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Review Article

Types of Knee Function Estimating Patient Reported Outcome Measures: A Review

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Abstract:

Contribution of a patient's insight about their health situation aids in revamping the treatments. Patient-reported outcome measures or PROMs gauge a patient's point of view through questionnaires. The knee joint, being a more liable human part to suffer an injury, had been considered well by clinicians all around. There had been the introduction of numerous knee function measuring tools that could be either patient or clinician-administered. This article focuses on six patient-relevant outcome measures that are being used in various clinical as well as research contexts. This includes the IKDC Rating Scale, Oxford Knee Score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Knee Osteoarthritis Outcome Score (KOOS), Knee Outcome Survey- Activities of Daily Living (KOS-ADL) Scale and MARX Activity Rating Scale (MARS).

Keywords: Patient-reported outcome measures (PROMs), knee injury, IKDC, WOMAC, KOOS, questionnaires, KOOS-ADL, MARS

Introduction:

The knee joint, which forms a junction of four bones, is the most complex and injury-prone joint of the human body. Stress, hyperflexion, hyperextension, etc makes the knee more susceptible towards injury. Knee injuries are of different types like strains, bursitis, ligament injury, meniscal tear, open fracture, patellar injuries, and so on. Medical conditions like osteoarthritis, osteoporosis, rheumatoid arthritis, or major surgeries like TKR may lessen the effective functioning of the knee. A study, conducted to analyze the type and frequency of knee injuries in athletes, reported that 39.8% were injuries associated with the knee joint [1]. Assessment of knee function is hence important for better patient care.

A new successful trend that has been adopted by many clinicians is the implementation of a Patient-Reported Outcome Measure (PROM). PROMs capture a person's impression of their own health through questionnaires. Patients themselves rate their present condition based on how they feel after the intervention. This information can also be used to compare their earlier and future health state based on their own rating, thus, it possess a lot of merits (Table 1).

TABLE 1: ADVANTAGES OF PROMs

Advantages of PROMs
Help patients to share their struggles with their clinicians.
Create an awareness among patients about their health condition and treatments.
Aid in locating health concerns that may require further investigations.
Advanced tracking of health outcomes over time.
To compare individual patient outcomes with that of others, sharing similar health scenario.

To assist health care professionals in decision making.

The principle behind the development of a PROM is to extract patient's perceptions and views about their health status without interpretation of their response by another individual. Patient-derived outcome measures improve the objectivity of results and offer critical feedback to the health care professionals when used judiciously [2]. In addition, patients will become the 'well-informed' consumers of health care and the objective outcome measures can guide a patient through the available treatment options [2].

However, the selection of the right PROM varies with individuals. Health outcome surveys can be broadly divided into two categories: general and condition-specific. General health questionnaires measure overall health through a wide breadth of questions covering multiple aspects of health while condition-specific surveys focus on the functional impact and symptoms of a given condition [2, 3]. In the past 2 decades, outcome assessment following knee surgery has focused increasingly on the patient's perspective [4]. The object of this article is to address few commonly employed knee-specific PROMs employed in numerous clinical as well as research settings.

The IKDC Rating System

The International Knee Documentation Committee (IKDC) was found in 1987 to introduce and develop an industry standard document for knee specific conditions that could be used rationally amongst all healthcare professionals. This lead to the birth of IKDC Standard Knee Evaluation Form in 1993 followed by the IKDC Subjective Knee Evaluation Form in 1997. All these rating scales have undergone subsequent minor revisions since its publication.

IKDC focuses to detect improvement or deterioration in symptoms, function and sports activities (due to knee impairment) through 18 items [5]. It was intended to be used in ligament injuries, meniscal tears, articular cartilage lesions and patellofemoral pain. Among the 18 questions, 7 items are for symptoms, 1 item for sport participation, 9 items for daily activities and 1 item for current knee function. The updated version of this evaluation tool is feely available at the AOSSM (American Orthopaedic Society for Sports Medicine) website www.sportsmed.org/tabs/research/ikdc.aspx. The questionnaire has to be completed by the patient and score could be calculated online or manually. The possible score range of the responses would lie between 0-100 (where 100 represents normal functioning of knee and 0 represent deterioration in knee function). Provision for missing data had been included in the revised versions.

