



ORJİNAL MAKALE / ORIGINAL ARTICLE

Balıkesir Sağlık Bilimleri Dergisi / BAUN Sağ Bil Derg
Balıkesir Health Sciences Journal / BAUN Health Sci J
ISSN: 2146-9601- e ISSN: 2147-2238
Doi: <https://doi.org/10.53424/balikesirsbd.1354175>



Turkish Validity and Reliability of the Marx Activity Rating Scale (MARS) for Patients with Knee Problems

Elif Tugce CİL¹, Ebru AKBUĞA KOÇ¹, Yağmur BARLAS¹, Helin Su ARKUN¹,
Gülce Şevval BAĞCIBAŞI¹, Gökhan MERİÇ²

¹ Yeditepe University, Faculty of Health Science, Physiotherapy and Rehabilitation Department,

² Yeditepe University Hospitals, Department of Orthopedics and Traumatology

Geliş Tarihi / Received: 02.09.2023 Kabul Tarihi / Accepted: 23.11.2023

ABSTRACT

Objective: The Marx Activity Rating Scale (MARS) is a recently developed in English to assess patients' who have knee problems activity level. However, there is no Turkish validation for it. **Materials and Methods:** MARS was translated into Turkish language according to the recommended stages by Beaton et al. 100 Patients (mean age, 30.9 ± 10.5) with various types of the knee problems were included. Each participant completed the MARS twice at fourteen day intervals to determine the test-retest reliability using the interrater correlation coefficient and Cronbach's alpha evaluating internal-consistency. Spearman's "rank correlation" coefficient was done to measure construct validity between the MARS, the EUROQoL General Quality of Life Scale (EQ-5D), the International Knee Documentation Committee (IKDC) Scale. **Results:** A total of 100 patients (37 females, 63 males) completed the Turkish-language MARS. The reliability of the test-retest was 0.9, with Cronbach's alpha of 0.8 at the initial and 0.7 for the retest. High correlations were found between the IKDC and MARS (r=0.2). MARS also strongly correlated with the EQ5D-VAS component score (r=0.2). Floor or ceiling effects were not found for the overall MARS score. **Conclusion:** In conclusion, the MARS was found to be valid and reliable. It is considered to be a preferable scale for patients with knee problems.

Keywords: Validity and Reliability, Knee, Activity, Daily Living, MARS.

Diz Problemi Olan Hastalar İçin Marx Aktivite Değerlendirme Ölçeğinin (MADÖ) Türkçe Geçerlik ve Güvenirliği

ÖZ

Amaç: Marx Aktivite Değerlendirme Ölçeği (MADÖ), diz problemi olan hastaların aktivite düzeyini değerlendirmek için yakın zamanda geliştirilmiş bir araçtır. Ancak, İngilizce olarak geliştirilmiş bu ölçeğin Türk popülasyonunda validasyonu yapılmamıştır. **Gereç ve Yöntem:** MADÖ, Beaton ve arkadaşları tarafından önerilen aşamalara göre Türkçe'ye çevrilmiştir. 100 Çeşitli diz problemleri olan hastalar (ortalama yaş, 30.9 ± 10.5) çalışmaya dahil edilmiştir. Her katılımcı MADÖ'yu on dört gün arayla iki kez doldurmuş ve test-tekrar test güvenirliliğini belirlemek için değerlendiriciler arası korelasyon katsayısı ve iç tutarlılığı değerlendiren Cronbach's alpha kullanılmıştır. MADÖ, EUROQoL Genel Yaşam Kalitesi Ölçeği (EQ-5D) ve Uluslararası Diz Dokümantasyon Komitesi (IKDC) Ölçeği arasındaki yapı geçerliliğini ölçmek için Spearman'ın sıralama korelasyon katsayısı kullanılmıştır. **Bulgular:** Toplam 100 hasta (37 kadın, 63 erkek) Türkçe MADÖ'yu doldurdu. Test-tekrar testin güvenirliliği 0.9 olup, Cronbach alfa değeri başlangıç için 0.8 ve tekrar test için 0.782'dir. IKDC ve MADÖ arasında yüksek korelasyon bulunmuştur (r=0.2). MADÖ ayrıca EQ5D-VAS bileşen skoru ile de güçlü bir korelasyon göstermiştir (r=0.2). Genel MADÖ skoru için taban veya tavan etkisi bulunmamıştır. **Sonuç:** Sonuç olarak MADÖ'nün geçerli ve güvenilir olduğu bulunmuştur. Diz problemi olan hastalar için tercih edilebilir bir ölçek olduğu düşünülmektedir.

