the quality of life.Its survey consists of a total of eight subcategories of physical function (PF), role physics (RP), bodily pain (BP), general health (GH), vitality (VT), social function (SF), restriction emotion (RE) and mental health (MH). The score in each subcategory was converted to a scale of 0–100, with a higher score indicating better health[2, 7]. The Western Ontario and McMaster Universities Arthritis Index (WOMAC) was used along with SF-36 as tools to evaluate knee functions and the patients' quality of life[8]. The WOMAC comprises a total of 24 subcategories under the key categories of pain, stiffness, and physical functions. Scores are on a scale of 0 to 4, with four being the highest score, and low scores indicate low levels of pain and knee functions. WOMAC reliability is in the range of 0.77−0.83 during measurement and re-measurement[2].

All statistical analyses in this study were performed using the Statistical Package for the Social Sciences (SPSS) version 19.0. The general characteristics of participants are expressed as mean and standard deviation, using the descriptive analysis function in SPSS. In addition, to evaluate the correlations between SF-36 PCS, SF-36 MCS, functional state and quality of life, a correlation analysis was performed. The level of statistical significance was set at $p \leq 0.05$.

RESULTS

There were correlations of the SF-36 PCS with age, VAS, KSS, KSFS, HSS, Function and ROM ($p<0.05$). Among the subcategories of the SF-36 PCS, VAS had high correlations with Function while KSS had correlations with HSS and ROM ($p<0.05$). In addition, KSFS showed correlations with HSS and pain ($p<0.05$) (Table 1).

There were correlations of the SF-36 MCS with age, BMI, KSFS, Function and ROM ($p<0.05$). Among the subcategories of the SF-36 MCS, VAS had correlations with the KSS, KSFS, HSS while KSS had correlations with HSS, ROM, Pain and Alignment ($p<0.05$). In addition, HSS showed correlations with Pain, Function and ROM ($p<0.05$) (Table 2).

DISCUSSION

With age, one's overall physical functions decline. In particular, the gait speed and step length decrease due to a smaller range of motion for hip flexion, resulting in an increase in the stance time and a decline in balance while walking. This, in turn, raises the risk of falling. If a patient has knee osteoarthritis, he or she experiences a distinct decline in balance, which causes postural perturbation and greatly affects the quality of life[3].

Regular exercise is the first and foremost step that elderly people can take to maintain their health. Since activities of daily living and leisure are based on full body movement, elderly people, especially people for whom muscle weakness such as arthritis is the underlying cause of illness, should perform regular exercise[9].

People in their forties and above have a high incidence of knee osteoarthritis because they generally experience an apparent health decline due to inadequate exercise and individual health management. The pressure on the knee during walking is 0.3 times the body weight whereas the pressure is 2.5 times the body weight during stair ascension, 3.5 times during stair descent and 7 times during squatting[10]. Given such pressure on the knee, people with severe pain have difficulty in performing efficient movements during the activities of daily living, which may affect the functional assessment scores such as KSS, KSFS and HSS. The full range of motion is not required to carry out the activities of daily living.

About 117 degrees of flexion is required when tying a shoelace or putting on socks, about 90 degrees is required to sit on a chair and about 80 degrees is required to climb stairs. However, during knee extension, the full range of motion is needed in order to carry out any activities of daily living without limitation. During the present study, the range of motion appeared to have greater impact on the quality of life. Both SF-36 PCS and SF-36 MCS showed high correlations with the range of motion, particularly in subcategories such as KSS, HSS and KSFS. There was a significant correlation between SF-36 MCS score and pain this study. Therefore, management of psychological and mental problems is needed to improve pain in patients with arthritis of the knee.

Knee osteoarthritis brings about change in the muscle structure and results in a high body mass index and a decrease in both the range of knee flexion and the quadriceps thickness, accompanied by asymmetric weight support and the limitations of gait[11].