Although IKDC could be used in clinical as well as research settings, it possess few limitations. Firstly, it has not been validated for administration by interview (either in person or via telephone) [5]. Secondly, it cannot be used in patients with general leg pathology as it is specifically designed for knee. Thirdly, despite its widespread use, no normative data had been established for IKDC.

Oxford Knee Score (OKS)

Arthroplasty gained a huge popularity among patients with osteoarthritis and other knee disorders. Initially, along with judgements of the surgeon, clinical and radiological data were used to measure the outcome of TKR (Total Knee Replacement) [6]. However, many researchers have reported that patients had different viewpoints regarding their well-being and the treatments provided. This turned out to be the means of propulsion behind the development of a 12-item questionnaire which was later launched as The Oxford Knee Score in the year 1998[6].

The OKS consists of 12 items that cover areas of pain and function of the knee. Each response is assigned a score from 0-4 (0 = significant disability and 4 = no problems). While interpreting the total score, higher values indicate better outcomes and lower values reflect poor outcomes. OKS has undergone a number of rigorous assessment on reliability, validity and responsiveness [7].

The Oxford Knee Score is a simple, self – reported tool available in few different languages. Properties like ease of administration and scoring makes it eligible to fit into use in various clinical as well as research fields. Its scope had been broadened to audits and trials. It has also made its place in national joint replacement registries [7]. However, need of

acquirement of permission and lack of MCID (minimal clinically important difference) are considered as its prime limitations [5].

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

WOMAC is the most widely used, condition specific, self-administered outcome measure employed for assessing the course of disease or response to treatment in patients with knee or hip osteoarthritis [8]. It was developed in 1982 by Osteoarthritis Research Society International and had undergone multiple revisions (most recent WOMAC 3.1).

The WOMAC survey includes 24 items divided into 3 subscales: Pain (5), Stiffness (2) and Physical function (17). All the responses are recorded on a scale of 0 to 4 (low scores indicate lower levels of physical disability). The entire values are then summed up to give a final WOMAC score. A revised 7 point version of WOMAC has also been validated. However the need to obtain permission and pay licensing fee may encourage users to opt alternatives [5].

WOMAC is a simple, exceedingly popular and extensively used (both in observational and epidemiological studies) rating scale available in over 65 languages [10]. An Australian population based study reported assessment of normative values using WOMAC in clinical and research settings, to benchmark its application to next level [11]. WOMAC has also been used over telephone or electronic devices such as a computer or mobile [12-15]. Furthermore its use has been extended for patients with lower back pain, rheumatoid arthritis, juvenile onset rheumatoid arthritis, systemic lupus erythematosus and fibromyalgia [10].

However, there are few drawbacks in using WOMAC. Firstly, a low test-retest reliability of stiffness subscale and secondly it's reduced ability to detect change in the physical subscale.

Knee Osteoarthritis Outcome Score (KOOS)

KOOS was developed in 1995 by Eva M Roos and colleagues at Lund University (Sweden) and University of Vermont (USA). It was found convenient to assess outcomes for injuries due to OA as well as for traumatic injuries that often cause associated damage to multiple structures (ligament, menisci, cartilage, etc). This instrument can be implemented for estimating performance during follow up and as well in determining the long term consequences of knee injury.

KOOS is a patient administered questionnaire. It includes 42 items that appraise 5 outcomes: Pain (9), Symptoms (7), Activities of Daily Life or ADL function (17), Sport and Recreation function (5) and Quality of Life (4). All responses are rated on a 5-point Likert scale (0-4). The scores are then transformed to a 0 to 100 scale, where 0 represents extreme knee problem and 100 represent no knee problem. A scoring form is available in Microsoft Excel format [16].

KOOS can be used to reckon knee function outcomes over a wide period of time (weeks to years). It can be employed in both physically active patients as well as elderly. It is freely accessible from www.koos.nu . Population based study on normative parameters had been conducted for KOOS, stratified by age and sex [17]. It is presented in simple language and translations for more than 35 dialects are available. The scoring instructions are self-explanatory thus making it easier for calculation. In 2012, an updated version revealed that at least 50% of the outcomes must be responded. This new form showed comparison among older version with the new one in terms of requirement of items for each subscale, as shown in Table 2[18].