Anahtar Kelimeler: Geçerlik ve Güvenirlik, Diz, Aktivite, Günlük Yaşam, MADÖ.

Sorumlu Yazar / Corresponding Author: Elif Tugce CİL, Yeditepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Turkey

E-mail: tugce.cill@gmail.com

Bu makaleye atıf yapmak için / Cite this article: CİL, E.T., Akbuğa Koç, E., Barlas, Y., Arkun, H.S., Bağcıbaşı, G.Ş & Meriç, G. (2024). Turkish Validity and Reliability of the Marx Activity Rating Scale (MARS) for Patients with Knee Problems. *BAUN Health Sci J*, 13(1), 60-66.

<https://doi.org/10.53424/balikesirsbd.1354175>



BAUN Health Sci J, OPEN ACCESS <https://dergipark.org.tr/pub/balikesirsbd>

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License

INTRODUCTION

The knee joint is susceptible to many acute and chronic injuries involving the bone, meniscus, articular cartilage, tendons, and ligaments. These injuries often occur during sports activities, as noted in various academic sources (Grainger and Hopper, 2010; Patel and Villalobos, 2017). Given that the knee joint transmits substantial forces, acute traumatic injuries can occur, particularly in sports that involve bending movements and sudden changes in direction. (da Silva and Pereira, 2017). On the other hand, recurrent chronic injuries may develop due to overuse, particularly in sports that involve running and jumping (Grainger et al., 2010; Alonso et al., 2014; Aicale, Tarantino and Maffulli 2018)

Knee disorders are frequently accompanied by limitations in activity and participation at various levels. These activity restrictions may manifest as difficulties with climbing stairs, running, hopping, descending, cutting, and turning. Similarly, participation restrictions mean the inability to participate in sports that involve a high degree of knee joint motion, as noted in various academic research. (Hewett and Webster, 2019; Inderhaug, Lindanger, Mølster, Strand and Solheim, 2019; Doyle-Baker et al., 2019).

Numerous instruments have been developed to evaluate sports activity levels or participation following knee injuries. These outcome rating scales are critical for assessing the effectiveness of treatment methods, such as surgical intervention and rehabilitation, for individuals with knee injuries. Consequently, utilizing these instruments is essential for accurately measuring the outcomes of interventions and ensuring that patients receive appropriate and effective care (Lysholm and Tegner, 2007; Marx, 2003; Inderhaug et al., 2019).

Several measures of knee function are commonly used in clinical practice, including the IKDC, Lysholm knee and Knee Injury and Osteoarthritis Outcome Score (KOOS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Kujala Anterior Knee Pain Scale, and MARS, as cited in various academic sources (Celik, Coşkunsu, and Kılıçoğlu, 2013; Dereli, Kuru and Yaliman, 2010; Jupiter, Koh, Parikh and Stein, 2019; Kuriyama, Nakamura and Nishitani, 2023).

MARS is a newly designed scoring scale which can be used for most individuals with knee injuries. This scale varies from previous activity measures in that it assess physical function components common to different sports activities rather than engagement in specific sports. As a result, patients can be more appropriately compared by analyzing the types of a particular physical activity, such as jogging, jumping or running. This outcome measure is critical for accurately measuring intervention success and improving overall treatment for people with knee problems (Jones, Marx, Stump, Warren and Wickiewicz, 2001; Harner, Herzka, Irrgang and Zelle, 2005).