Table 1. Correlation analysis of SF-36 PCS

	SF-36 PCS	Ages	Heights	BMI	VAS	KSS pre Lt	KSS pre Rt	KSFS pre Lt	KSFS pre Rt	HSS pre Lt	HSS pre Rt	Pain	Function	ROM extention LT	ROM flexion LT	ROM extension RT	ROM flexion RT
SF-36 PCS	1.000																
Ages	−0.273*	1.000															
Heights	0.071	−0.133	10.00														
BMI	−0.082	−0.107	0.012	10.00													
VAS	−0.543*	0.182	0.097	−0.038	1.000												
KSS Lt.	0.305*	−0.363*	0.150	−0.076	−0.248*	1.000											
KSS Rt	0.263*	−0.243*	0.044	0.050	−0.323*	0.422*	1.000										
KSFS Lt	0.677*	−0.276*	0.217*	−0.203*	−0.252*	0.388*	0.330*	1.000									
KSFS Rt	0.678*	−0.263*	0.179	−0.145	−0.289*	0.414*	0.344*	0.915*	1.000								
HSS Lt	0.576*	−0.324*	0.134	−0.032	−0.327*	0.507*	0.369*	0.629*	0.531*	1.000							
HSS Rt	0.560*	−0.367*	0.135	0.047	−0.384*	0.499*	0.641*	0.599*	0.574*	0.823*	1.000						
Pain	0.648*	−0.013	0.071	−0.085	−0.412*	0.301*	0.133	0.528*	0.464*	0.595*	0.501*	1.000					
Function	0.757*	−0.142	−0.005	−0.066	−0.660*	0.285*	0.236*	0.491*	0.449*	0.551*	0.482*	0.696*	1.000				
ROM extension LT	−0.147	0.267*	−0.069	0.017	0.012	−0.488*	−0.411*	−0.224*	−0.185	−0.617*	−0.525*	−0.095	−0.080	1.000			
ROM flexion LT	0.188	0.020	0.014	−0.161	−0.207*	0.242*	0.183	0.218*	0.133	0.364*	0.311**	0.139	0.218*	−0.161	1.000		
ROM extension RT	−0.071	0.270*	−0.035	−0.263*	0.147	−0.312*	−0.561	−0.312*	−0.007	−0.405*	−0.534*	0.019	−0.105	0.660*	−0.182	1.000	
ROM flexion RT	0.269*	0.009	0.094	0.003	−0.224*	0.227*	0.401	0.332*	0.304*	0.380*	0.485	0.128	0.214*	−0.279*	0.699*	−0.260	1.000

*$p<0.05$; SF-36 PCS: Short form 36- physical component summary; BMI: body mass Index; KSS: knee society score; KSFS: knee society function Score; HSS: hospital special surgery; ROM: range of motion

Table 2. Correlation of SF-36 MCS

	SF pre MCS	Ages	VAS	KSS pre Lt	KSS pre Rt	KSFS pre Lt	KSFS pre Rt	HSS pre Lt	HSS pre Rt	Pain	Function	ROM extension LT	ROM flexion LT	ROM extension RT	ROM flexion RT
SF pre MCS	1.000														
Ages	0.015	1.000													
VAS	−0.016	0.182	1.000												
KSS pre Lt	−0.089	−0.363*	−0.248*	1.000											
KSS pre Rt	0.062	−0.243*	−0.323*	0.422*	1.000										
KSFS pre Lt	−0.320*	−0.276*	−0.252*	0.388*	0.330*	1.000									
KSFS pre Rt	−0.338*	−0.263*	−0.289*	0.414*	0.344*	0.915*	1.000								
HSS pre Lt	−0.114	−0.324*	−0.327*	0.507*	0.369*	0.629*	0.531*	1.000							
HSS pre Rt	−0.104	−0.367*	−0.384*	0.499*	0.641*	0.599*	0.574*	0.823*	1.000						
PAIN	−0.140	−0.013	−0.412*	0.301*	0.133	0.528*	0.464*	0.595*	0.501*	1.000					
FUNCTION	−0.240*	−0.142	−0.660	0.285*	0.236*	0.491*	0.449*	0.551*	0.482*	0.696*	1.000				
ROM extension LT	−0.175	0.267*	0.012	−0.488*	−0.411*	−0.224*	−0.185	−0.617*	−0.525*	−0.095	−0.080	1.000			
ROM flexion LT	0.018	0.020	−0.207	0.242*	0.183	0.218*	0.133	0.364*	0.311*	0.139	0.218*	−0.161	1.000		
ROM extension RT	−0.288*	0.270*	0.147	−0.312*	−0.561*	−0.031	−0.007	−0.405*	−0.534*	0.019	−0.105	0.660*	−0.182	1.000	
ROM flexion RT	−0.034	0.009	−0.224	0.227*	0.401*	0.332*	0.304*	0.380*	0.485*	0.128	0.214*	−0.279*	0.699*	−0.260*	1.000

*p<0.05; SF-36 MCS: short form 36- medical component summary; BMI: body mass index; KSS: knee society score; KSFS: knee society function score; HSS: hospital special surgery; ROM: range of motion

Among patients with knee osteoarthritis, a decrease in the range of knee flexion due to body weight increase has a high correlation with an increase in pain[12]. Particularly, given the relatively lower effect of rehabilitation programs among patients with BMI higher than 25 kg/m[13], it appears that systematic and professional therapeutic interventions such as aerobic exercises which aim to secure and maintain the range of motion and adequate BMIs are needed from the early stages of knee osteoarthritis to enhance the quality of life for knee osteoarthritis patients.

The present study has limitations because of a small number of research subjects and future studies should include more research subjects. Moreover, the present study explored and identified the muscle strength based on functional scores such as KSS. For the purpose of future research, the correlations of the quality of life need to be studied based on an objective assessment of muscle strength.

Conflict of interest

Financial disclosure statements have been obtained, and no conflicts of interest have been reported by the author or by any individuals in control of the content of this article.

ACKNOWLEDGEMENT

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