TABLE 2: PERMITTED MISSING ITEMS IN KOOS SUBSCALES [18]

	Number of items needed for calculation of subscale score (2012 rule for missing items)	Number of items needed for calculation of subscale score (1998 rule for missing items)
PAIN	5	7
SYMPTOMS	4	5
ADL	9	15
SPORT/REC	3	3
QOL	2	2

Nevertheless, KOOS has not be validated for interview administration [5]. Originally, it was launched to assess outcomes in both younger and older population but it gained popularity in the former group. Moreover, KOOS has undergone various psychometric testing yet there is lack of information on MCID (minimal clinically important difference) and PASS (post authorization safety study).

Knee Outcome Survey- Activities of Daily Living (KOS-ADL) Scale

KOS-ADL was endorsed in the year 1998 with an aim of determining symptoms and functional limitation in daily life regime caused by various knee pathologies [19]. It was utilized by those patients undergoing physical therapy as well as those subjected to orthopaedic knee procedures. It has also proved to be of good use among young athletes and older adults [20, 21].

KOS-ADL scale generally compares disabilities during everyday activities and sport activities. This particular rating scale has found to be useful in variety of knee related disorders which include meniscal tears, patellofemoral pain syndrome, ACL tears and injury due to osteoarthritis. It was found to be a valid and reliable instrument for functional analysis of the knee [19]. The standard effect sizes were found to be sound enough to comply the basic requirements of an assessment scale and the minimum clinically important difference(MCID) corresponded to a decrease of 1.16 points[22].

It is a 14 item questionnaire using a Likert scale method for scoring. KOS-ADL is available in its original publication as an appendix [19]. It is a patient completed instrument consisting of 2 subscales: Symptoms (6) and ADL Function (8). There are three additional questions (15-17) but they are not included in the calculation of overall score [23]. The scores are furthermore converted to an ordinal scale of the range 0 to 100. The instrument was originally developed in English language and currently it is available in German, Portuguese, Turkish and Greek languages. [5].

However, its content validity is under question due to lack of direct patient input. In addition, the questions in KOS-ADL seem to be confusing due to its descriptive nature. Furthermore, there is lack of validation for interview administration and no instructions were alluded for missing data, which decreased its acceptance among clinicians.

MARX Activity Rating Scale (MARS)

Lack of evaluation of measurement models and psychometric properties of existing knee function rating scales led to the formulation of a new instrument specifically focusing on physically active patients with knee injuries [24]. The MARS was designed to gauge the activity levels of subjects with knee problems. Originally, it was launched in 2001 as an alternative to Tegner Activity Score [25]. As opposed to Tegner Scale, the MARS is not grounded on engaging in certain athletic activities as it estimates different sections of physical function which are parts of several sports [24, 26, 27]. It is available as an appendix in its original publication [24].

The MARS includes four items that assess the frequency of running, cutting, decelerating and pivoting [24]. Each item gets a score based on 5-point ordinal scale ranging between 0 (less 1 time in a month) and 4 (four or more times in a week). A study has reported that MARS has good test –retest reliability and adequate concurrent and divergent validity [28].

MARS is, therefore, a short, simple knee specific instrument intended to provide data on athlete's highest activity level [5]. Recently a study has shown that this rating scale is statistically reliable to be used in paediatric patients those under the age of 18[29]. However there are no instructions provided for missing items. The rating scale has not been validated for interview administration. In addition, a study has reported lack of formal evaluation regarding responsiveness of the instrument [28].

Conclusion

The knee joint becomes more vulnerable following a serious injury. Evaluation of knee function using an appropriate patient – administered instrument is mandatory to gain their appeasement as well as to keep a check on their clinical status. Absence of a

'gold-standard' PROM prompts clinicians to switch among various tools, depending on injury. However, validity, reliability, responsiveness, accessibility and simplicity are the prime factors to be considered prior to the selection of any tool.

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