MARS is a grading scale that assesses the patients' activity levels with knee disorders (cartilage, ligament, meniscus, or patellofemoral problem e.g.). Patients are asked to evaluate their highest activity levels from the

previous 12 months by eliminating other factors such as recent injuries, or surgery. MARS allows the patient's total general activity level to be correctly monitored. This scale is important for determining the effective rehabilitation and prevention strategies for individuals with knee injuries (Marx et al., 2001).

In current literature reported that MARS is a valid and reliable tool for assessing patients' ability to do sports-related activities. The scale has been translated into many languages to provide suitable and objective assessment way for patients with knee problems activity levels. In addition, this scale gives opportunity strengthen the scientific validity of clinical investigations in this area. However, according to our knowledge, studies on the reliability, validity and translation of MARS in Turkey have yet to be undertaken (Marx et al., 2001; Cameron et al., 2015; Ageberg, Flosadottir and Roos, 2017; Goharpey et al., 2011; Faur et al., 2020). Therefore, this research aims to translate MARS into Turkish language and examine its validity and reliability for patients who have knee problems. The results of current study will contribute to the patients' activity level information on the assessment and treatment of knee injuries by providing significant insights into the suitability of MARS for usage in Turkey.

MATERIALS AND METHODS

Study type

This validity and reliability study was conducted through face-to-face interviews with patients by researchers (three different researchers; YB, HAS, GSB) from private physiotherapy clinic between December 2022 and February 2023.

Study group

The sample size of the study was calculated using the program named G*Power 3.1.9.2; a power analysis was performed by taking the effect size of similar studies previously published in the literature as reference (Faur et al., 2020) $d=0.30$ (medium effect size), $\alpha=0.05$, Power = 0.95, and according to the results, the number of participants planned to participate in the study was determined as one hundred.

One hundred six patients with knee problems were enrolled on the Physiotherapy Clinic between December 2022 and February 2023. (1) being 18 years or older; (2) patients with a diagnosis of knee pathology: meniscal and traumatic ligament injury, fractures, patellofemoral joint pain, and mild osteoarthritis (3) do not receive any intervention between the test-retest periods were the inclusion criterias while (1) lack of understanding of the Turkish language; (2) having cognitive impairment (3) multiple ligament injuries, large osteochondral fractures, significant focal cartilage defects requiring surgery, malignancy, and advanced osteoarthritis (4) were the exclusion criterias.

Dependent and independent variables

The MARS evaluates four activity items: running, deceleration, cutting and pivoting. It has a 5-point scale referring to the frequency of performing these activities in the past 12 months, with a higher score meaning more

frequent participation. The independent variables of this research is time while the dependent variables are Pearson's correlation coefficient, and ICC.

Procedures

First of all, the participants were asked to fill in the socio-demographic form. While this form collected information such as age, height, weight, gender, it also questioned whether they practiced sports and if so, which sport they were interested in. Afterwards, participants were requested to fill the Turkish interlingual rendition of the MARS, the previously validated Turkish version of the IKDC (Coşkunsu, Çelik, Ergönül, Irrgang and Kılıçoğlu, 2014) is a 10-item validated questionnaire that evaluates symptoms, functional limitations and athletic performance for different types of the knee problems, including ligament, meniscus, cartilage, and patellofemoral discomfort. Each item is rated, with 0 being the lowest level of function and increasing scores denoting higher levels (10) of function (Anderson et al., 2010) and EUROQoL (Kahyaoglu Süt and Ünsar, 2011), the research society of Western European Quality of Life developed this instrument for assessing the patient's health in 1987. The scale is divided into two sections. The first is the daily health profile, which includes five subdivisions: usual activities, movement, self-care, pain and anxiety. The second item is the visual analogue scale (VAS), in which participants rate their actual health condition on a scale (0 to 100). There is a favourable increase in health perception when the VAS score rises (Balestroni and Bertolotti, 2012).

From these items an index can be done with values predetermined for the target population (country), as well as quality-adjusted life years and disability-adjusted life years.

Our study used health Measurement Instruments checklist (COSMIN) for selecting to realize consensus-based validity assessment (Alonso et al., 2010).

MARS was translated into Turkish and culturally adapted according to the recommended stages by Beaton et al. (Beaton, Bombardier, Ferraz and Guillemin, 2000). Two native speakers, a physiotherapist and a translator without any medical background, independently translated the original scale into Turkish in the first stage. The bilingual person reviewed translations in the second stage. Thirdly, two native speakers of English who speaks and understands Turkish well translated the MARS Turkish translation into English. Before confirming the Turkish translation of MARS, four translators made comparison of the English re-translation with the original Turkish translation. Following versions of this scale are compared with the original translation, and a standard version was created from these agreements. The scale was then administered to patients, and a pilot study was done with 20 patients who were selected from all participants.

Statistical analysis

Spearman's correlation coefficient was done for evaluating construct validity. A correlation coefficient was considered as good if it is between 0.4 to 0.6, very good if it is between 0.6-0.8 and excellent if it is greater

than 0.8. The floor and ceiling effects presence determined content validity f more than 15% of patients scored minimum or maximum. Cronbach's alpha coefficient tested the internal consistency of the MARS scale at the initial and second implementation. A Cronbach alpha rate of more than 0.7 shows a high degree for internal consistency. To measure the test-retest reliability of the MARS, the intraclass correlation coefficient (ICC) was used and, 100 patients filled the scale 14 days after the initial evaluation. If the ICC is higher than 0.9, it is considered excellent, between 0.7 and 0.9 it is considered good, and greater than 0.7 it is considered fair. Spearman's correlation coefficient assessed the reproducibility of the questionnaire (Suciu, et al., 2020). Furthermore, SPSS 22 version were used for statistical analyses. For testing normality of all datas, Kolmogorov-Smirnov test was applied and $p \leq 0.05$ was the significance level.

Ethical considerations

Patients included in the study were referred to the physiotherapy clinic by orthopaedics. Before participants were recruited for an assessment, they provided written informed consent, which the ethical committee at the Faculty of Health Sciences of Marmara University had approved (IRB study protocol:118).

RESULTS

We selected 106 suitable patients with knee complaints from a physiotherapy clinic between December 2022 and February 2023. The MARS required approximately 3 minutes to complete. The pilot study was conducted with 20 patients (seven females, 13 males; mean age, 35.0 ± 12.5 years). During our study period, six subjects were excluded due to the incompleteness of the retest assessment. Therefore, in total, 100 patients (mean age, 30.9 ± 10.5 ; range, 19–59 years) with various types of knee disorders were involved in this study.

37.0 % of the participants were female and meniscus tear was found to be the pathology with the highest percentage (33.0%) among knee problems. Among the sports activities in which individuals participated, basketball had the highest percentage of sports, while running and rowing had the lowest (24%, 2% and 2% respectively) (Table 1).

Validity

The correlation coefficient between the MARS and IKDC score was 0.2 which is significant, excellent results ($p=0.01$). The highest correlation was found between EQ5D-VAS and IKDC (Spearman's $r = 0.6$, $p = 0.00$), respectively. The correlation was identified between EQ5D-VAS and the MARS as $r = 0.2$, $p = 0.00$, Table 2). There were no floor or ceiling effects for the overall MARS rating, with 9% of patients reports the lowest (0) and 4% the greatest score (16), respectively.

Reliability

Table 3 showed the inter-item correlation matrix of the two evaluations. The MARS showed a high reliability score. At the first completion of the scale, Cronbach's alpha was calculated as 0.8. For the retest, Cronbach's

alpha was found as 0.7. The intraclass correlation coefficient (ICC) was used to

measure the test-retest reliability of the MARS assessment form. The ICC was found as 0.9 (95% CI 0.8–0.9, Table 3).

Table 1. Demographic characteristics of the study group (n=100).

Variables	Number
Age (years, mean \pm SD)	30.9 \pm 10.46
Gender n(%)	
Female	37 (37.0)
Male	63 (63.0)
Diagnosis n (%)	
ACL injury	20 (20.0)
Meniscus tear	33 (33.0)
ACL and meniscus injury	7 (7.0)
MCL injury	6 (6.0)
Cartilage damage	8 (8.0)
Fracture	1 (1.0)
Patellofemoral pain syndrome	19 (19.0)
Osteoarthritis	20 (20.0)
Sport activity involvement n (%)	
Swimming	8 (8.0)
Running	2 (2.0)
Pilates	8 (8.0)
Futbol	15 (15.0)
Basketball	24 (24.0)
Volleyball	11 (11.0)
Yoga	3 (3.0)
Tennis	5 (5.0)
Rowing	2 (2.0)
Kickbox	5 (5.0)
Fitness	8 (8.0)
Other	9 (9.0)

Table 2. Correlation between the tested scores.

	EQ5D VAS	IKDC	MARS
EQ5D VAS	1.000	0.621**	0.265**
IKDC		1.000	0.253*
MARS			1.000

Table 2. Spearman's correlation coefficient between the tested scores (n = 100)

* correlation is significant at the 0.05 level;

** Correlation is significant at the 0.01 level; EuroQol visual analogue scale (EQ5D VAS), International Knee Documentation Co

Table 3. Inter-item correlation for the two MARS forms.

	M1	M2	M3	M4
M1	1.000	0.700	0.512	0.475
M2		1.000	0.571	0.582
M3			1.000	0.476
M4				1.000
	M1 (re-test)	M2 (re-test)	M3 (re-test)	M4 (re-test)
M1 (re-test)	1.000	0.383	0.363	0.384
M2 (re-test)		1.000	0.639	0.621
M3 (re-test)			1.000	0.457
M4 (re-test)				1.000

DISCUSSION

As a result, a method of assessing this activity is crucial for research comparing two therapy results to guarantee that the patient groups are equal in this regard. Thus, assessments such as MARS are required for assessing activity level in individuals with knee diseases. That's why, our aim was to perform validity and reliability of the MARS. The present findings demonstrated that the Turkish translation of the MARS is acceptable, reliable, and valid. The degree of activity is an essential factor that should be assessed independently. The frequency and intensity with which patients participate in sports vary greatly.

The results demonstrated the sufficient psychometric properties of this scale according to internal consistency and test-retest reliability for patients in the Turkish population with various knee disorders. The test-retest reliability result was eligible and adequate with an 0.9 ICC and a Cronbach's alpha of 0.8 and 0.7 for the retest for subscales of the MARS. These values align with prior reports: ICC of 0.9 in the original study developed the MARS and ICC of 0.7 for the Iranian translation, respectively (Marx et al., 2001; Negahban et al., 2011). In this study, floor and ceiling effects were found as fewer minimal and maximal responses (9% & 4%, respectively) with comparing other studies (Negahban et al. -35% & Ageberg et al.-22% and 20%) (Ageberg et al., 2017; Negahban et al., 2011).

In the original validation study of the MARS, the Cincinnati, Tegner and Daniel Scales were used for convergent validity. An index (MARS) can be calculated from these scales using values established for the target population (country), as well as quality-adjusted life years and disability-adjusted life years.

They demonstrated excellent or moderate correlation with all three of them (Spearman's $r = 0.6$, Spearman's $r = 0.6$ and Spearman's $r = 0.5$, respectively) (Marx et al., 2001).

In a study, we used the IKDC and the EQ5D, because these scales will be more pertinent in current academic, research projects, and also appropriate based on the reviewed literature. (Anderson, Irrgang and Kanakamedala, 2016; Negahban et al., 2011; Suci et al., 2020). Suci et al. found significant correlations between the MARS score and IKDC (Spearman's $r = 0.8$, $p < 0.001$) and EQ-5D score (Spearman's $r = 0.4$, $p < 0.001$), respectively (Suci et al., 2020). In another study

conducted by Negahban et al., the Tegner and Marx activity scales both have a high ICC. Marx scale exceeded the minimum Cronbach's alpha level of 0.7. The majority of a priori assumptions were confirmed in terms of construct validity. In one systematic review, The reported test-retest intraclass correlations (ICCs) for the IKDC-SKF and MARS are 0.8 to 0.9 and 0.8 to 0.9, respectively (ICC > 0.7). The IKDC-SKF has been shown to have moderate/excellent correlations with 60/72 (83%) concomitantly administered physical health measures and poor/fair correlations with 28/31 (90%) mental health indicators, indicating both convergent and divergent validity. The MARS displays moderate/excellent correlations with 3/3 (100%) of the concurrently administered measures of level of sports activities, demonstrating its convergent validity (Kanakamedala et al., 2016). In this study, there were significant correlations between the MARS score and the IKDC (Spearman's $r = 0.2$, $p = 0.0$) and EQ5D VAS (Spearman's $r = 0.2$, $p = 0.0$, Table 2) respectively. These results were correlated well with each other, similar to previous studies.

The current study limitation can be the sample size. Although our sample size is sufficient according to the literature information and power analysis results, larger population should be applied to individuals with more diverse knee problems. In addition, there is no accepted and ideal range in the literature for test-retest interval. The short test-retest interval can be risk for the patient reaction because of their memory of the initial assessment. Although a longer time period may reduce this likelihood, other factors must be considered during this longer time period. For example, it is unethical not to cure an acute complaint for a long time, and patients with chronic diseases may be included in studies with long retest intervals. In addition, there may be spontaneous improvement in acute complaints and unexpected changes in complaints in patients with chronic diseases. Given these considerations, repeated applications of a clinical findings assessment should be relatively short (Celik et al., 2013). Suci et al. used a 1-month follow-up period in their MARS validity and reliability study with Romanians. Negahban et al. used an interval of 2 to 6 days in their MARS validity and reliability study with Iranians (Negahban, et al., 2011; Suci et al., 2020). Considering previous studies and literature, we determined the test-retest interval of 7-14

days and therefore, the clinical limitations related with this selection were accepted.

Limitations and Strengths of the Study

The Turkish MARS includes enough questions to designate the functional condition of patients who have the knee problems. It is a brief and straightforward scale for clinicians, researchers, and patients. Both the translation and the cultural adaption of the Turkish version of MARS are reliable and valid. This scale can put to good use the functional limitations of people suffering from knee problems. Although this pilot investigation supported the proposed translation, the Turkish form of MARS must be evaluated in more extensive and diverse groups.

CONCLUSION

In patients with knee problems, the Turkish translation of the MARS is a valid, consistent, and reliable outcome assessment.

Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: ETC, EBK, YB, HSA, GSB, GM; **Material, methods and data collection:** ETC, EBK, YB, HSA, GSB, GM; **Data analysis and comments:** ETC, EBK, YB, HSA, GSB, GM; **Writing and corrections:** ETC, EBK, YB, HSA, GSB, GM.

REFERENCES

- Aicale, R., Tarantino, D., & Maffulli, N. (2018). Overuse injuries in sport: a comprehensive overview. *Journal of orthopaedic surgery and research*, 13(1), 1-11. <https://doi.org/10.1186/s13018-018-1017-5>
- Balestroni, G., & Bertolotti, G. (2012). EuroQol-5D (EQ-5D): an instrument for measuring quality of life. *Monaldi Archives for Chest Disease*, 78(3). <https://doi.org/10.4081/monaldi.2012.121>
- Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, 25(24), 3186-3191.
- Cameron, K. L., Peck, K. Y., Thompson, B. S., Svoboda, S. J., Owens, B. D., & Marshall, S. W. (2015). Reference values for the Marx Activity Rating Scale in a young athletic population: history of knee ligament injury is associated with higher scores. *Sports Health*, 7(5), 403-408. <https://doi.org/10.1177/1941738115576121>
- Celik, D., Coşkunsu, D., & Kılıçoğlu, Ö. (2013). Translation and cultural adaptation of the Turkish Lysholm knee scale: ease of use, validity, and reliability. *Clinical Orthopaedics and Related Research*, 471, 2602-2610. <https://doi.org/10.1007/s11999-013-3046-z>
- Çelik, D., Coşkunsu, D., Kılıçoğlu, Ö., Ergönül, Ö., & Irrgang, J. J. (2014). Translation and cross-cultural adaptation of the international knee documentation committee subjective knee form into Turkish. *Journal of orthopaedic & sports physical therapy*, 44(11), 899-909. <https://www.jospt.org/doi/10.2519/jospt.2014.4865>
- da Silva, M. V., & Pereira, B. (2017). Biomechanics of Lower Limb Injuries. In J. Espregueira-Mendes, C. Niek van Dijk, P. Neyret, M. Cohen, S.D. Villa, H. Pereira, J.M. Oliveira. (Eds.) *Injuries and Health Problems in Football: What Everyone Should Know* (pp. 53-64). Springer Nature.
- Flosadottir, V., Roos, E. M., & Ageberg, E. (2017). Translation, cross-cultural adaptation, and validation of the activity rating scale for disorders of the knee. *Orthopaedic Journal of Sports Medicine*, 5(9), 2325967117729361. <https://doi.org/10.1177/2325967117729361>
- Greco, N. J., Anderson, A. F., Mann, B. J., Cole, B. J., Farr, J., Nissen, C. W., & Irrgang, J. J. (2010). Responsiveness of the International Knee Documentation Committee subjective knee form in comparison to the Western Ontario and McMaster Universities Osteoarthritis Index, modified Cincinnati Knee Rating System, and Short Form 36 in patients with focal articular cartilage defects. *The American journal of sports medicine*, 38(5), 891-902. <https://doi.org/10.1177/0363546509354163>
- Hopper, M. A., & Grainger, A. J. (2010). Knee injuries. In P. Robinson (Ed.), *Essential Radiology for Sports Medicine*, (pp. 1-28). Springer Nature.
- Kahyaoğlu Süt, H., & Ünsar, S. (2011). Is EQ-5D a valid quality of life instrument in patients with acute coronary syndrome? *Anatolian Journal of Cardiology/Anadolu Kardiyoloji Dergisi*, 11(2). <https://doi.org/10.5152/akd.2011.037>
- Kanakamedala, A. C., Anderson, A. F., & Irrgang, J. J. (2016). IKDC Subjective Knee Form and Marx Activity Rating Scale are suitable to evaluate all orthopaedic sports medicine knee conditions: a systematic review. *Journal of ISAKOS*, 1(1), 25-31. <https://doi.org/10.1136/jisakos-2015-000014>
- Koh, J. L., Parikh, S., Stein, B. S., & JUPITER Group. (2019). Conducting a multicenter trial: learning from the JUPITER (Justifying Patellar Instability Treatment by Early Results) experience. In V. Musahl, J. Karlsson, M.T. Hirschmann, O.R. Ayeni, · R.G. Marx, J. L. Koh, N. Nakamura (Eds.), *Basic methods handbook for clinical orthopaedic research: A practical guide and case based research approach*, (pp. 415-425). Springer Nature.
- Kuru, T., Dereli, E. E., & Yaliman, A. (2010). Validity of the Turkish version of the Kujala patellofemoral score in patellofemoral pain syndrome. *Acta Orthopaedica et Traumatologica Turcica*, 44(2), 152-6. <https://doi.org/10.3944/AOTT.2010.2252>
- Lindanger, L., Strand, T., Mølster, A. O., Solheim, E., & Inderhaug, E. (2019). Return to play and long-term participation in pivoting sports after anterior cruciate ligament reconstruction. *The American journal of*

- sports medicine*, 47(14), 3339-3346.
<https://doi.org/10.1177/0363546519878159>
- Lysholm, J., & Tegner, Y. (2007). Knee injury rating scales. *Acta orthopaedica*, 78(4), 445-453.
<https://doi.org/10.1080/17453670710014068>
- Marx, R. G. (2003). Knee rating scales. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*, 19(10), 1103-1108.
<https://doi.org/10.1016/j.arthro.2003.10.029>
- Marx, R. G., Stump, T. J., Jones, E. C., Wickiewicz, T. L., & Warren, R. F. (2001). Development and evaluation of an activity rating scale for disorders of the knee. *The American journal of sports medicine*, 29(2), 213-218.
<https://doi.org/10.1177/03635465010290021601>
- Mokkink, L. B., Terwee, C. B., Knol, D. L., Stratford, P. W., Alonso, J., Patrick, D. L., et al. (2010). The COSMIN checklist for evaluating the methodological quality of studies on measurement properties: a clarification of its content. *BMC medical research methodology*, 10(1), 1-8.
<https://doi.org/10.1186/1471-2288-10-22>
- Negahban, H., Mostafaei, N., Sohani, S. M., Mazaheri, M., Goharpey, S., Salavati, M., et al. (2011). Reliability and validity of the Tegner and Marx activity rating scales in Iranian patients with anterior cruciate ligament injury. *Disability and rehabilitation*, 33(22-23), 2305-2310.
<https://doi.org/10.3109/09638288.2011.570409>
- Nishitani, K., Nakamura, S., & Kuriyama, S. (2023). Clinical evaluation of knee joint diseases. *Journal of Joint Surgery and Research*, 1(1), 9-17.
<https://doi.org/10.1016/j.jjoisr.2022.12.003>
- Patel, D. R., & Villalobos, A. (2017). Evaluation and management of knee pain in young athletes: overuse injuries of the knee. *Translational Pediatrics*, 6(3), 190.
<https://doi.org/10.21037/tp.2017.04.05>
- Suciu, O., Prejbeanu, R., Haragus, H., Faur, C., Onofrei, R. R., & Todor, A. (2020). Cross-cultural adaptation and validation of the Romanian Marx activity rating scale for anterior cruciate ligament reconstruction. *In Healthcare*, 8(3), 318.
<https://doi.org/10.3390/healthcare8030318>
- Timpka, T., Alonso, J. M., Jacobsson, J., Junge, A., Branco, P., Clarsen, B., et al. (2014). Injury and illness definitions and data collection procedures for use in epidemiological studies in Athletics (track and field): consensus statement. *British journal of sports medicine*, 48(7), 483-490.
<http://dx.doi.org/10.1136/bjsports-2013-093241>
- Webster, K. E., & Hewett, T. E. (2019). What is the evidence for and validity of return-to-sport testing after anterior cruciate ligament reconstruction surgery? A systematic review and meta-analysis. *Sports Medicine*, 49, 917-929.
<https://doi.org/10.1007/s40279-019-01093-x>
- Whittaker, J. L., Toomey, C. M., Nettel-Aguirre, A., Jaremko, J. L., Doyle-Baker, P. K., Woodhouse, L. J., et al. (2019). Health-related Outcomes after a Youth Sport-related Knee Injury. *Medicine and science in sports and exercise*, 51(2), 255-263.
<https://doi.org/10.1249/mss.0000000000001787>
- Zelle, B. A., Herzka, A. S., Harner, C. D., & Irrgang, J. J. (2005). Evaluation of clinical outcomes in anterior cruciate ligament surgery. *Operative Techniques in Orthopaedics*, 15(1), 76-84.
<https://doi.org/10.1053/j.oto.2004.11.013>